



Shri Balasaheb Mane Shikshan Prasarak Mandal's,

ASHOKRAO MANE GROUP OF INSTITUTIONS

NH - 4, Vathar Tarf Vadgaon, Tal: - Hatkanangale, Dist: - Kolhapur-416112

Website: www.amgoi.edu.in

An Autonomous Institute



**Curriculum Structure
and
Evaluation Scheme
for
M. Tech.
in
Mechanical Production
Engineering
with
Multidisciplinary Minor**
(To be implemented for 2025-2027 Batch)


HOD

DEPT. OF MECHANICAL ENGINEERING
SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S
ASHOKRAO MANE GROUP OF INSTITUTIONS



Dr. Mrs. S. R. Chougule
DIRECTOR

Shri Balasaheb Mane Shikshan Prasarak Mandal's
Ashokrao Mane Group Of Institutions
Vathar Tarf Vadgaon, Tal. Hatkanangale
Dist. Kolhapur, Maharashtra - 416112



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ABBREVIATIONS

- **L:** Lecture
- **T:** Tutorial
- **P:** Practical
- **ISE-I-** In Semester Evaluation I
- **ISE-II-** In Semester Evaluation II
- **MSE:** Mid Semester Exam
- **ESE:** End Semester Exam
- **PCC:** Program Core Course
- **PEC:** Program Elective Course
- **OE:** Open Elective Course
- **AEC:** Ability Enhancement Course
- **AC:** Audit Course
- **RM:** Research Methodology



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Department: Department of Mechanical Engineering

Semester: I

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	P25MP101	Advanced Material and Processing	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	P25MP102	Production and Operation Management	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	P25MP103	Metal Casting Technology	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	P25MP104	Program Elective-I	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
RM	P25MP105	Research Methodology and IPR	2	-	-	2	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ELC	P25MP106	Seminar		-	2	1	ISE	50	20	40
							ESE (OE)	50		
PCC	P25MP107	PG Lab- I		-	4	2	ISE	50	20	40
							ESE (POE)	50		
AC	P25MP108	Yoga and Meditation	1	-	--		-	-	-	
							-	-		
							-	-		
Total			15	3	06	20	700			
			24							
Total Contact Hours- 24						Total Credits- 20				



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Department: Department of Mechanical Engineering
Semester: II

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	P25MP201	Quality Control and Reliability	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	P25MP202	Advanced CNC Technology	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	P25MP203	Advances in Welding and Joining Technology	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	P25MP204	Program Elective-II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	P25MP205	Open Elective-I	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VEC	P25MP206	Technologies for Industrial Evolution	2	-	-	2	ISE-I	25	20	20
							ISE-II	25		
ELC	P25MP207	Mini Project	-	-	2	1	ISE-I	25		40
							ISE-II	25		
							ESE (POE)	50	20	
PCC	P25MP208	PG Lab- II	-	-	4	2	ISE	50		40
							ESE (POE)	50		
ELC	P25MP209	Internship/Field Training	-	-	-	-	Will be Evaluated in Sem-III	-	-	
Total			17	2	06	22	750			
			25							
Total Contact Hours- 25						Total Credits- 22				



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Department: Department of Mechanical Engineering

Semester: III

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
OE	P25MP301	Open Elective-II ^{\$}	3		-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	P25MP302	Multi-Disciplinary Minor ^{\$}	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ELC	P25MP303	Dissertation Phase- I*	-	-	20	10	ISE-I	25		40
							ISE-II	25		
							ESE(POE)	50	20	
ELC	P25MP209	Internship/Field Training	-	-		2	ISE-I	50	20	-
Total			6	-	20	18	350			
			26							
Total Contact Hours- 26			Total Credits- 18							

*\$ It is mandatory to opt these courses certification from SWAYAM/NPTEL, MOOC platform.

* It is required to complete 30% work of Dissertation.

It is required to do Four weeks domain specific industrial internship after completing first year of the program evaluated in Semester-III



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Department: Department of Mechanical Engineering
Semester: IV

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
ELC	P25MP401	Dissertation Phase- II*	-	-	40	20	ISE-I	50	40	80
							ISE-II	50		
							ESE	100	40	
Total			-	-	40	20	200			
			40							

It is required to publish/present two papers out of which at least one paper should be in a SCI/ SCIE/ SCOPUS/ Web of Science/ Peer-Reviewed Journal before Thesis Submission.



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OPEN ELECTIVE COURSES

(Students have to select any one Open Elective course, for each applicable semester, of their interest from the basket below.)

Open Elective – I Semester II			Open Elective – II Semester III		
Sr.	Course Code	Course Name (OE)	Sr.	Course Code	Course Name (OE)
1	P25MP205A	Environment and Development	1	P25MP301A	Labour Welfare and Industrial Relations
2	P25MP205B	Engineering Economics	2	P25MP301B	Sustainable Technology
3	P25MP205C	Project Management	3	P25MP301C	Entrepreneurship Development
4	P25MP205D	Healthcare Engineering	4	P25MP301D	Industrial Automation



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Exit Courses after Semester- II - P.G. Diploma

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme		
			L	T	P	Cr	Components	Max	Min for Passing
ELC	P25MP209	Internship/Training	-	-	-	2	ISE	50	40
							ESE	50	
AEC	P25MP210	Management Information System	4	-	-	4	ISE-I	50	40
							ESE	50	
Total			4	0	0	6	200		
			2						
Total Contact Hours- 4			Total Credits- 06						

*It is mandatory to opt this course certification from SWAYAM/NPTEL MOOC platform

Four weeks domain specific industrial internship after successfully completing first year of the program.



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PROGRAM ELECTIVE CORE

(Students have to select any one Program Elective Core course out of 03, for each applicable semester, of their interest, offered by the Department from the table below)

Program Elective Core - I

Sr.	Course Code	Course Name	Semester
1	P25MP 104A	Abrasive Machining and Finishing Processes	I
2	P25MP 104B	Sustainable Manufacturing	
3	P25MP 104C	Manufacturing Planning and Control	

Program Elective Core - II

Sr.	Course Code	Course Name	Semester
1	P25MP 204 A	Computer Integrated Manufacturing	II
2	P25MP 204 B	Total Productive Maintenance	
3	P25MP 204 C	Lasers in Manufacturing	

MULTIDISCIPLINARY MINOR (MDM) BASKET

(Students have to select any one course of their interest (other than a courses offered by their program) for the award of Minor Degree from the table below)

Sr.	Course Code	Course Name	Semester	Offered by the Department
1	P25MP302	Automation in Manufacturing	III	Mechanical Engineering
2	P25MD302	Introduction to Industry 4.0 and Industrial Internet of Things	III	Mechanical Engineering
3	P25MP302	Artificial Intelligence & Machine Learning	III	Computer Science Engineering
4	P25CM302	Principles of Construction Management	III	Civil Engineering
5	P25ET302	IoT and its Applications	III	Electronics & Telecommunication Engineering



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Department of Mechanical Engineering

PG Program: Mechanical Production Engineering

Semester: I

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	P25MP101	Advanced Material and Processing	3	1	-	4	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
PCC	P25MP102	Production and Operation Management	3	1	-	4	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
PCC	P25MP103	Metal Casting Technology	3	1	-	4	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
PEC	P25MP104	Program Elective-I	3	-	-	3	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
OE	P25MP105	Research Methodology and IPR	2	-	-	2	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
ELC	P25MP106	Seminar		-	2	1	ISE	50	20	40
							ESE (OE)	50		
PCC	P25MP107	PG Lab- I		-	4	2	ISE-I	50	20	40
							ESE (POE)	50		
AC	P25MP108	Yoga and Meditation	1	-	--		-	-		-
							-	-		
							-	-		
Total			15	3	06	20	700			
			24							
Total Contact Hours- 24						Total Credits- 20				



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Title of the Course Name: Advanced Material and Processing Course Code: P25MP101	L	T	P	Credits
	3	1	--	4
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite:Materials, Manufacturing Processes

Course Objectives: The course aims,

1. To introduce the classification, composition, structure, and properties of engineering materials
2. To familiarize students with advanced manufacturing techniques
3. To impart knowledge on micro-machining processes
4. To analyze the processing techniques, structural design, and application areas of smart materials

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

C01	Understand the fundamental properties, classifications, and applications of conventional and modern engineering materials.
C02	Analyze the influence of heat treatment processes on the structure and mechanical properties
C03	Evaluate various advanced and non-conventional machining techniques
C04	Apply the knowledge of material behavior and processing methods to select suitable materials and processes for engineering design and manufacturing challenges.

Course Content		
Unit No.	Unit title and Content	Hrs



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1	Review of Engineering Materials- metals, alloys- ferrous and non-ferrous, plastics and polymers, ceramics and composites. Dual phase steels, micro alloyed steels, High strength low alloy steels, transformation induced plasticity (TRIP) steels, Maraging steels. Heat treatment of ferrous and nonferrous alloys for modification of structure and properties.	06
2	Modern materials- Compositions, properties and applications of: Inter-metallics, Ni and Ti aluminides, smart materials, shape memory alloys, Metallic glass- quassi-crystals, semiconductors, conductors & super conducting materials. Magnetic and photoelectric materials, optical materials, Bio materials, nano-materials. Polymer materials, formation of polymer structures, production techniques of fibers, foams, adhesives and coatings. Structure, properties and applications of engineering polymers	06
3	Composites: Fibers-glass, boron, carbon, organic, ceramic and metallic fibers- Matrix materialspolymers, metals and ceramics. Processing of polymer matrix composites: open mould process, bag molding, compression molding with BMC and SM- filament winding, pultrusion-centrifugal casting, injection molding, applications of PMC"s. Processing of metal matrix polymers: solid state fabrication techniques- diffusion bonding, powder metallurgy techniques, plasma spray, chemical and physical vapour deposition, Liquid state fabrication methods, Infiltration, squeeze casting, Rheo casting, compo casting. Applications.	07
4	Advanced Fine Finishing Process: Abrasive Flow Machining; Magnetic Abrasive Finishing; Magneto Rheological Abrasive Finishing: Process principle, process equipment; Analysis and modeling of finishing mechanism; parametric analysis; Applications.	06
5	Micro-Machining: Introduction to micromachining, Micro-electro discharge Machining: Principles of micro-EDM, micro-EDM, micro-WEDM, micro-WEDG, micro-ECM, Principles of micro-turning, micro-drilling and micro-milling, micro grinding, Hybrid micromachining method, films and film depurification,Oxidation,diffusion,ion-implantation,etching,bonding, metallization, surface and bulk machining – LIGA Process, Solid free form fabrication.	06



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6	Advances in Non-Conventional Machining Processes: A review of non-conventional machining processes, Analysis of mechanical, thermal and Electro-chemical type non-traditional machining processes. Tool design for selected nontraditional machining processes. Modeling and simulation of selected processes. A comparative study of various processes.	06
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Text Books:

1. Chawla K. K., "*Composite Materials*", Springer-Verlag New York Inc., 2nd edition, 2001.
2. Amitabha Ghosh & A. K. Mallik, "*Manufacturing Science*", Affiliated East-West Press, 2nd edition, 2010.
3. NishaKumar, "*Non-Conventional Machining in Modern Manufacturing Systems*", IGI Global, 1st Edition, 2018.
4. Kalpakjian&Schmid, "*Manufacturing Engineering and Technology*", Pearson, 8th edition, 2023.

Reference Book:

1. Groover, M. P. "*Fundamentals of Modern Manufacturing* ", Wiley India , 4th edition, 2013.
2. Kalpakjian, S., "*Manufacturing Engineering and Technology*". Pearson, 4th edition, 2001.
3. Fassi, I. "*Micro-Manufacturing Technologies & Applications*" Springer, 1st edition 2017.
4. Ashby & Jones, "*Engineering Materials: An Introduction to Properties, Applications and Design*", Elsevier, 5th edition, 2018.



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Department of Mechanical Engineering

Title of the Course Name: Production and Operation Management Course Code: P25MP102	L	T	P	Credits
	3	1	--	4
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Production, Industrial Management

Course Objectives: The course aims,

1. To evaluate the key factors influencing the design of effective operating systems.
2. To compare various operating systems used in firms.
3. To predict production outcomes under varying conditions and constraints.
4. To develop efficient production planning and operations scheduling systems

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

C01	Identify and evaluate the key factors and the interdependence of these factors in the design of effective operating systems
C02	Analysis of operating systems of the firm
C03	Predict the production using different models
C04	Design production planning and operations scheduling

Course Content		
Unit No.	Unit title and Content	Hrs
1	Introduction, Product and Service Design: Relation between production and operations and other functions, products and services, impact of information technology on productions and operations management, Business strategy- competitive priorities, developing operations strategy, productivity and competitiveness. Traditional and concurrent product design, design for manufacture, service, assembly, Design of services, types of services, Quality of design, costs of quality	07



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2	Forecasting Models: Classification, simple and weighted moving average method, exponential smoothening methods: additive model, trends and seasonality model, mixed model, Regression (linear and multiple) models, causal model, measures of forecasting accuracy, reliability of forecasts	06
3	Aggregate Production Planning: Production planning strategies, aggregate production planning model, chase demand and level workforce strategies, and techniques- trial and error, linear programming, transportation model, dynamic programming, Master production schedule, Materials requirement planning - structure and application; Capacity planning- measures and methods to generate capacity, Aggregate planning for services- yield management	06
4	Operations Scheduling: Approaches to scheduling – infinite and finite loading, forward or backward scheduling, Assignment model for assigning jobs to work centers, dispatching rules for scheduling n jobs on one machine, composite rules, scheduling with Johnson"s rule – n jobs-2 stations with same and different sequence, 2 jobs-n stations (graphical method), preparation of Gantt"s chart, job shop scheduling, open shop scheduling, dynamic scheduling in flexible manufacturing systems, employee scheduling for service	06
5	Inventory Management: Classification, EOQ models, order timing decisions, Safety Stock and reorder level decisions. Order quantity and reorder point, Continuous review systems, periodic review systems, selective inventory control - ABC analysis, Multi-item and Coordinated Replenishment Models- Spare parts and maintenance inventory models, Inventory models with probabilistic demands: Single period discrete probabilistic demand model, multiple period probabilistic models	06
6	Theory of constraints: Optimized Production Technology, Drum-rope-buffer models, CONWIP models, Planning and Control of JIT.	05

Text Books:

1. R. B. Khanna, “ *Production & Operations Management*”, PHI 1st edition, 2007.
2. Martin K. Starr, “*Production & Operations Management*”, India Edition, Cengage Learning, 1st edition 2007
3. Dr. K.C. Arora, “*Production & Operations Management*”, University Science Press , 1st edition, 2009



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Reference Book:

1. Jay Heizer, “*Operations Management*”, Pearson 9th Edition, 2009
2. Lee J. Krajewski & Larry P Ritzman, “*Operations Management- Strategy & Analysis*”, Pearson Education, 6th edition, 2001
3. E Silver, “*Inventory management and Production Planning and Scheduling*”, Wiley India ,3rd edition 1998



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Title of the Course Name: Metal Casting Technology Course Code: P25MP103	L	T	P	Credits
	3	1	--	4
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Manufacturing Processes, Basic of casting

Course Objectives: The course aims

1. To develop foundational knowledge of various casting processes, tools, materials.
2. To impart practical knowledge of moulding techniques, tools, pattern types and sand properties
3. To enable students to design and analyze gating systems and casting setups
4. To familiarize students with industrial melting practices & advanced casting processes

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

C01	Select the appropriate casting process for the manufacturing of a given component
C02	Design of gating and Riser system
C03	Analyze the flow of molten metal in gating system
C04	Describe the need and significance of special casting processes with appropriate inspection methods

Course Content		
Unit No.	Unit title and Content	Hrs
1	Principles of Metal Casting and Moulding Sand Technology: Different casting processes, Terminology and tools of sand moulding, Moulding sand and design, Moulding sand properties, Moulding sand property testing.	06
2	Pattern Design and Gating System in Sand Casting Different types of Patterns and Allowances, Steps involved in making sand castings, Design of Gating system, design of, Sand Casting defects	06



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3	Melting Practices and Solidification in Casting: Melting, fluidity and solidification, Melting furnaces and practice, Treatment of molten metal, Fluidity of molten metal, solidification.	06
4	Casting Alloys: Types and Applications: Common cast alloys: Cast iron and steels, Aluminum and magnesium cast alloys, Copper, Zinc and Titanium cast alloys.	06
5	Advanced Casting Techniques and Specialized Moulding Methods: Permanent mould and special casting processes: Die casting process, investment casting process, continuous casting process, Evaporative pattern casting and plaster moulding, vacuum sealed moulding and squeeze casting.	06
6	Casting Finishing, Inspection, and Environmental Aspect: Finishing design and environment: shakeout, fettling and finishing, Inspection, testing and quality, design consideration and Economics, Environment, Health and safety aspects.	06

Texts Books:

1. Khanna, O. P. "A Text-Book of Foundry Technology "DhanpatRai& Sons,15th edition, 2011.
2. Hajra Choudhury, S. K. "Elements of Workshop Technology(Vol. I & II)". Media Promoters, 1st edition,2001.
3. Rao, P. N. "Manufacturing Technology, Volume 1",5th edition, 2024

Reference Books:

- 1.Flinn, "Fundamentals of Metal Casting", Addison Wesley, 1st Edition, 1963.
- 2.Heine, R. W., Loper, "Principles of Metal Casting", McGraw Hill, 2nd Edition, 1967.
- 3.Niebel, Draper, "Product Design and Process Engineering Practice", McGraw Hill Foundry / Isaac Pitman, 1st Edition, 1974.



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Title of the Course Name: Abrasive Machining and Finishing Processes Course Code: P25MP104A	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Machine Tool and Manufacturing Processes

Course Objectives: The course aims to:

1. To introduce the principles and applications of abrasive machining and grinding fluids.
2. To Introduce students with advanced surface finishing techniques
3. To provide comprehensive knowledge of non-traditional machining processes
4. To explore magnetically assisted abrasive finishing and hybrid machining techniques

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

CO1	Describe the fundamental concepts of abrasive machining, grinding fluids, and surface finishing processes
CO2	Classify and compare advanced non-traditional machining processes and magnetic/abrasive flow-based techniques.
CO3	Analyze the working mechanisms and performance characteristics of magneto-rheological and hybrid finishing processes
CO4	Evaluate the sustainability and environmental impact of modern machining methods

Course Content		
Unit No.	Unit title and Content	Hrs
1	Abrasive Machining and Grinding Fluids Introduction to abrasive machining and finishing processes, grinding process, grinding fluids, grinding fluid additives, grinding fluids and its emissions.	06



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2	Advanced Surface Finishing Processes Honing process, Lapping process, Super finishing and sand blasting, vibratory bowl finishing, rotary barrel finishing or tumbling, drag finishing, Ice bonded abrasive finishing, pitch polishing, pad polishing	06
3	Advanced Non-Traditional Machining Processes Abrasive jet machining, Abrasive water jet machining, Ultrasonic machining, Electric discharge grinding, Electric discharge diamond grinding, Electro-chemical machining.	07
4	Magnetic and Abrasive Flow-Based Finishing Techniques Abrasive flow machining, Magnetic field assisted abrasive finishing, Magnetic abrasive finishing, Magnetic abrasive deburring, Magnetic float finishing.	06
5	Magneto-Rheological Based Finishing Processes Magneto rheological finishing, Magneto rheological Abrasive flow finishing, Rotational Magneto rheological Abrasive flow finishing.	06
6	Hybrid and Eco-Friendly Precision Machining Methods Elastic emission machining, Powder mixed EDM, sustainable grinding process: biodegradation of grinding fluids, MQL in grinding process.	05

Texts Books:

- 1 V. K. Jain, "Micro-manufacturing Processes", CRC Press, 1st Edition, 2012
- 2 V. K. Jain, "Nanofinishing science and Technology, Basic and Advanced finishing and Polishing Processes", CRC Press, 1st Edition, 2016
- 3 A. Ghosh and A. K. Malik, "Manufacturing Science", East West Press, 2nd Edition, 2010

Reference Books:

- 1 J. A. McGeough, "Advanced Methods of Machining", Springer Science and Business, 1st Edition, 1988
- 2 Zhang, Y., & Li, C "Hybrid-Energy Sustainable Machining: Mechanism and Processability". Springer Nature Singapore, 1st Edition, 2025.
- 3 V. P. Astakhov and S. Joksche, "Metalworking fluids for cutting and grinding", Woodhead Publishing, 1st edition, 2012
- 4 Khan, D. A., Alam, Z., & Iqbal, F. "Magnetic Field Assisted Finishing: Methods, Applications and Process Automation". CRC Press, 1st edition, 2021.



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Title of the Course Name: Sustainable Manufacturing Course Code: P25MP104B	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Product Life cycle, Production Management.

Course Objectives: The course aims to:

- 1.To enable learners to comprehend the fundamentals of sustainable manufacturing
- 2.To develop the ability to perform Life Cycle Assessment of manufacturing processes
3. To cultivate skills in modeling green manufacturing systems and Industry 4.0.
4. To introduce students to simulation-based decision-making and data analysis using tools.

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

C01	Explain the fundamental concepts of sustainable manufacturing
C02	Apply life cycle assessment procedures and utilize appropriate techniques
C03	Analyze discrete event simulation models and interpret statistical data
C04	Evaluate and design smart and sustainable manufacturing systems using Industry 4.0 technologies

Course Content		
Unit No.	Unit title and Content	Hrs
1	Fundamentals of Sustainable Manufacturing: Basics of production, Sustainability and manufacturing, Introduction to simulation, basic statistical concept for sustainable manufacturing analysis.	05
2	Life Cycle Assessment: Elements and Procedure Life cycle assessment, Life cycle assessment elements, Life cycle assessment procedure, Quantitative Techniques in LCA, Integration of LCA in Sustainable Manufacturing	06



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3	Green Manufacturing Strategies: Green manufacturing modeling: metrics for green manufacturing, Indices for green manufacturing, Developing green manufacturing system, green manufacturing techniques.	06
4	Simulation and Data Analysis for Sustainable Systems Basics of discrete event simulation and system modeling, Statistical analysis techniques: regression, ANOVA, hypothesis testing, Design of experiments (DoE) for sustainability studies, Interpreting simulation data for process improvement	07
5	Smart and Sustainable Manufacturing Systems Concept of Industry 4.0 and digital transformation in sustainability, Smart factories: architecture and sustainable benefits, IoT in green manufacturing, Role of AI/ML in predictive energy/resource management	07
6	Sustainability Frameworks Sustainability framework, basic modeling functions for factory simulation, Productivity and sustainability, Decision Support Systems for Sustainable Manufacturing.	05

Texts Books:

1. Stark, "*Sustainable Manufacturing: Challenges, Solutions and Implementation Perspectives*", Springer, 1st edition, 2017.
2. Jawahir, I. S, "*Sustainable Manufacturing: Fundamentals and Applications*", Wiley, 1st edition, 2013
3. V. K. Jain, "*Sustainable Manufacturing Processes*", Springer, 1st edition, 2019

Reference Books:

1. Ibrahim Garbie, "*Sustainability in Manufacturing Enterprises*", Springer publication, 1st edition, 2016.
2. J. Paulo Davim, "*Green manufacturing processing and systems*", Springer publication, 1st edition, 2013
3. Günther Seliger, Jérémy Bonvoisin, "*Sustainable Manufacturing*", Springer publication, 1st edition, 2017



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Title of the Course Name: Manufacturing Planning and Control Course Code: P25MP104C	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Production Systems

Course Objectives: The course aims to:

1. To understand the structure and functioning of various manufacturing systems and production models.
2. To Apply advanced manufacturing strategies and preplanning methods for effective production control.
3. To Implement operations planning and control systems such as MRP, MRP II, and JIT effectively.
4. Evaluate quality and cost performance in manufacturing systems using simulation and case studies.
5. Analyze and optimize FMS operations through lot sizing, production scheduling, and line of balance.

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

C01	Describe the structure, components, and production models of various manufacturing systems.
C02	Apply design and decision-making tools such as group technology and line balancing to improve manufacturing system performance.
C03	Analyze operations planning and control strategies including MRP, ERP.
C04	Evaluate quality and cost control techniques and design simulation-based solutions for real-time monitoring and optimization.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Introduction to Manufacturing Systems and Production Models Overview of manufacturing systems and various issues of interest: assembly line, repetitive batch manufacturing, Cellular manufacturing	05



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2	Advanced Manufacturing Systems and Production Planning FMS, JIT, CIM, preplanning: forecasting, economic analysis, aggregate planning, capacity planning, inventory planning	06
3	Design Decisions in Manufacturing Systems Decision making in design of manufacturing systems: group technology, line balancing, plant layout, Cellular Manufacturing.	06
4	Operations Planning and Control Systems Operations planning: MRP, MRP II, hierarchical planning systems, JIT systems ,Enterprise Resource Planning (ERP) Systems	07
5	FMS Operations and Scheduling Strategies FMS Operation and control: lot sizing decisions, production scheduling, line of balance,Real-Time Monitoring,Multi-objective scheduling	06
6	Quality and Cost Control in Manufacturing Systems Quality planning and control, cost planning and control, Simulation analysis of manufacturing systems, case studies	06

Texts Books:

1. Jacobs, "Manufacturing Planning and Control for Supply Chain Management", McGraw-Hill Education, 3rd Edition, 2024.
2. Groover, M. P," Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", Wiley & Sons, 7th Edition, 2022
3. Chang, "Computer-Aided Manufacturing", Pearson Education, 3rd edition 2005.

References:

- 1.D.D.Bedworth and J.E Bailey, "Integrated Production Control, System-management, Analysis and Design", John Wiley, 1stedition,1983.
2. A.C.Hax and D.Candea,"Production and Inventory Managemeny", Prentice-Hall, 1st Edition, 1984.
3. M.G.Korgaokar," JIT Manufacturing, Macmillan", 1st edition,1992



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Title of the Course Name: Research Methodology and IPR Course Code: P25MP105	L	T	P	Credits
	2	-	-	2
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Research

Course Objectives: The course aims:

1. To introduce the fundamental principles of research methodology.
2. To develop an understanding of research design and analysis.
3. To enable formulation of research problems and objectives.
4. To provide knowledge about Intellectual Property Rights and their importance.
5. To create awareness about patents, copyrights, and trademarks.

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

CO	Course Outcomes
C01	Understand the basic concepts and types of research.
C02	Identify appropriate research problems and prepare research proposals.
C03	Understand the importance of ethics in research and publication.
C04	Explain the significance and types of Intellectual Property Rights.
C05	Apply for patents and understand processes involved in IPR protection.
C06	Demonstrate the impact of IPR on innovation and economic growth.

Course Content		
Unit No.	Contents	Hrs
1	Introduction to Research Methodology Meaning, Objectives, Motivation, Types of Research, Research Approaches, Research Process, Criteria of Good Research	06
2	Research Problem and Design Identifying Research Problem, Literature Survey, Research Objectives, Research Design Concepts, Features of Good Design	06
3	Data Collection and Analysis Sources of Data, Sampling Methods, Data Processing, Statistical	06



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	Techniques, Hypothesis Testing, Report Writing	
4	Ethics in Research Ethical Principles, Plagiarism, Impact of Misconduct, Ethical Committees, Publishing Ethics	06
5	Introduction to IPR Overview of Intellectual Property, Importance of IPR, Types: Patents, Trademarks, Copyrights, Industrial Designs	06
6	IPR Procedures and Case Studies Patent Filing Procedure, Patentable and Non-patentable Items, Patent Search, Licensing, Case Studies on IPR Disputes	06

Text Books:

1. C. R. Kothari, "Research Methodology: Methods and Techniques", New Age International, 2nd Edition, 2004.
2. P. Pandey and S. Pandey, "Research Methodology: Tools and Techniques", Bridge Center, 1st Edition, 2015.
3. Neeraj Pandey and Khushdeep Dharni, "Intellectual Property Rights", PHI Learning, 1st Edition, 2014

Reference Books:

1. Ranjit Kumar, "Research Methodology: A Step-by-Step Guide", Sage Publications, 4th Edition, 2014.
2. T. Ramakrishna, "Basic Principles and Acquisition of Intellectual Property Rights", CIPRA, NLSIU, 1st Edition, 2005.
3. V. Scaria, "Intellectual Property Rights in the Global Era", LexisNexis, 1st Edition, 2012.

MOOC/NPTEL Platform:

1. NPTEL Course: Research Methodology – Prof. Rajat Agarwal (IIT Roorkee)
2. SWAYAM Course: Understanding IPR – Prof. Feroz Ali (IIT Madras)



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Title of the Course Name: Seminar Course Code: P25MP106	L	T	P	Credits
	--	--	2	1
	ISE	MSE	ESE	Total
	50	50	50	100

Pre-Requisites: Previously studied courses

Course Objectives: The course aims to:

1. To identify and critically compare technical issues within the chosen area of specialization.
2. To develop the ability to compile an annotated bibliography showcasing research and scholarly inquiry.
3. To enhance skills in writing well-structured technical reports using proper formatting, language, and logic.
4. To interpret, evaluate, and analyze technical topics with clarity and depth of understanding

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

C01	Identify and compare technical issues related to the area of course specialization
C02	Outline annotated bibliography of research demonstrating scholarly skills.
C03	Prepare a well organized report employing elements of technical writing & critical Thinking.
C04	Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting



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Title of the Course Name: PG LAB-I Course Code: P25MP107	L	T	P	Credits
	--	--	4	2
	ISE	MSE	ESE	Total
	50	--	50	100

Course Objectives: The course aims to:

1. To enable students to measure and analyze cutting forces in milling operations using experimental methods.
2. To develop competency in modeling mechanical components using advanced CAD software.
3. To apply knowledge of fluid power systems in designing hydraulic circuits.
4. To perform finite element analysis of machine components using simulation tools such as ANSYS and LS-DYNA.

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

C01	Measure the cutting forces in machining process
C02	Apply solid modeling tools to create structural and machine component models and analyze their mechanical behavior using simulation software such as ANSYS or LS-DYNA.
C03	Design a hydraulic circuit for the given application
C04	Analyze real-time industrial manufacturing practices and compare them with theoretical concepts

Perform the following experiments (Any Five)

Exp. No.	Content
1	Cutting force determination using force dynamometer.
2	Experimental study in micromachining using photo chemical machining.
3	Analysis of machine components using ANSYS/LS Dyna etc. software
4	Solid modeling of structural components using modeling software.
5	Solid modeling of machine components using modeling software.



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6	Sequencing of cylinders using hydraulic trainer kit.
7	Synchronizing of cylinders using hydraulic trainer kit.
8	Industrial Visit



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Title of the Course Name: Yoga and Meditation Course Code: P25MP108	L	T	P	Credits
	1	--	--	--
	ISE	MSE	ESE	Total
	--	--	--	--

Pre-Requisite: Basic understanding of human anatomy and interest in physical and mental well-being.

Course Objectives:

1. To explore the philosophical and psychological foundations of Yoga and Meditation.
2. To introduce and practice the Eight Limbs of Yoga (*Ashtanga Yoga*) for holistic self-regulation.
3. To train students in meditation, breathing, and ethical practices for enhancing clarity, focus, and emotional balance.
- 4.To help students integrate yogic wisdom and mindfulness

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

C01	Comprehend the core teachings of YogaSutras.
C02	Practice foundational yogic techniques.
C03	Apply principles of <i>Yama</i> and <i>Niyama</i> for improved discipline, ethics, and self-awareness.
C04	Develop concentration and mindfulness for stress reduction and productivity.



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Course Content		
Unit No.	Unit title and Content	Hrs
1	Foundations of Yoga Philosophy Origin and evolution of Yoga; Introduction to Yoga Sutras.Definition of Yoga – “YogasChittaVrittiNirodha”.The five Vrittis (mental fluctuations) and their control.	03
2	Ethical and Personal Discipline (Yama &Niyama) The five Yamas – Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha. The five Niyamas – Shaucha, Santosha, Tapas, Svadhyaya, IshwarPranidhana.Relevance of Yama-Niyama in academic and professional life.	03
3	Physical & Mental Purification (Asana, Pranayama, Pratyahara) Asana – Role of posture; stability and comfort in the body Pranayama – Breath control techniques; calming the nervous system Pratyahara – Withdrawal of senses; mastering inner awareness	03
4	Concentration, Meditation, and Liberation (Dharana, Dhyana, Samadhi) Dharana – Developing concentration and focus Dhyana – The process and practice of meditation Samadhi – State of absorption; experiencing inner peace and unity	03

References:

1. Swami Satchidananda, "*The Yoga Sutras of Patanjali*", Integral Yoga Publications, 1st Edition, 2012.
2. B. K. S. Iyengar, "*Light on the Yoga Sutras of Patanjali*", HarperCollins Publishers India, 1st Edition, 2002.
3. Swami SatyanandaSaraswati, "*Four Chapters on Freedom*", Yoga Publications Trust, 1st Edition, 2008.
4. Swami Vivekananda, "*Raja Yoga*", AdvaitaAshrama, 1st Edition, 1896 (Reprint 2020).



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Department: Department of Mechanical Engineering

Semester: II

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min for Passing	
PCC	P25MP201	Quality Control and Reliability	3	1	-	4	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
PCC	P25MP202	Advanced CNC Technology	3	1	-	4	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
PCC	P25MP203	Advances in Welding and Joining Technology	3	-	-	3	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
PEC	P25MP204	Program Elective-II	3	-	-	3	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
OE	P25MP205	Open Elective-I	3	-	-	3	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
VEC	P25MP206	Technologies for Industrial Evolution	2	-	-	2	ISE-I	25	20	20
							ISE-II	25		
ELC	P25MP207	Mini Project	-	-	2	1	ISE-I	25	20	40
							ISE-II	25		
							ESE (POE)	50		
PCC	P25MP208	PG Lab- II	-	-	4	2	ISE	50	20	40
							ESE (POE)	50		
ELC	P25MP209	Internship/Field Training	-	-	-	-	Will be Evaluated in Sem-III	-	-	
Total			17	2	06	22	750			
			25							
Total Contact Hours- 25						Total Credits- 22				



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Title of the Course Name: Quality Control and Reliability Course Code: P25MP201	L	T	P	Credits
	3	1	--	4
	ISE	MSE	ESE	Total
	20	30	50	100

Pre Requisite:- Machining Processes, industrial management

Course Objectives: The course aims to:

1. To explore the foundational philosophies and frameworks of quality management.
- 2 To equip students with the skills to design and analyze experiments for process and quality improvement.
3. To develop the ability to apply various quality improvement tools.
4. To enable students to understand and apply Statistical Process Control

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

C01	Explain the principles of Total Quality Management (TQM) and the role of continuous improvement in modern manufacturing.
C02	Apply statistical tools and techniques such as confidence intervals, hypothesis testing, ANOVA, and factorial design to improve product and process quality.
C03	Analyze quality improvement tools and models to identify root causes and enhance customer satisfaction.
C04	Evaluate and design robust manufacturing systems using Statistical Process Control (SPC), Taguchi methods, and reliability engineering principles for long-term product quality and system reliability.



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Course Content		
Unit No.	Unit title and Content	Hrs
1	Total Quality Management in Manufacturing: Introduction: New culture of TQM, TQM axioms, consequences of total quality managing, cost of total quality, valuable tools for quality, and the Japanese factor. The Deming Approach to management: Deming's fourteen points for management, deadly sins & diseases, implementing the Deming's philosophy, Deming on management.Juran on Quality: Juran's quality trilogy, JuranVs Deming.	07
2	Quality Leadership and Continuous Improvement Strategies Crosby & the Quality Treatment: Crosby diagnosis of a troubled company, Crosby's quality vaccine, Crosby's absolutes for quality management, Crosby's fourteen steps for quality improvement. Imai's Kaizen: The concept, Kaizen & innovation, the Kaizen management practices.	06
3	Statistical Analysis and Experimental Design for Quality and Process Improvement Basic Techniques for Statistical Analysis: Introduction, measures of central tendency & dispersion, confidence intervals, hypothesis testing, frequency distributions & histograms, probability distributions, measuring linear associations. Design & Analysis of Experiments: Introductions, factorial experiments, aliasing, constructing fractional designs, analysis of variance.	06
4	Tools and Techniques for Quality Improvement : Affinity diagram, bar chart, block diagram brain storming, cause and effect analysis, control charts, cost benefit analysis, customer-supplier relationship check list, decision analysis, flow charts, force field analysis, line graph/run charts, pareto analysis, quality costing, quality function development (QFD), quality project approach & problem solving process, risk analysis scatter diagrams.	06



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5	Statistical Process Control and Taguchi Methods Statistical Process Control: Introduction, data collection plan, variables charts, attributes, interpreting the control charts. Taguchi's Approach to Experimental Design & Offline Quality Control: Introduction, Taguchi's recommended design techniques, from Deming to Taguchi & vice-versa.	06
6	Reliability Engineering Reliability: Introduction, life cycle curves & probability distribution in modeling reliability, system reliability, operating characteristic curves, reliability and life testing plans.	05

Texts Books:

1. N. Logothetis, *Managing for Total Quality: From Deming to Taguchi and SPC*, Prentice Hall of India, New Delhi, 1st Edition, 2005.
2. A. Mitra, *Fundamentals of Quality Control and Improvement*, Prentice Hall of India, New Delhi, 2nd Edition, 2003.

Reference Books:

- 1 R.F. Lochner & J.E. Matar, *“Designing for Quality”*, Chapman & Hall, 1st Edition, 2001.
- 2 A. Zaidi, *“SPC: Concepts, Methodologies and Tools”*, Prentice Hall of India, 1st Edition, 1995.



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Title of the Course Name: Advanced CNC Technology Course Code: P25MP202	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Prerequisite: Machine Tools

Course Objectives: The course aims to:

- 1 To understand the significance of CNC machines in modern manufacturing.
- 2 To describe the role and importance of feedback devices in CNC control systems.
- 3 To develop accurate CNC part programs for different machining operations.
- 4 To simulate and verify CNC part programs using relevant simulation software.

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

C01	Explain the significance of CNC machines
C02	Describe the significance of the feedback devices in CNC machines
C03	Identify the key features of CNC system
C04	Develop and Simulate CNC part program for a given components

Course Content		
Unit No.	Unit title and Content	Hrs
1	Fundamentals of CNC and Control Systems Introduction to Numerical Control in computer aided manufacturing, components of a CNC system, types of CNC systems, open loop and closed loop control systems.	06



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2	Drives, Feedback, and CNC Machine Construction Drives and controls, interpolators, feedback devices, CNC machine constructional features.	06
3	CNC Tooling, and Advanced System Feature CNC design considerations, CNC turret punch press, tooling for CNC, APC, ATC, CNC machine accessories, advanced features of CNC system	06
4	CNC Programming and Simulation Tools Conversational and graphics based software, solids based part programming, free form surface machining, simulation and verification of CNC programs, Manual Part Programming,	06
5	Advanced CNC Programming and System Utilization Computer assisted part programming. Maintenance and installation of CNC systems, utilization of CNC machines.	06
6	CNC Part Programming for Turning and Milling Applications CNC part programming for turning and milling, post processors, CNC part programming with CAD-CAM.	06

Texts Books:

1. Rao, P. N., "CAD/CAM: Principles and Applications", McGraw-Hill, 3rd edition, 2010.
2. B. S. Pabla, "CNC Machines", New Age International Pvt. Ltd., 3rd edition, 2018
3. V. K. Jain, "Advanced Machining Processes", Allied Publishers Pvt. Ltd., 1st edition, 2007

Reference Book:

1. S. Krar, A. Gill, "CNC Technology and Programming", McGraw-Hill Publishing Co., 1st edition, 1990.
2. P. J. Amic, "Computer Numerical Control Programming", Prentice Hall, 1st edition, 1996.
3. K. J. Astrom, B. Wittenmark, "Adaptive Control", 2nd Edition, 1994
4. Alan Overby, "CNC Machining Handbook", McGraw-Hill, 1st edition, 2010



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Title of the Course Name: Advances in Welding and Joining Technology Course Code: P25MP203	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Prerequisite: Materials, Metallurgy

Course Objectives: The course aims to:

- 1 To introduce the principles, classifications, and applications of conventional and advanced welding and joining processes.
- 2 To develop understanding of modern welding technologies such as laser beam welding, electron beam welding, hybrid welding, and solid-state joining methods.
- 3 To explain the thermal and metallurgical aspects of welding, including heat transfer, solidification, stress analysis, and weld joint design.
- 4 To impart knowledge of weld defect analysis, non-destructive testing methods, and safety practices in welding operations.

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

C01	Select the appropriate welding process for the application
C02	Select the appropriate input parameters for enhancing weld quality
C03	Describe the melted and heat affected zone of a metal
C04	Describe the welding defects and Analyze the stresses in welding structures

Course Content		
Unit No.	Unit title and Content	Hrs
1	Fundamentals of Welding Processes Welding processes classification, arc welding processes-solid state welding processes, plasma arc welding and ultrasonic welding - Resistance welding process-different types weld joints, welding positions.	06
2	Secondary Joining Methods Brazing, soldering and adhesive bonding, process principles & applications, Comparison with welding methods, Selection of joining methods for specific applications	06



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3	Advanced Welding Techniques Electron beam welding -Laser beam welding -Hybrid welding -CMT welding -SpinArc GMAW -Tandem GMAW -Activated TIG welding-Hot wire TIG welding-Diffusion bonding -Weld Surfacing & cladding.	06
4	Solid-State and High-Energy Welding Methods Friction Surfacing, Friction stir spot welding, Explosive Welding, Welding of Al and Mg based alloys -Dissimilar welding of Non-ferrous alloys -Friction welding with Cu interlayer, Magnetically impelled arc butt (MIAB) welding -Under water welding -Welding of Cu, Al, Ti and Ni alloys	07
5	Weld Metallurgy and Thermal Considerations Heat transfer during welding, Solidification mechanisms in welds, Heat Affected Zone, Residual stresses and their effects, Pre-weld and post-weld heat treatments, design consideration in weld joint.	06
6	Inspection, Defects, and Safety in Welding Types and causes of welding defects,Methods of defect prevention and correction,Inspection and testing of welds,Visual, Radiographic, Ultrasonic, Magnetic Particle, Dye Penetrant testing,Safety measures in welding environments,Codes and standards related to welding quality and safety	06

Text Books

- 1 Dr. R.S. Parmar, "*Welding Processes and Technology*", Khanna Publishers, 3rd ed.,2011.
- 2 H.S. Bawa, "*Manufacturing Technology– I*", Tata McGraw Hill Publishers, 2007
- 3 P. L. Jain, "*Principles of Foundry Technology*", Tata McGraw Hill Publishers, 5th ed., 2012.

Reference Book:

- 1 S.V. Nadkarni, "*Modern Arc Welding Technology*", Oxford & IBH Publishing Co. Pvt. Ltd., 2nd ed., 2018.
- 2 Cornu J., "*Advanced Welding Systems – Volumes I, II and III*", JAICO Publishers, 1st ed,1994
3. J.F. Lancaster, "*Metallurgy of Welding*", George Allen & Unwin Publishers, 1980
4. Howard B. Cary & Scott C. Helzer, "*Modern Welding Technology*", Prentice Hall, 5th ed. 2001.



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Title of the Course Name: Computer Integrated Manufacturing Course Code: P25MP204A	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Prerequisite: Manufacturing Processes, Basic Mathematics and Geometry

Course Objectives: The course aims to:

1. To explain the importance of sustainable practices in modern manufacturing systems.
2. To describe the procedure and key elements involved in life cycle assessment.
3. To analyze green manufacturing models for improving process sustainability.
4. To apply sustainability frameworks and green manufacturing principles in the development of smart factories.

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

C01	Explain the need and significance of sustainable manufacturing processes
C02	Describe the procedure of life cycle assessment in a manufacturing context
C03	Analyze the need and significance of green manufacturing modeling
C04	Interpret the role of renewable energy in green machining
C05	Apply the sustainability and green manufacturing system in developing a smart factory

Course Content		
Unit No.	Unit title and Content	Hrs
1	Introduction to Computer Integrated Manufacturing and Automation Computers and manufacturing systems, Computer numerical control, Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, computerized elements of a CIM system, CAD/CAM and CIM. Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in process,	06



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2	Automated Production and Assembly Line Systems Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage, partial automation, analysis of automated flow lines with storage buffer, fundamentals of automated assembly systems, numerical problems.	06
3	Computer-Aided Design and Geometric Transformations The design process, applications of computers in design, software configuration, functions of graphics package, constructing the geometry. Transformations: 2D transformations, translation, rotation and scaling, homogeneous transformation matrix, concatenation, numerical problems on transformations	06
4	Group Technology, FMS, and Line Balancing Techniques Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, Line Balancing: Line balancing algorithms, methods of line balancing,	06
5	Industrial Robotics and Applications Robot anatomy, joints and links, common robot configurations, robot control systems, accuracy and repeatability, end effectors, sensors in robotics. Robot programming methods: on-line and off-line methods. Robot industrial applications: Material handling, processing and assembly and inspection.	08
6	Computerized Manufacturing Planning and Control Systems Computer Aided Process Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control	06



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Texts Books

- 1.Rehg, J. A, "*Computer-Integrated Manufacturing*", Prentice Hall ,3rd edition, 2004.
- 2.Scheer, A.-W., "*CIM: Computer Integrated Manufacturing – Towards the Factory of the Future*", Springer, 3rd edition, 1994.
- 3.Rao, P. N., "*CAD/CAM: Principles and Applications*" , McGraw-Hill, 3rd edition, 2010.

References:

- 1.Groover, M.P., "*Automation, production systems, and computer-integrated*", Tata McGraw Hill. 5th edition, 2011.
2. Weatherall, A. "*Computer integrated manufacturing: from fundamentals to implementation*". Butterworth-Heinemann, 2nd edition, 2013
3. Alasdair Gilchrist , "*Industry 4.0: The Industrial Internet of Things*", Apress, 1st edition, 2017,



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Title of the Course Name: Total Productive Maintenance Course Code: P25MP204B	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Prerequisite: Production systems, TQM

Course Objectives: The course aims to:

1. To impart fundamental knowledge of Total Productive Maintenance.
2. To develop the ability to analyze and implement various maintenance models.
3. To enable students to plan, implement, and evaluate TPM practices.
4. To introduce students with advanced maintenance management techniques.

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

C01	Apply maintenance strategies to increase the productivity of plant and equipment with modest investment.
C02	Explain the key operational activities involved in a quality management system.
C03	Analyse the causes of accelerated deterioration during the production process.
C04	Evaluate the root causes of productivity losses in industrial operations.
C05	Employing consultants to create this culture is common practice.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Fundamentals of Maintenance and TPM Concepts Outline of TPM. Maintenance Concepts, Objectives and functions, Tero technology, Reliability Centered, Maintenance, (RCM), maintainability prediction, availability and system, effectiveness, organization for maintenance	06
2	Equipment Effectiveness and Preventive Maintenance Models TPM-challenging limits, maximizing equipment effectiveness, Maintenance Models, Minimal repair, maintenance types, balancing preventive maintenance, and breakdown maintenance, preventive maintenance schedules: deviations on target values, preventive maintenance schedules: functional characteristics, replacement models	06



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3	TPM Structure Organizing for TPM implementation, PM Concepts, Importance of TPM, Zero breakdown concepts, Zero Defects and TPM, maximizing equipment effectiveness, autonomous maintenance program, five pillars of TPM, TPM Small group activities	06
4	TPM Planning, Implementation, and Global Trends TPM implementation and stabilization, TPM Planning and Implementation, Organization for TPM, management decision, awareness and training for TPM, establishment of basic policies and goals, formation of master plan, TPM implementation, Ongoing global trends in TPM.	06
5	Human Factors and Maintenance Logistics TPM small group activities, Maintenance Logistics, Human factors in maintenance, maintenance manuals, maintenance staffing methods, queuing applications, simulation, spare parts management, maintenance planning and scheduling	06
6	Advanced Maintenance Techniques and Condition Monitoring The PM prize for outstanding TPM plants, Online Monitoring Condition Monitoring Techniques, Vibration Monitoring and Signature Analysis. Wear Debris Monitoring, Maintenance Management Information System, Expert systems, Corrosion Monitoring and Control.	06

Text Books:

- 1.R. Srinivasan, "*Total Productive Maintenance*", Prentice Hall India, 1st Edition, 2006.
- 2.Amit Kumar Gupta and S. Ghosh, "*Total Productive Maintenance: A Systematic Approach*", Laxmi Publications, 1st Edition, 2012.
3. P. A. Kumar, "*TPM Implementation: A Practical Approach*", Notion Press, 1st Edition, 2018.

Reference Books:

- 1.Nahchi-Fujikoshi Corporation, "*Training for TPM*", Japan Institute of Plant Maintenance, 1st Edition, 1990.
- 2.S. Nakajima, "*Introduction to TPM: The Purto Factory*", Japan Institute of Plant Maintenance, 1st Edition, 1986.
3. S. Nakajima, "*TPM: Maintenance Prevention Design*", Productivity Press Inc., 1st Indian Edition, 1993.
- 4.K. Shirole, Y. Kimura, and M. Kaneda, "*An Advanced Step in TPM Implementation*", Japan Institute of Plant Maintenance, 2nd Edition, 1995.



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Title of the Course Name: Lasers in Manufacturing Course Code: P25MP204C	L	T	P	Credits
	3	1	--	4
	ISE	MSE	ESE	Total
	20	30	50	100

Course Objectives: The course aims to:

- 1 To introduce the fundamentals of laser technology and its significance in various manufacturing processes.
- 2 To provide comprehensive knowledge of laser-based processes such as cutting, welding, surface treatment, and forming.
- 3 To expose students to advanced laser applications in additive manufacturing and laser-assisted machining.
- 4 To enable students to understand the integration of lasers with automation systems such as CNC and CAD for modern manufacturing.

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

C01	Explain the need and significance of lasers in modern manufacturing processes.
C02	Describe the mechanism and key parameters of the laser welding process and analyze common defects in welds.
C03	Illustrate the laser-based surface modification techniques such as hardening, alloying, and cladding, and evaluate their effects on material properties.
C04	Compare laser-based additive manufacturing and laser-assisted machining processes in terms of working principles, parameters, and outcomes.



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Course Content		
Unit No.	Unit title and Content	Hrs
1	Fundamentals of Laser Technology in Manufacturing Lasers in manufacturing: Importance and application, Fundamentals of Laser Technology, Laser system: Construction and types, Principle of operation, Types of laser cutting and kerf geometry, Types of Lasers in material removal, process and performance parameters	06
2	Laser Welding and Forming Techniques Mechanisms of laser welding, effects of process parameters during laser welding and study of defects in weld beads, Material forming and fundamental of laser forming, process parameters and their effects on the performance of laser forming.	07
3	Laser Surface Engineering Surface treatment and applications of lasers, laser surface hardening, laser surface alloying, Lasercladding	05
4	Laser-Based Additive Manufacturing Additive manufacturing techniques, Laser scanning stereolithography, selective laser sintering and selective laser melting, process and performance parameters of laser based additive manufacturing techniques	06
5	Automation and Integration in Laser Manufacturing Lasers in manufacturing automation, CNC for laser-based manufacturing, CAD for laser-based manufacturing, Laser assisted material forming, effect of coatings, 3D laser forming and micro forming.	06



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Text Books:

1. W. M. Steen, "*Laser Material Processing*", Springer-Verlag, London, 4th edition. 2005.
2. S. N. Joshi and U. S. Dixit, "*Laser Based Manufacturing*", Springer India, 2015.

Reference Books:

1. N. B. Dahotre & A. Samant, "*Laser Machining of Advanced Materials*", CRC Press, London, 1st ed, 2011.
2. K. Sugioka, M. Meunier & A. Piqué, "*Laser Precision Microfabrication*", Springer-Verlag, Berlin/Heidelberg, 2010.
3. J. C. Ion," *Laser Processing of Engineering Materials*", Elsevier, 2005.



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Title of the Course Name: Environment and Development Course Code: P25MP205A	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Basic knowledge of environmental science and sustainable practices

Course Objectives:

1. To understand the interrelationship between environment and development.
2. To assess the impact of development activities on ecosystems, biodiversity, and natural resources.
3. To analyze sustainable development concepts, environmental ethics, and green technologies.
4. To explore national and international environmental policies and enhance awareness on climate change and mitigation strategies.

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

C01	Recall and summarize the core concepts of environmental science, sustainable development, climate change, resource degradation, and ecological ethics.
C02	Interpret the interrelationships between environment, development, governance policies, and technological strategies for sustainability.
C03	Apply the principles of sustainable development, green technologies, and environmental ethics.
C04	Evaluate contemporary environmental issues and global case studies to assess the effectiveness of policies, renewable technologies, and sustainable practices.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Introduction to Environment and Development Definition and Scope, Need for Sustainable Development, Historical	6



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	Background, Environmental Movements.	
2	Natural Resources and Environmental Degradation Types of Natural Resources, Resource Depletion, Land Degradation, Pollution and Biodiversity Loss.	6
3	Sustainable Development and Environmental Ethics Principles of Sustainability, Environmental Ethics, Ecological Footprint, Green and Clean Technologies.	6
4	Climate Change and Global Concerns Climate Change Causes and Impacts, Global Warming, Carbon Cycle, Adaptation and Mitigation Strategies.	6
5	Policy and Governance Environmental Policies, Acts and Protocols (India & Global), Role of Government and NGOs, Environmental Impact Assessment (EIA).	6
6	Contemporary Issues and Case Studies Urbanization and Environment, Renewable Energy, Case Studies on Sustainable Practices in India and Abroad.	6

Text Books:

1. R. Rajagopalan, "*Environmental Studies: From Crisis to Cure*", Oxford University Press, 3rd edition, 2016.
2. Erach Bharucha, "*Textbook of Environmental Studies*", UGC Publication, 1st edition, 2005.
3. P. D. Sharma, "*Ecology and Environment*", Rastogi Publications, 11th edition, 2021.

Reference Books:

1. W. P. Cunningham and M. A. Cunningham, "*Principles of Environmental Science*", Tata McGraw-Hill, 7th edition, 2014.
2. D. B. Botkin and E. A. Keller, "*Environmental Science: Earth as a Living Planet*", Wiley India, 8th edition, 2011.
3. J. D. Sachs, "*The Age of Sustainable Development*", Columbia University Press, 1st ed., 2015.



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Course Name: Engineering Economics	L	T	P	Credits
Course Code: P25MP205B	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Mathematics, Management Information Systems (MIS)

Course Objectives: The course aims,

1. To understand fundamental economic concepts and cost analysis in engineering.
2. To apply interest formulas and cash flow techniques to evaluate alternatives.
3. To analyse depreciation and asset replacement decisions.
4. To evaluate public vs private projects with cost-benefit considerations.

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

C01	Recall and define key concepts in engineering economics such as cost elements, interest factors, cash flow models, depreciation techniques, and project financing.
C02	Interpret and compare economic decision-making tools including present worth, future worth, annual equivalent, and rate of return across engineering applications.
C03	Apply economic analysis techniques to evaluate material selection, make-or-buy decisions, equipment replacement, depreciation schedules, and project investments.
C04	Evaluate engineering alternatives and public-private project outcomes using life-cycle costing, value engineering principles, and inflation-adjusted economic assessments.



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Course Contents

Unit No.	Contents	Hours
1	Introduction Engineering Economy: Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering – Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis, P – V ratio, Elementary economic Analysis– Material selection for product, Design selection for a product, Process planning.	6
2	Value Engineering: Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications– Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fundfactor,EqualpaymentseriespaymentPresentworthfactor– equalpaymentseriescapitalrecovery factor – Uniform gradient series annual equivalent factor, Effective interest rate,Examples in all the methods.	6
3	Cash Flow: Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, Cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, Cost dominated cash flow diagram), rate of return method, Examples in all methods.	6
4	Replacement And Maintenance Analysis: Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset– capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.	6
5	Depreciation: Depreciation – Introduction, Straight line method of depreciation, – Declining balance method of depreciation – Sum of the years digits method of depreciation, – Sinking fund method of depreciation/Annuity method of depreciation, service output method of depreciation – Evaluation of public alternatives – Introduction – Examples – Inflation adjusted decisions – Procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.	6
6	Financing & Public vs Private Projects: Financing sources, economic evaluation in public projects, social costs, and regulatory factors.	6



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Text Books:

1. Panneer Selvam, R, "*Engineering Economics*", Prentice Hall of India Ltd, New Delhi, 2001.
2. Suma Damodaran, "*Managerial economics*", Oxford university press 2006
3. Stonier and Hauge "A Text book of Economic Theory" by, Pearson Publication.

Reference Books:

1. Sampat Mukherjee, "*Modern Economic Theory*", New Age International Publisher, 1st edition.
2. DeGarmo, "*Engineering Economics*", Prentice Hall, 1st edition.
3. Bo Sodersten, "*International Economics*", Macmillan, 1st edition



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Course Name: Project Management	L	T	P	Credits
CourseCode: P25MP205C	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Pre-Requisite: Engineering Mathematics, Engineering Physics, Engineering Mechanics

Course Objective: The course aims to:
1 Understand fundamentals of project management including project life cycle, stakeholders, and organizational structures.
2 Develop planning and scheduling skills using tools like WBS, CPM, and PERT.
3 Apply cost, quality, risk, and resource management techniques for effective project execution.
4 Enhance decision-making and leadership skills required for monitoring, controlling, and successful project completion.

Course Outcomes: At the end of the course, students will be able to:
CO1 Explain project management concepts, project life cycle, and roles of stakeholders.
CO2 Prepare project plans using scheduling and network techniques such as CPM and PERT.
CO3 Analyze project costs, risks, quality, and resources for effective control.
CO4 Evaluate project performance and apply modern tools for successful project closure.

CO-PO Mapping:														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	-	2	2	1
CO2	3	3	2	-	3	2	-	-	-	-	-	-	2	-
CO3	3	3	2	3	-	2	-	-	-	-	-	-	3	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	3	3

Course Content		
Unit No.	Description	Hrs
1	Introduction to Project Management Definition of project and project management, Characteristics of a project, Project life cycle phases, Project vs operations, Role of project manager, Project stakeholders, Project organization structures (functional, matrix, projectized)	06
2	Project Identification and Selection Project identification methods, Feasibility study (technical, economic, financial, social),	06



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	Project selection techniques, Cost-benefit analysis, Project charter, Project scope definition, Work Breakdown Structure (WBS)	
3	Project Planning and Scheduling Project planning process, Bar charts and milestone charts, Network techniques, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Time estimation, Float and slack analysis.	06
4	Project Cost and Resource Management Project cost estimation techniques, Budgeting and cost control, Earned Value Analysis (EVA), Resource planning and allocation, Resource leveling, Project procurement management.	06
5	Project Risk and Quality Management Concept of project risk, Risk identification and classification, Risk analysis (qualitative and quantitative), Risk mitigation strategies, Quality planning and assurance, Total Quality Management (TQM), Six Sigma concepts in projects.	06
6	Project Monitoring, Control, and Closure Project monitoring techniques, Performance measurement, Project control systems Project communication management, Project documentation, Project audit Project termination and closure, Introduction to project management software (MS Project)	06

Text Books:

1. K.K. Chitkara, *Project Management: Planning, Implementation and Control*, Tata McGraw-Hill Education.
2. P. K. Ghosh, *Project Management*, Oxford University Press.
3. Prasanna Chandra, *Projects: Planning, Analysis, Selection, Implementation and Review*, Tata McGraw-Hill.

Reference Books :

1. Harold Kerzner, *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, Wiley Publications.
2. Jack R. Meredith & Samuel J. Mantel Jr., *Project Management: A Managerial Approach*, Wiley India.
3. Gray, Clifford & Larson, *Project Management: The Managerial Process*, McGraw-Hill Education.



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Title of the Course Name: Healthcare Engineering	L	T	P	Credits
Course Code P25MP205D	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Basics of Management, Market Research Fundamentals, Financial Accounting Basics.

Course Objectives: The course aims:

1. To understand how the healthcare system works and what challenges it faces.
2. To learn how to improve hospital services using planning and optimization methods.
3. To study how patient waiting lines and hospital processes can be modeled and improved.
4. To explore new technologies like AI, remote care, and digital tools in future healthcare.

Course Outcomes: Students will be able to

C01	Recall fundamental components of healthcare systems, including resource planning, queuing models, data flows, and innovations in digital health.
C02	Interpret and formulate mathematical models for workforce optimization, facility layout, patient queuing, and healthcare delivery systems
C03	Apply optimization, queuing theory, and simulation methods to enhance healthcare system efficiency, throughput, and patient experience.
C04	Evaluate emerging healthcare technologies and simulation outcomes to improve clinical operations, policy design, and access to quality care.



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Unit No.	Unit title and Content	Hours
1	Introduction to Healthcare System Introduction: Facets of a Healthcare System, Size of a Healthcare System, Health Insurance and Financing, Healthcare Services, Healthcare Ecosystem, Healthcare System Challenges, Access to Healthcare, Healthcare Systems Engineering, Understanding Delivery: Data and Processes: Types of Healthcare Data, National Datasets, Healthcare Delivery Process Data, Process Throughput	7
2	Healthcare Resource Workforce and Access to Care Optimization Workforce: Optimization, Supply-Demand Matching, Assignment Models, Optimization : Facility Optimization, Developing Facility Layout to Minimize Travel Wastage, Considering Multiple Conflicting Objectives, Optimization using a Modeling Language	7
3	Modeling Patient Queues Kendall's Notation for Queuing Systems, Little's Law, Markovian Queuing Models: M/M/1, M/G/1 Queuing Model, Modeling Interconnected Services using Queuing Networks.	5
4	Healthcare System Simulation Building a Simulation Study Framework, Event Calendars in Discrete Event Simulation, Input Modeling in Simulation, Output Analysis in Simulation, Estimation in a Non-Terminating, Non-Stationary System: Emergency Department, Simulation of a Hospital Queuing Network	6
5	Future of Healthcare Shifting from Volume to Value, Evidence-Based Medicine, Personalized Medicine, Vision of the Future, Connected Medicine, Disease and Condition Management: Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantable, Digital Health and Therapeutics, AI, Conversational AI, Making and rationalizing decisions: Drug discovery, 3-D printing, Personalized prosthetics, Bioprinting and tissue engineering, Pharmacology and devices, Education, Gene therapy, Virtual and Augmented Reality, Merged Reality, Pain Management, Physical Therapy, Nursing and Delivery of Medicine, Virtual Appointments and Classrooms, Blockchain, Patient Record Access, Applications of AI in Healthcare	10

Reference Books:

1. Sanjay Mehrotra, Kevin Bui, "Healthcare Engineering", Springer, 1st edition, 2022.
2. Arjun Panesar, "Machine Learning and AI for Healthcare", Apress, 1st edition, 2019.



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Title of the Course Name: Technologies for Industrial Evolution Course Code: P25MP206	L	T	P	Credits
	3	--	--	3
	ISE-I	ISE-II	ESE	Total
	25	25	-	50

Pre-Requisite: Knowledge of Automation, IoT and Industrial Engineering.

Course Objectives: The course aims,

1. To understand the key technologies & impact of technological evolution on modern industries.
2. To provide insight into the integration of AI, Big Data, and Cloud Computing in industrial operations.
3. To familiarize students with digital twin, predictive maintenance, and robotic process automation.
4. To enable students to analyze current trends and future directions in industrial digitization.

Course Outcomes: Students will be able to

C01	Recall the evolution, core technologies, digital tools, automation systems, predictive analytics, and future trends shaping Industry 4.0.
C02	Interpret the role and integration of smart technologies such as IIoT, AI, cloud computing, and robotics in modern manufacturing ecosystems.
C03	Apply digital transformation methods and smart manufacturing tools to solve real-world challenges in automation, condition monitoring, and fault diagnostics.
C04	Evaluate the impact of Industry 4.0 initiatives using sustainability frameworks, case study insights, and advanced tools like digital twins and 5G networks.



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Course Contents

Unit No.	Contents	Hours
1	Introduction to Industrial Evolution Historical Industrial Revolutions, Key Drivers of Industry 4.0, Comparison of Industry 3.0 and 4.0, Global Trends and Indian Scenario.	06
2	Core Technologies in Industry 4.0 IIoT, Smart Sensors, Embedded Systems, Cyber Physical Systems (CPS), Edge and Fog Computing.	06
3	Digital Transformation Tools Cloud Computing, Big Data Analytics, AI & Machine Learning for Industry, Blockchain in Supply Chain.	06
4	Automation and Smart Manufacturing Additive Manufacturing, Smart Factories, Industrial Robotics, Human-Machine Collaboration.	06
5	Predictive Maintenance and Digital Twin Condition Monitoring, Real-time Data Acquisition, Digital Twin Modeling, Fault Diagnosis.	06
6	Future Trends and Case Studies Green Manufacturing, Sustainable Technologies, 5G for Industry, Case Studies on Digital Transformation.	06

Text Books:

1. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 1st Edi., 2016.
2. Sabina Jeschke, "Industrial Internet of Things: Cyber Manufacturing Systems", Springer, 1st Edition, 2017.
3. Markus Brettel, "How Virtualization, Decentralization and Network Building Change the Manufacturing Landscape: An Industry 4.0 Perspective", Procedia CIRP (Elsevier), 1st Edition, 2014.

Reference Books:

1. Douglas M. Considine and Glenn D. Considine, "Standard Handbook of Industrial Automation", Springer, 1st Edition, 1987.
2. Norman A. Anderson, "Instrumentation for Process Measurement and Control", Chilton Company, 3rd Edition, circa 1990.
3. Olushola Akande, "Industrial Automation from Scratch", Packt Publishing, 1st Edition, 2023.



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Title of the Course Name: Mini Project Course Code: P25MP207	L	T	P	Credit
	--	--	2	1
	ISE	MSE	ESE	Total
	50	--	50	100

Pre-Requisites: Previously studied courses.

Course Objectives: The course aims to:

1. To identify and define real-time engineering or managerial problems
2. To develop innovative solutions using current tools and technologies.
3. To enhance teamwork and project execution skills.
4. To improve technical documentation and presentation abilities.

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

C01	Identify and define an engineering or industrial problem of practical relevance or research interest.
C02	Analyze the problem systematically and apply domain knowledge to propose viable solutions.
C03	Document the project findings clearly in a structured report and defend the work through oral presentation.
C04	Demonstrate initiative, self-learning, and professional responsibility in executing project tasks individually or collaboratively.



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Title of the Course Name: PG LAB-II Course Code: P25MP208	L	T	P	Credits
	--	--	4	2
	ISE	MSE	ESE	Total
	50	--	50	100

Prerequisite:- Basic Geometry, Machine Tools.

Course Objectives: The course aims to:

- 1 To demonstrate the working mechanism of EDM.
- 2 To apply statistical quality control tools and software
- 3 To design and simulate pneumatic circuits for industrial automation applications
- 4 To develop CNC part programs using commercial CAD/CAM software tools.

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

C01	Explain the working mechanism of EDM
C02	Use of statistical quality control software to analyze data
C03	Design a pneumatic circuit for the given application
C04	Develop a CNC program and simulation of given component.

Perform the following experiments (Any five)

Exp. No.	Content
1	Study of EDM/Wire EDM for metal machining
2	Use of statistical quality control software for process optimization like Minitab, LibreOffice Calc, SOFA Statistics, PSPP, R (with QCC package)
3	Sequencing of cylinders using Pneumatic trainer kit
4	Modelling of component and determination of mass properties
5	Synchronizing of cylinders using Pneumatic trainer kit
6	Develop a CNC program for rough and finish turning of a step shaft.
7	Develop a CNC program for turning operations using canned cycle



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8	Tool Path Simulation Using Software.
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Title of the Course Name: Internship/Field Training[#] Course Code: P25MP209	L	T	P	Credits
	--	--	—	2
	ISE	MSE	ESE	Total
	50	--	—	50

Pre-Requisite: Previously studied courses

Course Objectives: The course aims to:

1. To expose students to real-time industry operations, tools, and technologies relevant to their domain of study.
2. To develop an understanding of organizational structure, workflows, safety standards, and professional ethics in the workplace.
3. To apply theoretical knowledge acquired during the first year to practical industrial challenges and problem-solving.
4. To encourage self-learning, teamwork, communication, and project documentation skills through active industry engagement.

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

CO1	Recall the functional processes, safety norms, and professional expectations observed in a domain-specific industrial setting.
CO2	Understand and explain the industrial practices, technology integration, organizational hierarchy, and role-specific responsibilities.
CO3	Apply engineering concepts and problem-solving techniques to complete assigned tasks or mini-projects during the internship.
CO4	Evaluate professional practices, identify gaps between theory and application, and prepare structured reports demonstrating industrial learning.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	2	1	-	-	-	2	-
CO2	-	-	-	-	2	1	-	-	-	1	-
CO3	-	-	-	-	2	2	-	-	-	3	-
CO4	-	-	-	-	3	2	-	-	-	2	-



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Contents:

A four-week domain-specific industrial internship is mandatory after the completion of the first year and is evaluated in Semester III. It provides students with practical exposure to real-world industrial environments aligned with their field of study. During the internship, students gain hands-on experience, understand organizational workflows, and apply theoretical knowledge to actual engineering problems. A detailed report, industry certificate, and viva voce are required for final evaluation.

It is required to do Four weeks domain specific industrial internship after completing first year of the program evaluated in Semester-III



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Sr. No.	Guidelines
1	Activities Involved 1. Identifying and applying to companies or R&D organizations 2. Completion of internship spanning 4 weeks 3. Hands-on work under assigned industry mentors 4. Weekly task updates and feedback sessions 5. Final presentation and submission of training report
2	Requirements • Internship should be in a core or allied domain: Telecom, Embedded, Signal Processing, Networking, VLSI, IoT, AI, etc. • Prior approval must be taken from the Internship/Training Coordinator • Maintain a daily logbook recording work done, observations, and reflections • Internship certificate must be obtained from the industry at the end of the training • Students are required to submit: a) Internship Completion Certificate b) Internship Report (format below) c) Logbook or Weekly Activity Sheet d) Presentation and Viva before Evaluation Panel.
3	Internship Report Format (Hardbound Copy) 1. Cover Page (Institute, Title, Student Name, Industry Name, Duration) 2. Certificate from Institute 3. Certificate from Company 4. Acknowledgment 5. Table of Contents 6. Chapter 1: Introduction – Overview of the organization and objectives 7. Chapter 2: Training Activities – Tasks performed, tools used, departments visited 8. Chapter 3: Technical Learning – Concepts, skills, technologies learned 9. Chapter 4: Analysis and Outcomes – Contributions made, learnings, challenges 10. Chapter 5: Conclusion – Summary and future scope 11. References (if applicable) 12. Appendices – Screenshots, tools used, code samples (if allowed)



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Title of the Course Name: Management Information System Course Code: P25MP210	L	T	P	Credits
	4	-	--	4
	ISE	MSE	ESE	Total
	50	-	50	100

Pre-Requisite: Basic computer knowledge, Production and Manufacturing,

Course Objectives: The course aims to:

- 1.To introduce key terminologies and foundational concepts in marketing management, IT.
- 2.To equip students with the skills to design, develop, and implement IT solutions to improve overall efficiency.
- 3.To understand and critically evaluate ethical and legal issues in business.
4. To develop project planning, teamwork, and time management skills.

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

C01	Determine key terminologies and concepts including IT, marketing, management, economics, accounting, finance in the major areas of business
C02	Demonstrate understanding of computer systems, hardware, software, and data resource management in enterprise computing environments.
C03	Analyze the use of telecommunications, networking, and ERP systems in developing and managing business/IT solutions across functional areas.
C04	Evaluate the challenges and best practices in IT security, ethical issues, and global management of information technology in organizations.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Introduction to Information Systems and Business Strategy Organization and Information Systems, Foundation Concepts, Information Systems in Business, The Components of Information Systems, Competing with Information Technology, Fundamentals of Strategic Advantage, Using Information Technology for Strategic Advantage. Changing Environment and its impact on Business, Kinds of Information Systems.	06



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2	Computer Systems and Data Resource Management Computer Fundamentals, Computer Hardware, Computer Systems: End User and Enterprise Computing, Computer Peripherals: Input, Output, and Storage Technologies, Computer Software, Application Software, System Software, Computer System Management, Data Resource Management, Technical Foundations of Database Management, Managing Data Resources	06
3	Telecommunications and Networking in Business Telecommunication and Networks, Telecommunications and Networks, The Networked Enterprise, Telecommunications Network Alternatives	06
4	Business System Development and Implementation Fundamentals, Implementation Challenges, Developing Business/IT Solutions, Developing Business Systems, Implementing Business Systems.	06
5	Information Systems in Functional Areas and IT Management Manufacturing and Service Systems Information systems for Accounting, Finance, Production and Manufacturing, Marketing and HRM functions, Enterprise Resources Planning (ERP), Choice of IT, Nature of IT decision, Managing Information Technology, Managing Global IT,	06
6	IT Security, Ethics, and Global Management Security and Ethical Challenges, Security and Ethical Challenges, Security and Ethical, and Societal Challenges of IT, Security Management of Information Technology, Enterprise and Global Management of Information Technology	06

Texts Books:-

1. MahadeoJaiswal and Monika Mital, "*Management Information Systems*", Oxford University Press, 1st Edition, 2008.
2. C.S.V. Murthy, "*Management Information System: Text and Applications*", Himalaya Publishing House, 3rd Edition, 2013.

Reference Books:-

1. Kenneth J Laudon, "*Management Information Systems*", Pearson/PHI, 10th Edition, 2007.
2. W. S. Jawadekar, "*Management Information Systems*", TMH, 3rd Edition, 2004.



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Title of the Course Name: Labour Welfare and Industrial Relations	L	T	P	Credits
Course Code: P25CM301A/ P25CS301A/ P25ET301A/ P25MD301A / P25MP301A	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite:Fundamentals of Human Resource Management, Basics of Organizational Behaviour, Indian Labour Laws (basic awareness preferred)

Course Objectives: The course aims:

1. Provide an in-depth understanding of labour welfare concepts and principles.
2. Study the evolution and framework of industrial relations in India.
3. Analyze the role of trade unions, collective bargaining, and dispute resolution mechanisms.
4. Evaluate labour policies, legislation, and welfare measures with real-world applications.

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

CO	Course Outcomes
CO1	Define and explain the concepts of labour welfare and industrial relations.
CO2	Analyze the role of trade unions, employee participation, and dispute resolution mechanisms.
CO3	Examine labour laws and welfare measures applicable in industrial settings.
CO4	Evaluate the effectiveness of industrial relations strategies in promoting harmony and productivity.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	2	1	-	-
CO2	-	-	-	-	-	-	-	3	2	-	-
CO3	-	-	-	-	-	-	-	2	1	-	-
CO4	-	-	-	-	-	-	-	3	3	2	-



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Unit No.	Contents	Hrs
1	Introduction to Labour Welfare: Concept of labour welfare and its importance, Principles and types of labour welfare, Role of the government and employers in labour welfare, Statutory and non-statutory welfare measures	6
2	Industrial Relations Framework: Evolution and scope of industrial relations, Objectives and importance of industrial relations, Approaches to industrial relations, Role of stakeholders (government, employers, employees)	6
3	Trade Unions in India: Trade unions: concept, structure, and functions, Growth of trade union movement in India, Trade union legislation, Role of trade unions in industrial relations, Challenges faced by trade unions	6
4	Collective Bargaining and Employee Participation: Concept and process of collective bargaining, Types and importance of collective bargaining, Workers' participation in management, Joint management councils, Works committees	6
5	Industrial Disputes and Resolution Mechanisms: Causes and effects of industrial disputes, Methods of dispute resolution (conciliation, arbitration, adjudication), Role of grievance redressal systems, Disciplinary procedures	6
6	Labour Legislation and Contemporary Issues: Overview of key labour laws (Factories Act, Trade Unions Act, Industrial Disputes Act), Recent changes in Indian labour codes, Case studies on labour welfare and industrial relations, Emerging trends and challenges	6

Text Books:

1. Sinha, P.R.N., Sinha, I.B., and Shekhar, S.P. – Industrial Relations, Trade Unions, and Labour Legislation, Pearson Education
2. Mamoria, C.B. and Mamoria, S. – Dynamics of Industrial Relations, Himalaya Publishing House

Reference Books:

1. Monappa A., Nambudiri R. & Selvaraj, P. – Industrial Relations and Labour Laws, 2nd Edition, McGraw Hill
2. Srivastava, S.C. – Industrial Relations and Labour Laws, Vikas Publishing
3. Indian Labour Codes & Government Publications – Ministry of Labour and Employment

MOOC/NPTEL Platform:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc25_mg159/preview



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Title of the Course Name: Sustainable Technology	L	T	P	Credits
Course Code:P25CM301B/ P25CS301B/ P25ET301B/ P25MD301B/ P25MP301B	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Basic knowledge of science, environment, and technological applications, Awareness of current environmental challenges and sustainability needs

Course Objectives: The course aims:

1. Introduce the concepts and principles of sustainable development, technology.
2. Evaluate the impact of current technologies on environmental, social, and economic systems.
3. Explore clean and green technologies that promote sustainability.
4. Enable students to design or adopt sustainable solutions for real-world applications.

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

CO	Course Outcomes
CO1	Explain the core principles of sustainability and sustainable development
CO2	Analyze various sustainable technologies in energy, water, and waste sectors
CO3	Evaluate lifecycle and environmental impact of a given technology
CO4	Propose sustainable technology solutions for specific local/global issues

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	2	-	2	-	-	-
CO2	-	-	-	-	-	1	-	3	2	-	-
CO3	-	-	-	-	-	1	-	2	-	-	-
CO4	-	-	-	-	-	2	-	3	3	-	-



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Course Content		
Unit No.	Contents	Hrs
1	Introduction to Sustainable Development and Technology: Sustainability principles, triple bottom line, SDGs, environmental degradation, ecological footprint, carbon emissions, circular economy	6
2	Sustainable Energy Technologies: Renewable energy sources, solar PV, wind, hydropower, biomass, green hydrogen, energy efficiency, smart grids	6
3	Sustainable Water and Sanitation Technologies: Rainwater harvesting, water purification technologies, wastewater treatment, greywater recycling, low-flow devices, SDG 6 focus	6
4	Sustainable Waste Management: Waste hierarchy (Reduce-Reuse-Recycle), e-waste, composting, biodegradable packaging, plastic alternatives, waste-to-energy	6
5	Green Building and Smart Infrastructure: Energy-efficient building materials, passive solar design, green rating systems (LEED, GRIHA), smart cities, sustainable transportation	6
6	Life Cycle Assessment and Sustainable Innovation: LCA tools and methods, carbon footprint tools, eco-design, green product innovation, sustainable entrepreneurship, case studies	6

Text Books:

1. Sustainable Engineering: Concepts, Design and Case Studies – D. Allen, D. Shonnard
2. Sustainability Principles and Practice – Margaret Robertson

Reference Books:

1. Green Technologies and Environmental Sustainability – R. Raveendran
2. Reports from UNEP, NITI Aayog, MoEFCC

MOOC/NPTEL Platform:

1. **NPTEL:** Sustainable Engineering Concepts and Life Cycle by ByProf.Brajesh Kumar Dubey, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc25_ce117/preview



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Title of the Course Name: Entrepreneurship Development Course Code: P25CM303C/ P25CS301C/ P25ET301C/ P25MD301C/ P25MP301C	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Basics of Management, Market Research Fundamentals, Financial Accounting Basics.

Course Objectives: The course aims:

1. To introduce the fundamental concepts and evolution of entrepreneurship, including the role of creativity and innovation.
2. To enable students to recognize business opportunities and develop viable business models using structured techniques.
3. To equip students with knowledge of business planning, financial feasibility, legal structures, and institutional support for startups.
4. To explore funding strategies, growth management, and emerging trends in entrepreneurship and intrapreneurship.

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

CO	Course Outcomes
CO1	Explain the concepts, types, and evolution of entrepreneurship along with the importance of innovation.
CO2	Apply opportunity recognition, business modeling techniques like BMC and lean startup.
CO3	Analyze the feasibility of a business idea considering financial, legal, institutional frameworks.
CO4	Evaluate different funding options and growth strategies, including emerging trends in entrepreneurship.

CO-PO Mapping:											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	2	-	-	2	-	-	-
CO2	-	-	-	-	3	-	-	2	2	-	-
CO3	-	-	-	-	2	-	-	3	-	-	-
CO4	-	-	-	-	3	-	-	3	2	-	-



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Course Content		
Unit No.	Contents	Hrs
1	Fundamentals of Entrepreneurship Definition, types and evolution of entrepreneurship, Entrepreneur vs intrapreneur, Importance of creativity and innovation in venture creation.	6
2	Opportunity Recognition & Business Models Idea generation techniques - brainstorming, TRIZ, SCAMPER, Market research and feasibility analysis, Business Model Canvas and lean startup methodology.	6
3	Business Planning and Project Feasibility Components of a business plan, Cost-benefit analysis - NPV, IRR, ROI, Financial planning, budgeting, cost structures.	6
4	Legal & Institutional Framework Business entity types - sole proprietorship, LLP, Pvt. Ltd, Registration processes, IPR fundamentals - patents, trademarks, Schemes and support - Start-up India, SIDBI, NABARD.	6
5	Financing and Growth Management Funding sources - bootstrapping, angel investors, VC, loans, Scaling strategies, growth stages, risk management, Role of incubation, accelerators, and mentorship.	6
6	Emerging Entrepreneurship Trends Social, rural, digital entrepreneurship, Corporate intrapreneurship dynamics, Technology-driven ventures and ecosystem trends.	6
Text Books: 1. Engineering Entrepreneurship: From Idea to Business Plan – Paul Swamidass, Cambridge University Press, 2015. 2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Crown Business, 2011. 3. Entrepreneurship Development, S. Anil Kumar, Scientific Publishers, 2019.		
Reference Books: 1. Disciplined Entrepreneurship: 24 Steps to a Successful Startup, Bill Aulet, Wiley, 2013. 2. Opportunity Recognition in Entrepreneurial Teams, Maureen McKelvey, Per Davidsson, Leif Wennberg, Springer, 2021. 3. Effectuation: Elements of Entrepreneurial Expertise, Saras D. Sarasvathy, Edward Elgar, 2008, 2nd ed. 2021.		



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Title of the Course Name: Industrial Automation Course Code: P25CM301D/ P25CS301D/ P25ET301D/ P25MD301D/ P25MP301D	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Electrical Networks and Control, Digital Electronics Basics.

Course Objectives: The course aims:

1. To familiarize students with the hierarchical structure of industrial automation systems and various sensing technologies used in the industry.
2. To impart knowledge of process control systems and tuning techniques including PID controllers and advanced control methods.
3. To train students in PLC programming, sequential control, and industrial networking protocols for automation.
4. To introduce advanced automation technologies including IIoT, CNC, robotics, and cyber-secure smart manufacturing systems.

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

CO	Course Outcomes
CO1	Explain the structure of industrial automation systems and describe the working principles of common industrial sensors and actuators.
CO2	Apply PID tuning techniques to control processes using feedback loops, cascade control, and feed-forward methods.
CO3	Develop ladder and structured text programs for automation using PLCs and integrate industrial communication protocols (e.g., Modbus, Profibus).
CO4	Analyze and evaluate the integration of advanced automation systems like SCADA, IIoT, and robotics for Industry 4.0 implementations.

CO-PO Mapping:											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	2	-	-	2	-	-	-
CO2	-	-	-	-	3	-	-	2	-	-	-
CO3	-	-	-	-	3	-	-	1	2	-	-
CO4	-	-	-	-	2	-	-	2	2	-	-



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Course Content		
Unit No.	Contents	Hrs
1	Architecture and Sensing in Industrial Automation Overview of Automation Systems - Architecture, CPS, levels of automation, discrete vs process systems, Industrial Sensors and Signal Conditioning - Temperature, pressure, displacement, flow, force sensors; calibration, error analysis and conditioning circuits.	6
2	Process Control and PID Techniques Fundamentals of Control Systems - Feedback loops, stability, controller types, PID Controllers - P/PI/PID tuning methods Ziegler–Nichols, feed-forward, cascade, predictive control.	6
3	Sequence Control and PLC Programming Components of a business plan, PLC Basics - Hardware architecture, scan cycle, I/O interfacing, Programming in Ladder and Structured Control - Relay logic, timers, counter blocks, structured design.	6
4	Fieldbus Protocols, SCADA and DCS Industrial Communication Networks -Modbus, Profibus, HART, Fieldbus, Ethernet/IP,SCADA/DCS Architecture and HMI - Data acquisition, historian logs, alarms, cybersecurity, OPC UA.	6
5	Actuators and Drive Systems Actuator Technologies - Hydraulic, pneumatic valves, electric drives, stepper and servo motors, Drive Systems and VFDs - Variable frequency drives, speed control, energy-efficient operation.	6
6	Advanced Automation and Industry 4.0 Integration CNC & Robotics Basics - Machine tool control loops, robotic manipulators, grippers, kinematics, IIoT, Analytics and Cybersecurity - Edge computing, data analytics, smart manufacturing and automation system security.	6

Text Books:

1. Industrial Automation: Hands-On, Frank Lamb, McGraw-Hill, 1sted., 2013
2. Industrial Automation Solutions for PLC, SCADA, Drive and Field Instruments – Sanjay B. Katariya, Notion Press, 2020..

Reference Books:

1. Standard Handbook of Industrial Automation – Douglas M. Considine & Glenn D. Considine, Springer, 1sted., 1987.
2. Instrumentation for Process Measurement and Control – Norman A. Anderson, Chilton Company, 3rded., Circa 1990.
3. Industrial Automation from Scratch, Olushola Akande, Packt Publishing, 2023.



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MULTIDISCIPLINARY MINOR (MDM)

Title of the Course Name: Automation in Manufacturing	L	T	P	Credits
Course Code: P25MP302	3	--	--	3
Examination Scheme	ISE	MSE	ESE	
Marks	20	30	50	100

Pre-Requisite: Basic knowledge of manufacturing processes, Sensors and Actuators

Course Objectives: The course aims:

1. To introduce the fundamentals, concepts, strategies, and applications of manufacturing automation and automated manufacturing systems.
2. To develop an understanding of the design principles of automated manufacturing systems, including mechatronics, sensors, actuators, hydraulic and pneumatic systems.
3. To familiarize students with microprocessor-based control systems, programmable logic controllers (PLCs), and computer-integrated manufacturing technologies used in industrial automation.
4. To provide knowledge of CNC technology, computer-aided manufacturing, and emerging trends in smart manufacturing and Industry 4.0 for modern manufacturing industries.

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

CO	Course Outcomes
CO1	Describe the concepts, principles, strategies, and components of manufacturing automation and automated manufacturing systems.
CO2	Analyze the design and operation of automated manufacturing systems using sensors, actuators, hydraulic, pneumatic, and mechatronic components.
CO3	Apply microprocessor-based control systems, Programmable Logic Controllers (PLCs), and Computer Integrated Manufacturing (CIM) concepts for industrial automation applications
CO4	Evaluate CNC-based manufacturing systems and modern automation technologies to develop efficient and intelligent manufacturing solutions for Industry 4.0 applications.



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Course Content		
Unit No.	Contents	Hrs
1	Introduction to Manufacturing Automation Introduction to Manufacturing Automation ,need, scope and benefits of Automation ,automation strategies in manufacturing ,mechatronics and automated manufacturing systems , types of automated manufacturing systems, components of automated systems ,industrial applications and case studies	6
2	Design of Automated Manufacturing Systems Design methodology for automated systems ,mechatronics-based system design ,selection of mechanical, electrical and electronic components ,performance characteristics of electromechanical systems ,computer-aided design (cad) of components , fabrication processes for automated systems	6
3	Sensors, Transducers and Signal Conditioning measurement systems ,sensors and transducers ,position, displacement and proximity sensors ,pressure, flow and temperature sensors , signal conditioning techniques ,amplifiers, filters and protection devices ,Wheatstone bridge and pulse modulation	6
4	Actuators, Drives and Fluid Power Systems Electric motors for automation ,stepper motors and servo motors ,mechanical drives and motion transmission ,hydraulic systems and components ,pneumatic systems and components ,hydraulic and pneumatic circuits industrial applications of fluid power	6
5	Microprocessor-Based Automation and PLC Fundamentals of Microprocessors ,Microprocessor Programming Basics ,Interfacing in Automated Systems ,Programmable Logic Controllers (PLC) ,Automation Control Logic ,Industrial Control Applications ,Introduction to Computer Integrated Manufacturing (CIM)	6
6	CNC Technology and Industrial Automation Applications Computer Aided Manufacturing (CAM) ,computer aided process planning (CAPP) ,cnc machines and construction ,interpolation techniques, CNC programming fundamentals, industrial automation case studies ,emerging trends: smart manufacturing and industry 4.0	6



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Text Books:

1. Mikell P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, 5th Edition, Pearson Education, 2023.
2. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, 8th Edition, Pearson Education, 2020.
3. W. Bolton, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 7th Edition, Pearson Education, 2021.

Reference Books:

1. H. M. T. (HMT), Mechatronics, Tata McGraw-Hill Education Pvt. Ltd., Revised Edition.
2. Richard L. Shell and Ernest L. Hall, Handbook of Industrial Automation, CRC Press, 2000.
3. P. Radhakrishnan, S. Subramanyan, V. Raju, CAD/CAM/CIM, 4th Edition, New Age International Publishers, 2018.
4. M. P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 7th Edition, Wiley, 2020.

NPTEL Platform:

<https://nptel.ac.in/courses/112103293>



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Department of Mechanical Engineering

Title of the Course Name: Introduction to Industry 4.0 and Industrial Internet of Things Course Code: P25MD302	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	20	30	50	100

Pre-Requisite: Fundamentals of Sensors, Instrumentation, and Control Systems

Course Objectives: The course aims to:

1. To introduce the fundamental concepts of Industry 4.0, IoT, cyber-physical systems, and smart factories.
2. To understand the role of sensors, networking, data analytics, and cybersecurity in industrial IoT environments.
3. To apply IoT architectures, communication protocols, and AI/ML tools to industrial applications and case studies.
4. To evaluate real-world IIoT strategies, sustainability considerations, and future trends in smart manufacturing systems.

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

CO1	Recall core concepts of Industry 4.0, IoT architectures, sensors, networks, cybersecurity, and industrial applications.
CO2	Understand and interpret IoT layers, cloud-edge processing, big data tools, and smart system integration.
CO3	Apply IIoT architectures, networking models, and machine learning tools to solve practical industrial problems.
CO4	Evaluate IIoT solutions using real-time data, case studies, cost-benefit analysis, and strategic planning.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	2	-	-	2	-	-	-
CO2	-	-	-	-	3	-	-	2	-	-	-
CO3	-	-	-	-	2	-	-	2	2	-	-
CO4	-	-	-	-	2	-	-	2	2	-	-



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Course Content		
Unit No.	Unit title and Content	Hrs
1	Fundamentals of Industry 4.0 and IoT Introduction to sensing and actuation, communication and networking fundamentals, overview of Industry 4.0, globalization and trends, lean to smart factories, connected business models, cyber-physical systems, collaborative platforms, and PLM.	06
2	Advanced Technologies Enabling Industry 4.0 Next-generation sensors and devices, AR/VR applications in industry, basics of AI and ML, big data and predictive analytics, industrial internet systems, cybersecurity foundations, and industrial IoT overview.	06
3	Architecture and Layers of IoT IoT business models, reference architectures, sensing layer, edge devices, processing layer (edge vs cloud), communication layer protocols (MQTT, CoAP), network topologies, and challenges in industrial IoT networking.	06
4	Data Analytics, Networking, and Security in IIoT Big data storage and visualization, machine learning tools (R, Julia, Hadoop), software-defined networking (SDN), cloud computing, fog computing for real-time data handling, and cyber security practices in industrial systems.	06
5	Application Domains and Industrial Case Studies IoT in smart factories, assembly lines, food and beverage, healthcare, power plants, inventory and quality control, safety management, oil and pharma industries, UAVs in automation, Case Study I: Milk processing and packaging, Case Study II: Smart manufacturing systems.	06
6	Strategy Development and Future Trends Designing IoT strategies for smart manufacturing, integration with legacy systems, data-driven decision-making, scaling IoT solutions, cost-benefit analysis, sustainability and green IoT, upcoming trends in Industry 4.0 and digital transformation.	06



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Text Books:

1. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 1st Edition, 2016.
2. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms, Elsevier", 1st Edition, 2016.
3. Uday Kamath, Krishna Choppella, Anand Deshpande, "Industrial Digital Transformation: Accelerate digital transformation with business optimization, AI, and Industry 4.0", Packt Publishing, 2021.

References Books

1. Milan Milenkovic, "Internet of Things: Concepts and System Design", Springer, 1st Edition, 2020.
2. William Stallings, "Wireless Communications and Networks", Pearson, 2nd Edition, 2005.
3. Brett King, "Augmented: Life in the Smart Lane", Marshall Cavendish, 1st Edition, 2016.



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Title of the Course Name: Principles of Construction Management	L	T	P	Credits
	3	--	--	3
Course Code: P25CM302	ISE	MSE	ESE	Total
	10	30	10	50

Pre-Requisite: Project Management

Course Objectives: The course aims, 1. To understand the construction management principles, emphasizing the inter disciplinary nature of construction projects and project life cycle phases. 2. To gain the knowledge and skills required for accurate cost estimation in construction. 3. To introduce students to the fundamentals of project planning and scheduling. 4. To impart knowledge of effective resource management, project monitoring, and control techniques
--

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

CO1	Comprehend the importance of construction management and describe the various phases of a project life cycle.
CO2	Identify and apply various types of cost estimation methods, material quantities, and cost
CO3	Create project schedules and interpret network diagrams such as CPM and PERT
CO4	Apply resource leveling and allocation methods, utilize project monitoring and control systems, and implement quality control.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Introduction and Project Organization: Overview of construction management and its importance, Interdisciplinary nature of construction projects, Project life cycle and different phases, and Project organization structures and roles	07
2	Cost Estimation: Types of cost estimation, estimating quantities of materials, Cost break down and analysis, and Running account bills and payment procedures	07



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3	Construction Economic decision-making in construction, Depreciation of construction equipment, Time value of money and its application, and Financial planning and funding of projects	Economics: 07
4	Planning and Scheduling: Introduction to project planning and scheduling, Developing project schedules, Network diagrams (e.g., CPM, PERT), Critical path analysis.	07
5	Planning and Scheduling & Quality Management: Resource leveling and allocation, Project monitoring and control systems, Quality control in construction, and Quality assurance and standards	07
6	Safety Management & Legal Aspects: Introduction to construction safety, Accidents in the construction industry, Safety organization and responsibilities, Legal issues in construction management, and Contract administration and relevant laws.	07

Text Books:

1. V.N. Vazirani & S.P. Chandola, Construction Management and Accounts, Khanna Publishers.
2. L.S. Srinath, PERT and CPM – Principles and Applications, East-West Press.
3. Jimmie Hinze, Construction Contracts, McGraw Hill Education

References Books

1. Kumar Neeraj Jha, Construction Project Management: Theory and Practice, Pearson Education India.
2. R.L. Peurifoy & Clifford J. Schexnayder, Construction Planning and Equipment, McGraw Hill.
3. R.L. Brauer, Construction Safety Management, Wiley Publications
4. Chris Hendrickson & Tung Au, Project Management for Construction, Carnegie Mellon University

MOOC/NPTEL Platform:

1. https://onlinecourses.nptel.ac.in/noc25_ce95/preview
2. https://onlinecourses.nptel.ac.in/noc24_ce57/



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Title of the Course Name: IoT and its Applications Course Code: P25ET302	L	T	P	Credits
	3	--	--	3
	ISE	MSE	ESE	Total
	10	30	10	50

Pre-Requisite: Basic knowledge of electronics, embedded systems and

Course Objectives: The course aims, 1. To introduce the foundational concepts, architecture, and enabling technologies of the Internet of Things (IoT). 2. To develop understanding of sensor networks, wireless protocols, and IP-based communication in IoT systems. 3. To provide insight into data acquisition, storage, analytics, and cloud computing platforms relevant to IoT. 4. To explore real-world applications of IoT across domains and address associated ethical and legal considerations.

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

CO1	Describe the structure, components, and communication architecture of IoT systems.
CO2	Compare and apply various wireless technologies and IP-based protocols for IoT applications.
CO3	CO3 Implement basic IoT solutions using development platforms and interface them with cloud services for data logging and visualization
CO4	Evaluate the potential of IoT in sectors such as healthcare, agriculture, industry, and smart cities considering ethical and legal implications.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M	07



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2	Sensors Networks: Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, Raspberri Pi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT	07
3	Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT: IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols	07
4	Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Bigdata, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications	07
5	Cloud computation: Evolution of Cloud Computation, Commercial clouds and their features, open source IoT platforms, cloud dashboards, Interfacing and data logging with cloud: Blync, Thing speak, platforms	07
6	Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.	07

Text Books:

1. Adrian McEwen, Hakin Cassimally, Designing The Internet of Things, First Edition, Wiley
2. The Internet of Things: Enabling Technologies and Solutions for Design and Test, ApplicationNote,2016.
3. Vijay Madiseti, Arshdeep Bahga, Internet of Things A Hands-On- Approach

References Books

1. Raj Kamal, Internet of Things: Architecture and Design, McGraw Hill.2nd edition June 2022
2. Pethuru Raj, Anupama C. Raman, The Internet of Things Enabling Technologies, Platforms, and Use Cases, Taylor and Francis group. February 2017
3. Peter Waher, Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3, First Edition, Packt Publishing, 2018



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Title of the Course Name: Artificial Intelligence & Machine Learning Course Code: P25CS302	L	T	P	Credits
	3	--	--	3
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite:

Course Objectives: The course aims:

1. Apply AI techniques to solve the given problems.
2. Implement trivial AI techniques on relatively large system
3. Explain uncertainty and Problem-solving techniques.
4. Compare various learning techniques.

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

Course Outcomes	
CO1	Identify and analyze AI-based problems
CO2	Apply appropriate techniques and advanced search methods
CO3	Discuss and apply various learning techniques
CO4	Design expert systems

**Course Content**

Unit No.	Unit title and Content	Hrs
1	Introduction to AI Basic Concepts of AI and State space search, Introduction to unguided and guided search	6
2	Heuristic Search and Intelligent Learning Methods Problems in search and solutions, Genetic algorithms, Neural Networks, BPNN, learning process in BPNN	6
3	Advanced Search, Planning, and Problem Solving Some other search methods and Admissibility, Planning, Game Playing	6
4	Game Playing and Knowledge Representation Minimax and other game playing algorithms , using predicate logic for Knowledge Representation	6
5	Advanced Knowledge Representation and Reasoning Resolution and non-monotonic reasoning, Strong methods for knowledge representation, Fuzzy logic and certainty factors (CD)	6
6	Expert Systems and Machine Learning Concepts Scripts and introduction to expert systems, Developing expert systems, Basics of machine learning	6

Text books:

1. Stuart J. Russell, Peter Norvig ,” Artificial Intelligence: A Modern Approach”, Pearson, 4th edition, 2021.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair,” Artificial Intelligence”, McGraw Hill Education, 3rd edition, 2017.

Reference books:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, McGraw Hill Education, 3rd edition (Indian Adaptation), 2019.
2. Wolfgang Ertel, Introduction to Artificial Intelligence, Springer, 2nd edition, 2017.
3. Saroj Kaushik, Artificial Intelligence, Cengage Learning India, Revised edition, 2020.



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Title of the Course Name: Dissertation Phase- I*	L	T	P	Credits
	--	--	20	10
Course Code: P25MP303	ISE	MSE	ESE	Total
	50	--	50	100

*Note –Minimum 30% work of Dissertation Phase- II should be completed.

Pre-Requisite:

- Understanding of core and elective subjects related to the chosen domain.
- Familiarity with research methodology, academic writing, and referencing.
- Knowledge of simulation tools, programming platforms, or hardware (as required by the topic).

Course Objectives: The course aims:

1. To identify a research problem relevant to Electronics and Telecommunication Engineering.
2. To conduct an in-depth literature survey and identify research gaps.
3. To formulate objectives, scope, and methodology of the proposed work.
4. To enhance research planning, time management, and technical writing skills.

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

CO	Course Outcomes
CO1	Identify and define a research problem with appropriate scope and relevance.
CO2	Conduct a comprehensive literature survey and identify research gaps.
CO3	Formulate problem statements, objectives, and methodology.
CO4	Prepare and present a project proposal with justification and expected outcomes.
CO5	Demonstrate the ability to document and present research progress professionally

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	2	-	-	-
CO2	2	2	-	-	-	-	-	1	-	-	-
CO3	-	2	3	-	-	-	-	2	-	-	3
CO4	-	2	2	-	-	-	-	2	-	2	2
CO5	-	-	3	-	-	-	-	2	-	3	-



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Sr.No.	Guidelines
1	Activities Involved 1. Selection of a relevant research topic in consultation with a guide. 2. Literature review using journals, conference papers, patents, and technical reports. 3. Identification of research gaps, problem statement formulation. 4. Planning of methodology, tools, datasets, and experimental setup (if applicable). 5. Partial implementation or simulation (as feasible). 6. Periodic presentations and documentation.
2	Format for Report (Spiral Bound & Soft Copy) 11. Cover Page 12. Certificate (Guide + Head of Department) 13. Declaration 14. Acknowledgement 15. Abstract 16. Table of Contents 17. List of Figures/Tables (if applicable) 18. Chapters: - o Introduction - o Literature Review - o Problem Statement - o Objectives - o Proposed Methodology - o Preliminary Work Done - o Conclusion and Future Work 19. References (IEEE format) 20. Appendix (if applicable)
3	Deliverables • Synopsis (approved by guide and PRC). • Interim progress report. • Final report of Dissertation Phase-I. • Presentation and viva before the department PRC.



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Department of Mechanical Engineering

PG Program: Mechanical Production Engineering

Semester: IV

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Component s	Max	Min for Passing	
Project	P25MP401	Dissertation Phase-II*	-	-	40	20	ISE-I	50	40	80
							ISE-II	50		
							ESE (POE)	100	40	
Total			-	-	40	20	200			
Total Contact Hours- 40						Total Credits- 20				

* It is required to publish/present two papers out of which at least one paper should be in a SCI/ SCIE/ SCOPUS/ Web of Science/ Peer-Reviewed Journal before Thesis Submission.



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Title of the Course Name: Dissertation Phase-II	L	T	P	Credits
Course Code:P25MP401	--	--	40	20
	ISE	MSE	ESE	Total
	100	--	100	200

Pre-Requisite:

- Completion of Dissertation Phase-I with approved synopsis and partial implementation.
- Working knowledge of design tools, simulation software, or experimental hardware platforms.
- Familiarity with academic writing, plagiarism policies, and peer-reviewed publishing process.

Course Objectives: The course aims:

1. Implement the proposed methodology from Dissertation Phase-I using suitable tools and techniques.
2. Conduct detailed experimentation, simulation, or design, and critically analyze the results obtained.
3. Interpret research outcomes in the context of existing literature and assess their academic or practical impact.
4. Compile, document, and present the complete dissertation work through a formal report, presentation, and publication.

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

CO	Course Outcomes
CO1	Apply the selected research methodology and tools to execute the project effectively.
CO2	Analyze and interpret the results from experimentation or simulation to derive meaningful insights.
CO3	Demonstrate problem-solving, innovation, and research skills through validated outcomes and academic publications.
CO4	Prepare and present a complete dissertation report, defend the work confidently, and adhere to academic and ethical standards.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	2	-	-	-
CO2	2	2	-	-	-	-	-	1	-	-	-
CO3	-	2	3	-	-	-	-	2	-	-	3
CO4	-	2	2	-	-	-	-	2	-	2	2



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Sr.No.	Guidelines
1	Activities Involved 1. Full implementation of the system/methodology. 2. Conduct simulations, hardware experiments, or data analysis. 3. Compare results with existing methods or baseline systems. 4. Write and submit research papers to suitable conferences or journals. 5. Prepare the final dissertation report. 6. Final seminar and viva-voce before internal and external examiners.
2	Mandatory Paper Publication Requirements • Each student must publish a minimum of two research papers based on their dissertation work before submission. • The papers must be: ◦ At least one in a SCI/ SCIE/ SCOPUS/ Web of Science/ Peer-Reviewed Journal. ◦ The second can be in a national/international conference with review and proceedings. • Proof of acceptance or publication must be submitted along with the final dissertation. • Co-authorship with guide or peer students is acceptable, but the student must be the primary contributor.
	Report Format (Hardbound Copy) 1. Cover Page 2. Certificate (Guide, HoD, External Examiner) 3. Declaration 4. Acknowledgement 5. Abstract 6. Table of Contents 7. List of Figures and Tables 8. Chapters: ◦ Introduction ◦ Literature Review ◦ Gap Identification ◦ Problem Statement ◦ Objectives ◦ Methodology ◦ Implementation ◦ Results and Discussion ◦ Conclusion and Future Scope 9. References (IEEE format) 10. Appendices (if applicable) 11. Copies of Published Papers (as Annexure)



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3	Deliverables • Hardbound final dissertation report (in prescribed format). • Soft copy of report and presentation (PDF and PPT). • Plagiarism report (Turnitin/Urkund $\leq 10\%$). • Proof of 2 paper publications (acceptance letters/certificates/published copy). • Source code, design files, datasets (if applicable). • Final presentation and viva sheet signed by the PRC.
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