Your Dreams Our Goal

POORNIMA UNIVERSITY

Member of Association of Indian Universities & Approved by UGC (Govt. of India) under 2(f) & 12(B)

FACULTY OF ENGINEERING AND TECHNOLOGY

PROGRAM:

M.TECH PRODUCT DESIGN AND MANUFACTURING

SCHEME & SYLLABUS

INDEX

Disclaimer: The scheme, syllabus and other materials published in this booklet may be changed or modified as per the requirement after approval of competent authority. The decision taken by the management of Poornima University will be final and abiding to all.

Student Details

Name of Student:

Name of Program:

Semester:

VISION

To create knowledge based society with scientific temper, team spirit and dignity of labor to face global competitive challenges.

Mission

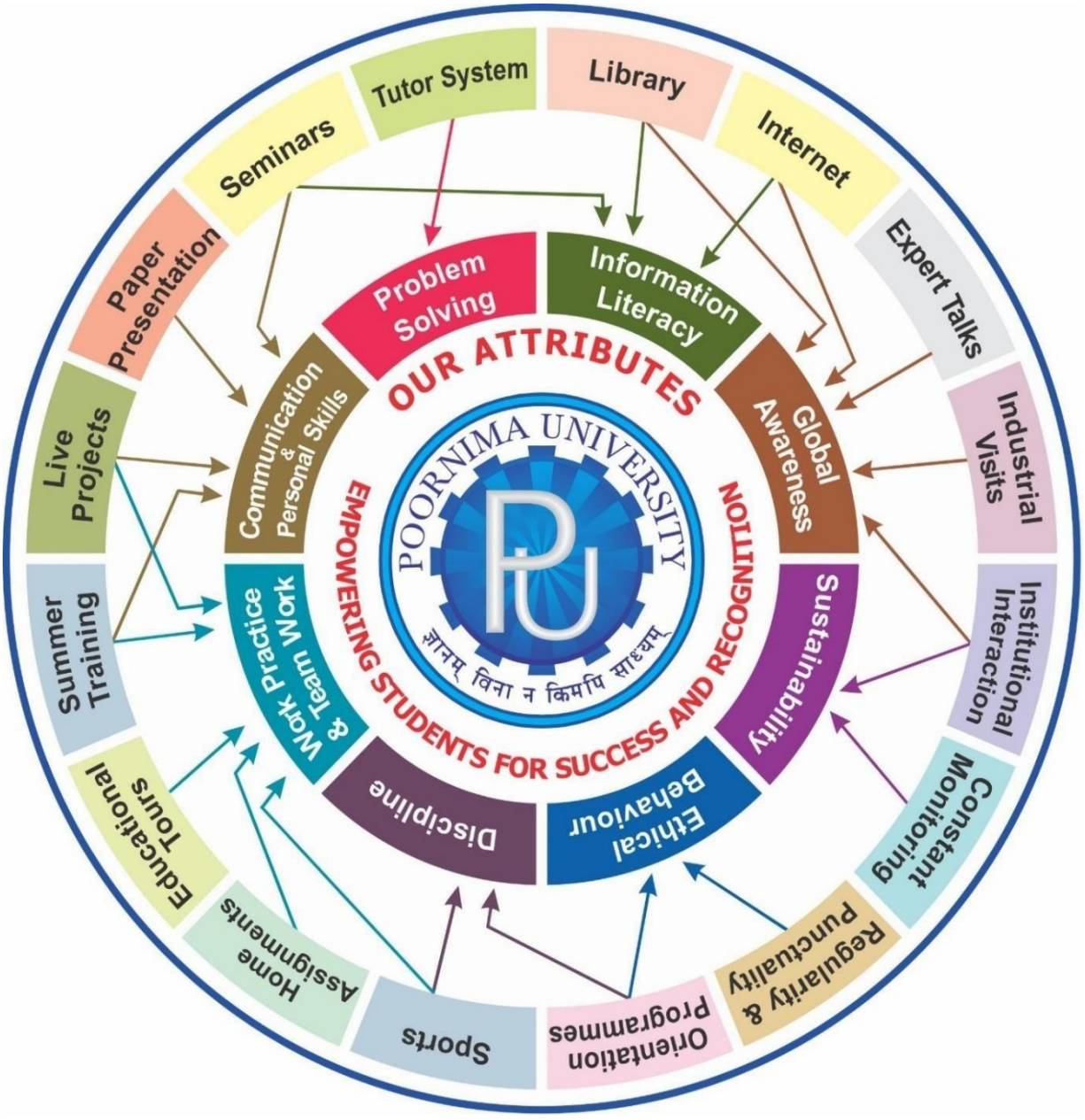
To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

Quality Policy

To provide Quality Education through Faculty development, updating of facilities and continual improvement meeting University norms and keeping stake holders satisfied

Knowledge Wheel

At Poornima, the academic atmosphere is a rare blend of modern technical aswell as soft skills and traditional systems of learning processes.



About Program and Program Outcomes (PO):

Title of the Programme: Master of Technology (M. Tech.)

Nature of the Programme: M. Tech. in Product design and Manufacturing is two year full-time programme.

Program Outcomes (PO) :

Engineering Graduates will be able to:

A. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

B. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

D. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

E. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

F. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

G. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

H. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

I. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

J. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

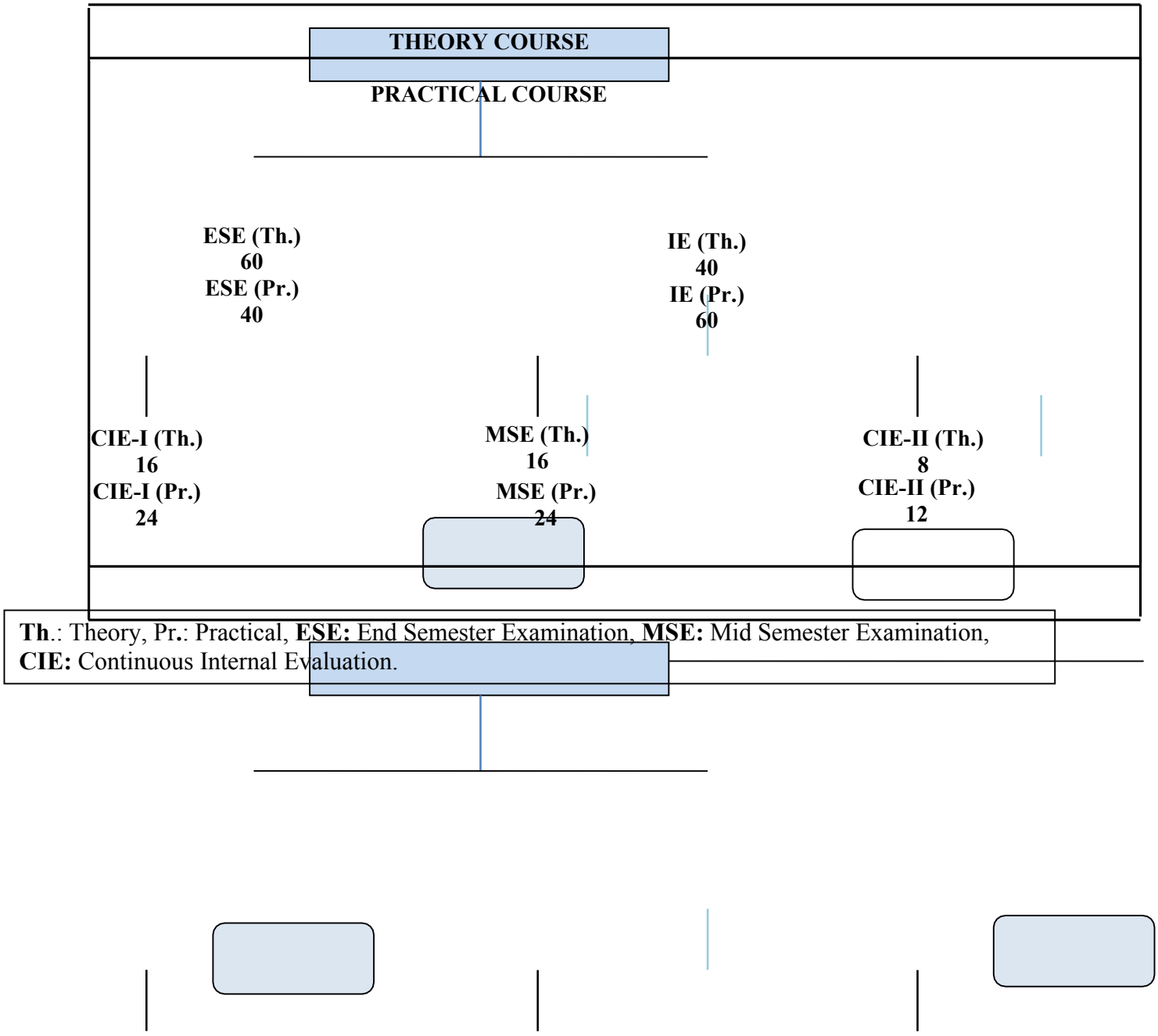
K. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

L. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Examination System :

A. **Marks Distribution of Theory Course:**

B. **Marks Distribution of Practical Course :**



CO Wise Marks Distribution:

Exam Entity	Theory Subject		Practical/ Studio Subject	
	Maximum Marks	CO to be Covered	CO to be Covered	Maximum Marks
CIE-I	16 (8 + 8)	1 & 2	1 & 2	24 (12 + 12)
MSE	16 (8 + 8)	3 & 4	3 & 4	24 (12 + 12)
CIE-II (Activity/ Assignment)	8 (8)	5	5	12 (12)
ESE	60	-	-	40
TOTAL	100	-	-	100

Minimum Passing Percentage in All Exams:

S No.	Program Name	Minimum Passing Percentage in		
		IE Component	ESE Component	Total Component
1	Course Work for PhD Registration	-	-	50%
2	B. Arch.	-	45%	50%
3	MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH	-	40%	40%
4	MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH	-	35%	35%

SGPA Calculation

$$SGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$SGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

C_i is the number of credits of subject i,

G_i is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course in the semester

CGPA Calculation

$$CGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$CGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

C_i is the number of credits of subject i,

G_i is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course of all the semesters up to which CGPA is computed

Grading Table:

Applicable for B.Arch. & Ph.D. Courses

Academic Performance	Grade	Grade Point	Marks Range (in %)
Outstanding	O	10	90≤ x ≤100
Excellent	A+	9	80≤ x <90
Very Good	A	8	70≤ x <80
Good	B+	7	60≤ x <70
Above Average	B	6	50≤ x <60
Fail	F	0	x <50
Absent	Ab	0	Absent

Applicable for All Courses except B.Arch. & Ph.D.

Academic Performance	Grade	Grade Point	Marks Range (in %)
Outstanding	O	10	90≤ x ≤100
Excellent	A+	9	80≤ x <90
Very Good	A	8	70≤ x <80
Good	B+	7	60≤ x <70
Above Average	B	6	50≤ x <60
Average	C	5	40≤ x <50
Pass	P	4	35≤ x <40
Fail	F	0	x <35
Absent	Ab	0	Absent

CGPA to percentage conversion rule:

Equivalent % of Marks in the Program = *CGPA* *10

Award of Class

CGPA	Percentage	Equivalent Division
7.50 ≤ CGPA	75% or more	First Division with Distinction
6.00 ≤ CGPA < 7.50	60% ≤ x <75%	First Division
5.00 ≤ CGPA < 6.00	50% ≤ x <60%	Second Division
4.00 ≤ CGPA < 5.00	40% ≤ x < 50%	Pass Class

Guidelines for Massive Open Online Courses (MOOCs)

(Session 2024-25)

Poornima University, in its never ending endeavor to equip students with best-of-class learning and knowledge, has undertaken to include MOOC courses as part of its credit scheme from session 2023-24 onwards. The objective behind this is to enable students to study courses designed by the best teachers in the country and to scale their knowledge base with the rest of learners from the nation. The MOOCs which are included under this scheme is can be chosen from SWAYAM and NPTEL.

1. Introduction of MOOCs: SWAYAM and NPTEL

About SWAYAM:

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

This is done through a platform that facilitates hosting of all the courses, taught in classrooms to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. However learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated centers on specified dates. Eligibility for the certificate will be announced on the course page and learners will get certificates only if this criteria is matched.

The courses hosted on SWAYAM are in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology.

In order to ensure that best quality content is produced and delivered, nine National Coordinators have been appointed. They are:

1. AICTE (All India Council for Technical Education) for self-paced and international courses
2. NPTEL (National Programme on Technology Enhanced Learning) for Engineering
3. UGC (University Grants Commission) for non-technical post-graduation education
4. CEC (Consortium for Educational Communication) for under-graduate education
5. NCERT (National Council of Educational Research and Training) for school education
6. NIOS (National Institute of Open Schooling) for school education
7. IGNOU (Indira Gandhi National Open University) for out-of-school students
8. IIMB (Indian Institute of Management, Bangalore) for management studies
9. NITTTR (National Institute of Technical Teachers Training and Research) for Teacher Training programme

Two types of courses are offered on SWAYAM platform: Credit Courses and Non- Credit Courses. Credit courses are offered for each semester in January and July every year. The list is available on SWAYAM official website: https://onlinecourses.swayam2.ac.in/ **About NPTEL:**

NPTEL (National Programme on Technology Enhanced Learning), is a joint venture of the IITs and IISc, funded by the Ministry of Education (MoE) Government of India, and was launched in 2003. Initially started as a project to take quality education to all corners of the country, NPTEL now offers close to 600+ courses for certification every semester in about 22 disciplines.

Some highlights:

- Largest online repository in the world of courses in engineering, basic sciences and selected humanities and management subjects
- YouTube channel for NPTEL – most subscribed educational channel, 1.3 billion views and 40+ lakhs subscribers

- More than 56000 hours of video content, transcribed and subtitled
- Most accessed library of peer-reviewed educational content in the world
- Translation of more than 12000 hrs of English transcripts in regional Indian languages

NPTEL Online Certification:

The objective of enabling students obtain certificates for courses is to make students employable in the industry or pursue a suitable higher education programme. Through an online portal, 4, 8, or 12-week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered. Enrolment to and learning from these courses is free. Following these online courses, an in-person, proctored certification exam is conducted and a certificate is provided through the participating institutions and industry, as applicable.
Some statistics regarding the open online courses since March 2014 till Dec 2021
Completed courses: 3496;
Enrollments across courses: 1.58 CRORE +
Number of exam registrations: 15.1 LAKH +
All the statistics pertaining to completed courses are available at https://beta.nptel.ac.in/courses. All courses are completely free to enroll and learn from. The certification exam is optional and comes at a fee of Rs 1000/course exam.

2. MOOCs at Poornima University:

MOOCs envelops best in class teaching - learning processes along with meeting the requirements of various courses in terms of quality of teaching and evaluation system. To promote the MOOCs among students of Poornima University, it is decided to consider the credits earned through MOOCs.

(a) Options for MOOCs at Poornima University

(For this document, only those MOOCs will be considered which are available on SWAYAM & NPTEL platforms)

- Credit and Non-credit SWAYAM MOOCs can be opted by anyone, anytime, anywhere and in any language. However, prior-permission of the University Authorities is mandatory if the credits are to be transferred to regular degree.
- In case of credit courses, there are two ways to opt these courses for the purpose of credit transfer to PU system as given below:

OPTION–I: As Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards):

Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards) are available at University level in offline mode for which relevant booklets are already published. **These courses carries 02 credits.** These category/type of courses (similar/different) are also available as MOOC courses. The respective Deans / HODs shall provide both the options to all the students to either select offline courses or MOOCs as per details given below:

- Deans / HODs shall prepare a list of upto 05 appropriate MOOC courses of 02/03 credits each, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students so that they can select any one course from the list, the credits **(only 02)** of which will be counted against Open Elective/ Multidisciplinary courses pertaining to that particular semester.
- If the students are not willing to opt for MOOC Open Elective/ Multidisciplinary course, they can proceed with the current offline practice of opting for Multidisciplinary courses.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.

OR

OPTION–II: As Major / Minor Courses:

- Deans / HODs shall identify a course of **03 credits** for each semester, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students citing that the particular course will be conducted through MOOCs only and is compulsory for all respective students. The credits of this course will be counted against Major/Minor courses pertaining to that particular semester.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.
- This is to be noted that if Deans / HODs decide to conduct any major/minor course in any semester through MOOCs, no offline course will be conducted against that.

(b) Important points related to MOOCs at Poornima University

- Only one MOOC shall be allowed in a particular semester for the purpose of credit transfer in the beginning.
- No attendance will be taken for MOOC courses.
- Last period of T/T/S shall be taken for MOOC courses which shall be in self-study mode.
- The method of assessments of MOOC such as assignments and examination are completely associated with that particular MOOC and no exam will be conducted by the department as well as by the Examination Cell.
- The respective Dean / HOD must submit the detail of course i.e., code, name and credit of MOOC opted against that particular course in particular semester attached with highlighting in the related examination scheme of syllabus of that semester signed by BOS Convener / HoD and Dean of Faculty to the office of Pro-President before commencement of the classes.
- SWAYAM will award a certificate to all the students passing the examination along with the credit earned. The center of examination for SWAYAM MOOCs will be finalized by SWAYAM. All the responsibility related to registration for MOOCs, timely submission of assignments, examinations etc. will be borne by the students only.
- The list of registered students in MOOC along with name of course will be submitted to the Examination Cell by the Deans / HoDs before commencement of the classes.
- Any student who would not be able to register/present/clear/pass the MOOC in the stipulated time, it is the choice of the student that he or she may register in next semester (odd or even) with MOOC again or appear as a back exam candidate of the University as per PU norms.
- There will be no provision of re-evaluation of MOOC.
- The scorecard and related certificate of MOOC along with a consolidated list of students with marks of assignment and final exam will be submitted to the examination cell by the concerned Dean / HOD for further process. It is also recommended that alteration/changes/scaling in marks obtained by the students in any MOOC will not be considered.
- The exam registration fee of MOOC up to Max. INR 1000/- will be reimbursed to the student only after successful completion of the course in first attempt and submission of the fee receipt, score-card and certificate of the MOOC to the concerned department within stipulated time after declaration of the results.

NOTE: This is to be noted that the procedure for getting approval from BOS, Faculty Board, Academic Council and BoM is to be followed as per regular process.

Attached Items:

Open Elective Booklet	Annexure-1
Soft Skills Booklet	Annexure-2
Value Added Course Booklet	Annexure-3

Required credits for Honors:

S.No	Program Duration	Required credits for Honors
1.	2- Year	10- Credits
2.	3- Year	15- Credits
3.	4-Year	20- Credits

S. No	NPTEL/ SWAYAM Course duration (in weeks)	Equivalent Credits
1	4	2
2	8	3
3	12	4

	POORNIMA UNIVERSITY, JAIPUR								
	Faculty of Engineering and Technology								
Name of Program:	**M.Tech in Product Design and Manufacturing Duration: 2 Years Total Credits:81**								
	Teaching Scheme for Batch 2024-26								
	Semester-I								
Course Code	**Name of Course**	**Teaching Scheme**				**Marks Distribution**			**Credits**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	**SH**	**IE**	**ESE**	**Total**	
A.		**Major (Core Courses)**							
A.1	**Theory**								
MPDCME1101	Product Design & Development	3	-	-	-	40	60	100	3
MPDCME1102	Materials and Manufacturing Technology	3	-	-	-	40	60	100	3
MPDCME1103	Ergonomics and Workplace Design	3	-	-	-	40	60	100	3
A.2	**Practical**								
MPDCME1201	Additive Manufacturing and prototyping Lab	-	-	2		60	40	100	1
B.		**Minor Stream Courses/ Department Electives I and II**							
B.1	**Theory**								
MPDEME1101	Computer Integrated Manufacturing	3	-	-	-	40	60	100	3
MPDEME1102	Automation in Manufacturing			-	-	40	60	100	
MPDEME1103	Industrial Robotics and Expert Systems			-	-	40	60	100	
MPDEME1104	Micro Electrical and Mechanical Systems			-	-	40	60	100	
MPDEME1105	Smart Technologies for Industry 4.0	3	-	-	-	40	60	100	3
MPDEME1106	Additive Manufacturing			-	-	40	60	100	
MPDEME1107	Design Thinking and Innovation			-	-	40	60	100	
MPDEME1108	Manufacturing Processes Design & Simulation			-	-	40	60	100	
B.2	**Practical**								
	-	-	-	-	-	-	-	-	-
C		**Multidisciplinary Courses**							
MULEBX1109	Research Methodology	3	-	-	-	-	-	-	3
D		**Ability Enhancement Courses (AEC)**							
MULCHM1101	Communication skill-I	-	-	2		60	40	100	1
E		**Skill Enhancement Courses (SEC)**							
MULCSE1201	Skill Enhancement Technical Course	-	-	2		60	40	100	2
F		**Value Added Courses (VAC)**							
	-	-	-	-	-	-	-	-	-
G		**Summer Internship / Research Project / Dissertation**							
MPDCCV1401	Seminar-I	-	-	4	-	60	40	100	2
Total		15	-	10					**24**
Total Teaching Hours		**25**							

	POORNIMA UNIVERSITY, JAIPUR								
	Faculty of Engineering and Technology								
Name of Program:	**M.Tech. in Product Design and Manufacturing Duration: 2 Years Total Credits: 81**								
	Teaching Scheme for Batch 2024-26								
	Semester-II								
Course Code	**Name of Course**	**Teaching Scheme**				**Marks Distribution**			**Credits**
		Lecture (L)	**Tutorial(T)**	**Practical**	**SH**	**IE**	**ESE**	**Total**	
A.		**Major (Core Courses)**							
A.1	**Theory**								
MPDCME2101	Design for Manufacturing and Assembly	3	-	-	-	40	60	100	3
MPDCME2102	Automation and Robotics	3	-	-	-	40	60	100	3
MPDCME2103	AI/ML in Manufacturing	3	-	-	-	40	60	100	3
A.2	**Practical**								
MPDCME2201	Computer Aided Engineering Lab	-	-	2	-	60	40	100	1
B.		**Minor Stream Courses/ Department Electives I and II**							
B.1	**Theory**								
MPDEME2101	Finite Element Methods	3	-	-	-	40	60	100	3
MPDEME2102	Computer Applications in Design			-	-	40	60	100	
MPDEME2103	Non-Traditional Machining Processes			-	-	40	60	100	
MPDEME2104	Machine Tool Design			-	-	40	60	100	
MPDEME2105	Industrial Tribology	3	-	-	-	40	60	100	3
MPDEME2106	Manufacturing System Engineering			-	-	40	60	100	
MPDEME2107	Quality Systems Engineering			-	-	40	60	100	
MPDEME2108	Operation Management			-	-	40	60	100	
B.2	**Practical**								
	-	-	-	-	-	-	-	-	-
C		**Multidisciplinary Courses**							
MPDEMC2121	MOOC Course-I	3	-	-	-	40	60	100	3
D		**Ability Enhancement Courses (AEC)**							
MULCHM2201	Communication skill-II	-	-	2	-	60	40	100	1
E		**Skill Enhancement Courses (SEC)**							
MULCSE2201	Skill Enhancement Technical Course-II	-	-	2	-	60	40	100	1
MULCME2202	Review/Research Paper-I	-	-	2	-	60	40	100	1
F		**Value Added Course (VAC)**							
	-	-	-	-	-	-	-	-	-
G		**Summer Internship / Research Project / Dissertation**							
MPDCME2401	Seminar-II	-	-	2	-	60	40	100	2
Total		18	-	10					**24**
Total Teaching Hours		**28**							

	POORNIMA UNIVERSITY, JAIPUR								
	Faculty of Engineering and Technology								
Name of Program:	**M.Tech. in Product Design and Manufacturing Duration: 2 Years Total Credits: 81**								
	Teaching Scheme for Batch 2024-26								
	Semester-III								
Course Code	**Name of Course**	**Teaching Scheme**				**Marks Distribution**			**Credits**
		Lecture (L)	**Tutorial (T)**	**Practical**	**SH**	**IE**	**ESE**	**Total**	
A.		**Major (Core Courses)**							
A.1	**Theory**								
A.2	**Practical**								
MPDCME3401	Review/Research Paper-II	0	0	2	-	60	40	100	1
MPDCME3402	Industrial Technical Seminar	0	0	4	-	60	40	100	2
B.		**Minor Stream Courses/ Department Electives/*Open Elective***							
B.1	**Theory**								
C		**Multidisciplinary Courses**							
MPDEMC3121	MOOC Course - II	3	-	-	-	-	-	-	3
D		**Ability Enhancement Courses (AEC)**							
E		**Skill Enhancement Courses (SEC)**							
-	-	-	-	-	-	-	-	-	-
F		**Value Added Courses (VAC)**							
G		**Summer Internship / Research Project / Dissertation**							
MPDCME3403	Internship	-	-	12	-	40	60	100	6
MPDCME3404	Dissertation Part - I	-	-	12	-	60	40	100	6
Total		3	0	30					**18**
Total Teaching Hours		**33**							

	POORNIMA UNIVERSITY, JAIPUR								
	Faculty of Engineering and Technology								
Name of Program:	**M.Tech. in Product Design and Manufacturing** **Duration: 2 Years** **Total Credits: 81**								
	Teaching Scheme for Batch 2024-26								
	Semester-IV								
Course Code	**Name of Course**	**Teaching Scheme**				**Marks Distribution**			**Credits**
		Lecture (L)	**Tutorial (T)**	**Practical**	**SH**	**IE**	**ESE**	**Total**	
A.		**Major (Core Courses)**							
A.1	**Theory**								
-	-	-	-	-	-	-	-	-	-
A.2	**Practical**								
-	-	-	-	-	-	-	-	-	-
B.		**Minor Stream Courses/ Department Electives/*Core Elective***							
B.1	**Theory**								
-	-	-	-	-	-	-	-	-	-
B.2	**Practical**								
-	-	-	-	-	-	-	-	-	-
C		**Multidisciplinary Courses**							
-	-	-	-	-	-	-	-	-	-
D		**Ability Enhancement Courses (AEC)**							
-	-	-							
E		**Skill Enhancement Courses (SEC)**							
-	-	-	-	-	-	-	-	-	-
F		**Value Added Courses (VAC)**							
	-	-	-	-	-	-	-	-	-
G		**Summer Internship / Research Project / Dissertation**							
MPDCME4401	Dissertation Part - II	-	-	30		250	250	500	15
Total		0	0	30					**15**
Total Teaching Hours		**30**							

FIRST SEMESTER

Code: MPDCME1101	Product Design and Development	3 Credits [LTP: 3-0-0]

COURSE OUTCOME

The student will able to:

CO1 Examine the importance of new product and their importance.

CO2 Identify the design problems of new product and their solution.

CO3 Evaluate the various concept selection of new product and apply on a new product.

CO4 Apply the management technique of a new product.

CO5 Evaluate the reliability of a new product using Bath tub curve, Reliability of systems in series and parallel, Failure rate, MTTF and MTBF.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Product Design and Development	5
2.	Morphology of Design	4
3.	Generation of Alternatives and Concept Selection	5
4.	Management of New Product	5
5.	Reliability	5

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Product Design and Development**
	• Introduction of Unit • Importance of new product-Definition-importance-Development Process. Introduction to PDD, Applications, Relevance, Product Definition, Scope, Terminology. Design definitions, the role and nature of design, old and new design methods, Design by evolution. Examples such evolution of bicycle, safety razor etc.Physical reliability & Economic feasibility of design concepts. New product development process and organization. • Conclusion of Unit including real life applications
2.	**Morphology of Design**
	• Introduction of Unit • Need analysis- Problem Formulation: Establishing economic existence of need, Need Identification and Analysis,Divergent, transformation and convergent phases of product design. Design criteria, functional aspects. Aesthetics, ergonomics, form (structure). Shape, size, color. Mental blocks, Removal of blocks. • Conclusion of Unit including real life applications
3.	**Generation of Alternatives and Concept Selection**
	• Introduction of Unit • **Generation of Alternatives and Concept Selection:** Concept generation- a creative process, Creativity,Road Elects to creative thinking-Fear of criticism and Psychological set. Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process. Brainstorming &Synectics. Morphological techniques. Utility concept, Utility value, Utility index. Decision making under multiple criteria. Economic aspects of design. • Conclusion of Unit including real life applications
4	**Management of New Product**

	• Introduction of Unit • Preliminary & detailed design- Design Review: Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility. Detailed design of subsystems, component design, Preparation of assembly drawings. Management of New Product – development and Launch: New Product Management's Challenges Maintaining focus, Promotion of Right Culture, Management of Creativity, Top Management attention. • Conclusion of Unit including real life applications
5.	**Reliability**
	• Introduction of Unit • Reliability considerations, Bath tub curve, Reliability of systems in series and parallel. Failure rate, MTTF and MTBF. Optimum spares from reliability consideration. Design of displays and controls, Man-Machine interface, Compatibility of displays and controls. Ergonomic aspects. • Conclusion of Unit including real life applications

C. RECOMMENDED STUDY MATERIAL:

Sr. No	Book	Author	Edition	Publication
a. Reference Books				
1.	Product Design &Manufacturing	A.K.Chitab&R.C.Gupta	Latest	PHI (EEE).
2.	Product Design & Decision Theory	M.K. Starr	Latest	Prentice Hall
3.	Quality Control & Reliability Analysis	Bijendra Singh	Latest	Khanna Publications.
4.	The Technology of Creation Thinking	R.P. Crewford	Latest	Prentice Hall
5.	Engineering: An Introduction to Creativeprofession	G.C. BeakleyHw leach	Latest	Macmillan
6.	Industrial Design In Engineering – Amarriage of Techniques	Charles H .Flurscheim	Latest	The Design Council - London
b. Important Web links				
https://nptel.ac.in/courses/112/107/112107217/ https://ocw.mit.edu/courses/sloan-school-of-management/15-783j-product-design-and-development-spring-2006/lecture-notes				

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**2**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 2	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 4	**2**	**2**	**2**	**1**	–	–	–	–	–	–	–	–
CO 5	**3**	**2**	**2**	**2**	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO 1	–	–	2
CO 2	–	–	2
CO 3	–	–	2
CO 4	–	–	2
CO 5	–	–	2

Code: MPDCME1102	Materials and Manufacturing Technology	3 Credits [LTP: 3-0-0]

COURSE OUTCOMES

The student will able to:

CO1 Analyze the features, classification, applications of newer class materials like smart materials, biomaterials, composite materials etc.

CO2 Analyze the Manufacturing processes for shaping and Superalloys.

CO3 Analyze and suggest the mechanical test

CO4 Apply the concept of Advance ceramic and glass shaping processes.

CO5 Analyze the property enhancing and surface processing operations.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Classification of materials and Manufacturing Process	9
2	Manufacturing processes for shaping and Superalloys	9
3	Polymers and Composite	10
4	Advance ceramic and glass shaping processes	9
5	Property enhancing and surface processing operations	10

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Classification of materials and Manufacturing Process**
	Scope and classification of Engineering Materials: Types, properties and uses of Metals and Alloys. Selection of materials. **Scope and classification of Manufacturing Techniques:** Types, properties and uses of manufacturing processes. Selection of manufacturing process.
2.	**Manufacturing processes for shaping and Superalloys**
	Manufacturing processes for shaping – casting, deforming, sheet metal forming, particulate processing, machining, and finishing and joining. , Advanced methods of manufacturing: Abrasive jet cutting, Ultrasonic machining, Laser beam machining, Electron beam and electrochemical machining. **Superalloys:** Types, properties, uses and their processing techniques. Nickel-base, Cobalt- base and iron-base superalloys, remelting, Particulate processing, casting, machining, rolling, forging and welding of superalloys.
3.	**Polymers and Composite**
	Polymers: Classifications Plastics: Types, properties, uses and manufacturing processing techniques. Thermoplastics, Thermosets, and Elastomers. **Composites:** Types, properties, uses and manufacturing processing techniques. Metal matrix composites, polymer matrix composites, ceramic matrix composites, FGM.
4.	**Advance ceramic and glass shaping processes**
	Glass: Types, properties, uses and shaping processes, **Ceramics:** Types, properties, uses and shaping processes,
5.	**Property enhancing and surface processing operations**

	Property enhancing and surface processing operations: Cleaning and surface treatments, Surface coating technology: Scope and classification of coating techniques. Electroplating (metal or composite coatings), Electroless plating (metal or composite coatings), Weld overlays (metal or ceramic coatings), Thermal spraying (metal, plastic, ceramic, or composite coatings), Cladding (thick metal coatings), Chemical vapor deposition (metals, graphite, diamond, diamond like carbon, and ceramics), Physical vapor deposition (metals, ceramics, or solid lubricants), Thermo-reactive deposition/diffusion process (carbides, nitrides, or carbonitrides), Recent development in materials and manufacturing technology.

C. RECOMMENDED STUDY MATERIAL:

Sr. No.	Book	Author	Edition	Publication
a. Reference Books				
1.	Fundamentals of Modern Manufacturing: Materials, Processes, and Systems	Groover, M. P.	Student Edition	Wiley Student Edition, John Wiley and Sons, 2005.
2.	Engineering Materials, Properties and Selection	Budinski, K. G.	Latest	Pub. Prentice-Hall of India, New Delhi, India.
3.	Materials Degradation and its Control by Surface Engineering	Batchelor, A.W., Lam, L.N. and Chandrasekaran, M.	2nd Edition	Imperial College Press, 2003
4.	Material Science and Engineering An Introduction	Callister W. D.	6th Ed	John Wiley & Sons, Inc.,., 2003.
5.	Plastic Technology, Theory, Design and Manufacture	Patton, W.J.,	Latest	Lenton Publishing Company
6.	Superalloys II	Sims, C. T., Stoloff, N. S., and Hagel, W.C	Latest	John Wiley and Sons, 1987.
7.	Materials Selection in Mechanical Design	Ashby, M.F.	Latest	Pergamon press, 1992.

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–
CO4	3	1	1	1	–	–	–	–	–	–	–	–
CO5	3	2	2	2	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–
CO4	2	–	–
CO5	2	–	–

Code: MPDCME1103	Ergonomics and Workplace Design	3 Credits [LTP: 3-0-0]

COURSE OUTCOMES

The student will able to:

CO1 Identify the need of ergonomics and ergonomics methods.

CO2 Illustrate the anthropometric measurements and analyzing body dimensions and proportions.

CO3 Apply the anthropometry details in designing of work areas, tools and equipment.

CO4 Identify the risk factors for ergonomic injuries in various environments and activities.

CO5 Describe the principles and methodologies of simulation in ergonomic design.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Ergonomics	7
2.	The Human System	8
3.	Design of Work Areas, Tools, and Equipment	8
4.	Health and safety at work	8
5.	Simulation in Ergonomic Design	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Ergonomics**
	• Introduction of Unit • Introduction to Ergonomics, Definition and History of Ergonomics. The evolution of Ergonomics, reasons to use ergonomics, micro- and macro- ergonomics, performing ergonomics, judging the effectiveness of ergonomics intervention. Trends in Industry That Impact Ergonomic Design. Ergonomic Methods- Field Studies, Experimental Simulation, Laboratory Experiment, Computer Simulation, Differences in Ergonomic Methods. • Conclusion and Summary of Unit
2.	**The Human System**
	• Introduction of Unit • The Skeletal Subsystem- The Extremities, Joint-Related Disorders. Muscle Contractions and Capabilities, The Role of Oxygen in Muscle Actions, Muscle Injuries and Disorders, Effects of Gender and Muscular Strength. • Anthropometry- Predicting the Stature of People, Estimating Body Dimensions, Predicting the Segment Mass of the Human Body. Anthropometric Data- Children and youths. • The Sensory Subsystems- The Visual Sensory Subsystem, Human Perception of Sound, Position and Motion Sensing. • Conclusion of Unit including real life applications.
3.	**Design of Work Areas, Tools, and Equipment**
	• Introduction of Unit • Applied Anthropometry- Drafting Templates, Computer Modeling Methods. Design of Work Areas and Stations- Traffic Areas, Workplace Dimensions and Layout Principles, Design of Seating. • Design of Tools and Equipment - Hands and Handedness: Some Initial Design Principles, Other Desired Properties of Grip Design, Other Features of Hand Tool Design. • Protective Equipment for the Operator- Safety Shoes, Helmets, Protective Gloves, Eye Protection and Spectacles, Hearing Protection. • Conclusion of Unit including real life applications.
4.	**Health and safety at work**
	• Introduction of Unit • Anthropometry of the hand, Fundamentals of handle design. Human factors in industrial safety: an overview. • Ergonomic injuries, Back injury at work, Work-related upper limb disorders, Lifting and handling. • Human Diversity- Sex differences, Ethnic differences, Growth and development, Ageing. • Ergonomics in the Home- The kitchen, The bathroom, The bedroom.

	• Conclusion of Unit including real life applications.
5.	**Simulation in Ergonomic Design**
	• Introduction of Unit • Simulation Versus Other Methods in Ergonomics. Essential Elements of Computer Simulation- Higher-Level Computer Languages, Computer Simulation in Ergonomics. • Cognitive Simulation- Production System Modeling of Cognitive Tasks, Temporal Simulation Using the Production System Model. Operator-in-the-Loop Simulation-Training Simulators, Ground Vehicle Simulators. • Conclusion of Unit including real life applications.

C. **RECOMMENDED STUDY MATERIAL:**

Sr. No	Reference Book	Author	Edition	Publication
1.	Human Factors and Ergonomics for Engineers	Mark R. Letho	Latest	Lawrence Erlbaum Associates
2.	A Guide to Ergonomics of Manufacturing	Martin Helander	Latest	TMH
3.	Introduction to Ergonomics	Bridger, R.S.	Latest	McGraw Hill,
4.	Human Factors for Information usability	Shackel, B.Richardson S	Latest	Cambridge University Press
5.	Bodyspace Anthropometry, Ergonomics and the Design of Work	Stephen Pheasant	Latest	Taylor and Francis
Important web links				
	https://nptel.ac.in/courses/107103085/			
	https://nptel.ac.in/courses/107103004/			

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	—	—	—	—	—	—	—	—
CO 2	2	3	1	-	—	—	—	—	—	—	—	—
CO 3	2	3	2	-	—	—	—	—	—	—	—	—
CO 4	2	3	2	-	-	—	—	—	—	—	—	—
CO 5	3	2	1	-	1	—	—	—	—	—	—	—

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	-	-	2
CO2	—	-	2
CO3	—	-	2
CO4	—	-	2
CO5	—	2	2

MPDCME1201 Additive Manufacturing and Prototyping Lab 1 Credit [LTP: 0-0-2]

COURSE OUTCOMES

The student will able to:

CO1 Demonstrate understanding of the fundamental principles and working of various additive manufacturing (AM) processes.

CO2 Identify and select appropriate materials based on the requirements and capabilities of different AM techniques.

CO3 Apply suitable CAD tools and effectively use CAD interfaces to design models for additive manufacturing.

CO4 Develop functional prototypes by selecting appropriate AM processes and optimizing relevant process parameters.

CO5 Fabricate physical objects that meet the requirements of product development, testing, and rapid prototyping.

A. LIST OF EXPERIMENT

Exp No.	Name of Experiment
1	Introduction to Additive Manufacturing
2	Generating STL files from the CAD Models & Working on STL files
3	Modifying STL files using open source - Meshmixer software
4	Modeling Creative Designs in CAD Software
5	Processing the CAD data using open source-CURA software
6	Sending the tool path data for fabricating the physical part on 3D Printer
7	Removing the supports & post processing (cleaning the surfaces)
8	Evaluating the quality of the fabricated parts for surface finish and dimensional accuracy
9	Evaluating the fabricated part for its suitability to a given application.
10	Cost analysis of AM parts

Important Web Links	
1	https://all3dp.com/2/meshmixer-tutorial-easy-steps-beginners/
2	https://www.youtube.com/watch?v=dvCGHgftNIg
3	https://www.youtube.com/watch?v=VEYGm9KTcTA
4	https://www.youtube.com/watch?v=eUNTlb5pEWA
5	https://www.youtube.com/watch?v=nl85ATWkKXw

B. CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	-	-	-	-	-	-	-
CO2	2	2	2	1	-	-	3	-	-	-	-	-
CO3	2	3	2	1	3	-	-	-	-	-	-	1
CO4	2	3	3	2	-	2	2	-	-	-	-	1
CO5	2	2	3	1	-	2	2	-	-	-	-	2

C. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	2	-	2
CO2	2	-	2
CO3	2	-	2
CO4	2	-	2
CO5	2	-	2

Code: MPDEME1101 Computer Integrated Manufacturing 3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO1 Analyze the need of CIM and their applications
CO2 Apply components of CIM and their functions
CO3 Analyze the controlling of CIM tools
CO4 Analyze the function of CIM for industrial application
CO5 Evaluate the benefits of CIM in industry

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction of CIM	6
2.	Components of CIM	7
3.	Control system of CIM	7
4.	Computer aided production management system	8
5.	Shop Floor Control & Integration of Components	7

B. DETAILED SYLLABUS

Unit	Unit Detail
1	**Introduction of CIM**
	The meaning and origin of CIM- the changing manufacturing and management scene - External communication - islands of automation and software-dedicated and open systems-manufacturing automation protocol - product related activities of a company- marketing engineering - production planning - plant operations - physical distribution- business and financialmanagement.
2	**Components of CIM**
	Building blocks of flexible manufacturing system; Manufacturing Machines and their Design Consideration e.g. CNC Turn, CNC Mill etc., Pallet, CMM, Measuring Probes, Robots, Job Loading& Unloading Arm, Work Transfer stations, Assembly Stations, Automated Storage Retrieved System(ASRS)
3	**Control system of CIM**
	Material Handling Systems: Automated Guided Vehicles (AGV), Conveyers, Computer ControlSystem. Mechatronics: Sensors, Actuators, Convertors, Modular Automation.
4	**Computer aided production management system**
	Computer Aided Process Planning(CAPP), Computer aided inventory Management, Manufacturing Resource Planning (MRP-II), Computer Aided Quality Control: Contact inspection method and non contact inspection method , Agile and Lean Manufacturing
5	**Shop Floor Control & Integration of Components**
	Shop floor control-phases -factory data collection system -automatic identification methods- Bar code& RFID technology- automated data collection system, Integration of manufacturing & business functions

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C. RECOMMENDED STUDY MATERIAL:

Sr. No.	Reference Book	Author	Edition	Publication
1.	Systems Approach to Computer Integrated Design and Manufacturing	Nanua Singh	Latest	John Wiley & Sons, Inc
2.	Automation, Production Systems and computer integrated manufacturing	Mikell.P.Groover	Latest	Pearson Education.
3.	Computer Integrated Manufacturing System	Yorem koren	Third	McGraw-Hill
4.	CAD/CAM/CIM	Radhakrishnan P, Subramanyan S.and Raju V	Second	New Age International (P) Ltd., New Delhi.
5.	Computer Integrated Manufacturing	Paul Ranky	Latest	Prentice-Hall International
Websites				
1. https://nptel.ac.in/courses/112/104/112104289/				
2. https://nptel.ac.in/courses/112/104/112104188/				

D. CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	2	2	–	–	–	–	–	–	–
CO2	2	1	1	2	3	–	–	–	–	–	–	–
CO3	2	2	2	1	2	–	–	–	–	–	–	–
CO4	3	2	2	1	2	–	–	–	–	–	–	–
CO5	2	2	1	1	2	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	–	2	–
CO2	–	3	–
CO3	–	2	–
CO4	–	2	–
CO5	–	2	–

Code: MPDEME1102	Automation in Manufacturing	3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO1 Analyze the components of automation and their applications.
CO2 Analyses of transfer line without storage for automated flow line.
CO3 Apply the clamping devices for automatic manufacturing.
CO4 Apply the control system of automatic manufacturing.
CO5 Analyze the application of buffer system and their application.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction of Automation	7
2.	Analysis of Automated Flow Lines	6
3.	Devices	7
4.	Control Engineering in Production System	8
5.	Automation	8

B. DETAILED SYLLABUS

Unit	Unit Detail
1	**Introduction of Automation**
	Definition and components of Automation, Economics of Automation, Automation for Productivity and cost reduction. Hard and soft Automation, FMS, CIM, Transfer Machines.
2	**Analysis of Automated Flow Lines**
	General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation,Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines. Devices for conveying small components: Bowl feeders, Hopper, wiper blade, Pressure breakEscapements mechanisms.
3	**Devices**
	Devices for Loading /unloading work pieces, Clamping Work pieces, Changing cutting tools, etc. Product Design forAutomated Assembly, need for Automated Assembly. Roll of computers and sensors in Automation.
4	**Control Engineering in Production System**
	Open loop and closed loop control systems, Mathematical modeling of dynamics systems, Transientfor response analysis of control systems, Basic control actions, and different type of controllers; Pneumatic, hydraulic & electronic controllers; Stability analysis of control system.
5	**Automation**
	Automated Flow lines, Methods of Workpart Transport, Transfer Mechanism, Buffer Storage,Control Functions, andAutomation for Machining Operations, Design and Fabrication Considerations.

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Handbook of design, manufacturing & Automation	R.C. Dorf	Latest	John Wiley & Sons, Inc
2.	Automation, Production Systems and computer integrated manufacturing	Mikell.P.Groover	Latest	Pearson Education.
3.	Industrial Automation	W.P. David	Latest	John Wiley and Sons.
4.	Anatomy of Automation	Amber G.H & P. S. Amber	Second	Prentice Hall.
5.	Performance Modeling of Automated Manufacturing Systems	Viswanandham,	Latest	PHI
Websites				
1. https://nptel.ac.in/courses/112/104/112104288/				
2. https://nptel.ac.in/courses/112/102/112102011/				

D. CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	1	1	2	2	–	–	–	–	–	–	–
CO2	3	1	1	2	3	–	–	–	–	–	–	–
CO3	2	3	2	1	2	–	–	–	–	–	–	–
CO4	3	2	1	1	2	–	–	–	–	–	–	–
CO5	2	2	1	1	2	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	–	3	–
CO2	–	3	–
CO3	–	2	–
CO4	–	2	–
CO5	–	2	–

Code: MPDEME1103	Industrial Robotics and Expert System	3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO1 Evaluate the necessity of automation and growth of mechanization.

CO2 Analyze the various automatic manufacturing tools and their application.

CO3 Analyze the need of FMS System and their working process

CO4 Analyze various types of robots and their working process.

CO5 Analyze the robot application and their benefits in industry

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction to Automation	6
2.	High Volume Manufacturing Automation and Programmable Manufacturing Automation	7
3.	Flexible Manufacturing Automation	7
4.	Robotics	8
5.	Robot Applications	7

B. DETAILED SYLLABUS

Unit	Unit Detail
1	**Introduction to Automation**
	Automation production system, Mechanization and automation, Types of automation, Automation strategies, Mechanical, electrical, hydraulic and Pneumatic automation devices and controls, Economics of automation.
2	**High Volume Manufacturing Automation and Programmable Manufacturing Automation**
	Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines, design of single model, multimodel and mixed model production lines. CNC machine tools, Machining centers,Programmable robots, Robot time estimation in manufacturing operations.
3	**Flexible Manufacturing Automation**
	Introduction to Group Technology, Grouping methods, Cell Design, Flexible manufacturing system. Assembly Automation: Assembly systems, Automatic transfer, feeding and orienting devices, Flexible assembly systems, Performance evaluation and economics of assembly systems.
4	**Robotics**
	Review of robotic technology and applications, Laws of robotics, Robot systems and anatomy, Robot classification, End Effectors, Robot kinematics, Object location, Homogeneous transformation,Direct and inverse kinematics, Manipulator motions, Robot drives, actuators and control, Drive systems, Hydraulic, Pneumatic Electrical DC and AC servo motors and stepped motors, Mechanical transmission method- Rotary-to-rotary motion conversion, Robot motion and path planning control and Controllers, Robot sensing, Range sensing, Proximity sensing, touch sensing, Force and torque sensing etc., Robot vision, Image representation, Image recognition approaches
5	**Robot Applications**
	Robot applications in manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Robot cell design and control, Robot cell layouts-Multiple robots & Machine interference, Economics and social aspectsof robotics, Future applications.

C. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1.	Automation, Production System & Computer Integrated Manufacturing	Groover	Latest	Prentice Hall India
2.	Principles of Automation &Automated Production Process	Malov and Ivanov	4th Edition	Mir Publication
3.	Automation in ProductionEngineering	Oates and Georgy	Latest	Newness Publication
4.	Stochastic Models of Manufacturing Systems	Buzacott & shanty Kumar	Latest	Prentice Hall India
5.	Robotics K.S. Fu	R.C. Gonzalez, C.S.G. Lee		McGraw Hill
Websites				
1. https://nptel.ac.in/courses/112/101/112101099/				

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	1	2	2	–	–	–	–	–	–	–
CO 2	3	1	1	1	2	–	–	–	–	–	–	–
CO 3	3	2	2	1	2	–	–	–	–	–	–	–
CO 4	3	2	1	2	2	–	–	–	–	–	–	–
CO 5	2	3	2	1	2	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	**2**	–
CO 2	–	**2**	–
CO 3	–	**2**	–
CO 4	–	**2**	–
CO 5	–	**2**	–

Code: MPDEME1104 Micro Electrical and Mechanical Systems 3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO1 Evaluate the necessity of MEMS system and their applications

CO2 Analyze the MEMS process and their benefits

CO3 Analyze the MEMS Sensors and their process technique

CO4 Analyze MEMS components and their process sequence

CO5 Apply the control of micro machining process

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction of MEMS	7
2.	MEMS Processes	7
3.	MEMS Sensors	8
4.	MEMS Components	7
5.	Reliability	6

B. DETAILED SYLLABUS

Unit	Unit Detail
1	**Introduction of MEMS**
	Introduction, History, Development and need of Micro-Electro-Mechanical Systems. Overview ofMEMS technology.
2	**MEMS Processes**
	Different electro-physical processes used for machining – dealing with MEMS materials; relevant non-conventional processes; IC fabrication processes used for MEMS.
3	**MEMS Sensors**
	MEMS sensors and actuators; Mechanical process techniques and process models for micromachining.
4	**MEMS Components**
	Fabrication processes and design of the process sequences; Agile Prototyping of design andmanufacturing processes inmicro-machining and computer based design.
5	**Reliability**
	Reliability and process control of micro manufacturing processes; Introduction and exposureto nano-technology processes and systems.

C. RECOMMENDED STUDY MATERIAL

Sr. No	Reference Book	Author	Edition	Publication
1.	RF MEMS and TheirApplications	Vijay Varadan, K. J. Vinoy, K. A. Jose	Latest	Wiley
2.	RF MEMS: Theory, Design,and Technology	Gabriel M. Rebeiz	4th Edition	Wiley
3.	Fundamentals of Microfabrication	Marc Madou	2nd Edition	CRC Press

4.	An Introduction to Microelectromechanical Systems Engineering	N. Maluf	Latest	Prentice Hall India
5.	Modeling MEMS and NEMS	J. Pelesko & D. Bernstein	Latest	McGraw Hill
Websites				
1. https://nptel.ac.in/courses/117/105/117105082/				
2. https://nptel.ac.in/courses/112/108/112108092/				

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	–	–	–	–	–	–	–	–
CO 2	3	2	1	1	–	–	–	–	–	–	–	–
CO 3	2	2	2	1	–	–	–	–	–	–	–	–
CO 4	2	2	1	1	–	–	–	–	–	–	–	–
CO 5	2	2	2	1	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	–	3
CO 2	–	–	3
CO 3	–	–	3
CO 4	–	–	3
CO 5	–	–	3

Code: MPDEME1105 Smart Technologies for Industry 4.0 3 Credits [LTP: 3-0-0]

COURSE OUTCOMES

The student will able to:

CO1 Analyze the drivers and enablers of Industry 4.0

CO2 Analyze the application of IoT in Smart Factories, Smart cities, smart products and smart services

CO3 Evaluate the systems used in a manufacturing plant and their role in an Industry 4.0 world

CO4 Recommend the support system for Industry 4.0 and mobile computing

CO5 Analyze the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction to Industry 4.0	05
2	Road to Industry 4.0	05
3	Related Disciplines, System, Technologies for enabling Industry 4.0	06
4	Role of data, information, knowledge and collaboration in future organizations	06
5	Other Applications and Case Studies	05

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Industry 4.0**
	The Various Industrial Revolutions, Digitalisation and the Networked Economy, Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 , The Journey so far: Developments in USA, Europe, China and other countries, Comparison of Industry 4.0 Factory and Today's Factory, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation
2.	**Road to Industry 4.0**
	Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services, Smart Manufacturing , Smart Devices and Products, Smart Logistics, Smart Cities, Predictive Analytics
3.	**Related Disciplines, System, Technologies for enabling Industry 4.0**
	Cyber physical Systems, Robotic Automation and Collaborative Robots , Support System for Industry 4.0 , MobileComputing, Related Disciplines, Cyber Security
4.	**Role of data, information, knowledge and collaboration in future organizations**
	Resource-based view of a firm, Data as a new resource for organizations, Harnessing and sharing knowledge inorganizations, Cloud Computing Basics, Cloud Computing and Industry 4.0
5.	**Other Applications and Case Studies**
	Industry 4.0 laboratories, IIoT case studies, Case studies from HKPolyU students, opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world

C. RECOMMENDED STUDY MATERIAL:

S.No.	Reference Book	Author	Edition	Publication
1.	The Fourth Industrial Revolution	Klaus Schwab	Latest	World Economic Forum
2	Industry 4.0: The Industrial Internet of Things	Alasdair Gilchrist	Latest	Press
3.	Industry 4.0 Value Roadmap: Integrating Technology and Market Dynamics for Strategy, Innovation and Operations	Tuğrul U. Daim	Latest	Springer
4	Industry 4.0 and Regional Transformations	Lisa De Propris	Latest	Routledge
Important Web Links:				
1	https://en.wikipedia.org/wiki/Industry_4.0			
2	https://www.dqindia.com/role-digital-verification-signature-scaling-industry-4-0/			

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	–	2	1	–	–	–	–	–	–	–	–
CO 2	2	–	1	1	–	–	–	–	–	–	–	–
CO 3	2	–	1	1	–	–	–	–	–	–	–	–
CO 4	2	–	1	1	–	–	–	–	–	–	–	–
CO 5	3	–	2	1	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	2	–	–
CO 2	2	–	–
CO 3	2	–	–
CO 4	2	–	–
CO 5	2	–	–

Code: MPDEME1106	Additive Manufacturing	3 Credits [LTP: 3-0-0]

COURSE OUTCOMES

The student will able to:

CO1 Analyze the fundamentals of Additive Manufacturing Technologies for engineering applications.

CO2 Recommend the methodology to manufacture the products using SLA and SGC technologies and study theirapplications, advantages and case studies

CO3 Apply the methodology to manufacture the products using LOM and FDM technologies and study their applications, advantages and case studies

CO4 Illustrate the methodology to manufacture the products using SLS and 3D Printing technologies and studytheir applications, advantages and case studies

CO5 Apply the Preparation of making of 3D Printer Model

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Additive Manufacturing Technology	7
2.	Liquid based systems	9
3.	Solid based systems	8
4.	Powder Based Systems	9
5.	Three dimensional printing (3DP)	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Additive Manufacturing Technology**
	Introduction, Prototyping fundamentals, Historical development, Advantages of AMT, Commonly used terms, process chain, 3D modelling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, RP data formats, Classification of AMT process, Applications to various fields
2.	**Liquid based systems**
	Stereo lithography apparatus (SLA): Models and specifications, process,working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid ground curing (SGC): Models and specifications, process, working, principle, applications, advantages and disadvantages, case studies.
3.	**Solid based systems**
	Laminated object manufacturing (LOM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages.
4.	**Powder Based Systems**
	Selective laser sintering (SLS): Models and specifications, process, working principle, applications, advantages and disadvantages, case studies.
5.	**Three dimensional printing (3DP)**
	Models and specification, process, working principle, applications, advantages and disadvantages, case studies.

C. RECOMMENDED STUDY MATERIAL:

Sr. No	Book	Author	Edition	Publication
Reference Books				
1	3D Printing and Additive Manufacturing	Chee kai chua&kah Fai Leong	5th Edition	World Scientific
2.	Rapid Prototyping	M. Adithan	Latest	Atlantic Publishers and Distributors Pvt Ltd
3.	Rapid Prototyping; A Brief Introduction	A Ghosh	Latest	Ewp
Important Web Links				
1. https://www.freecodecamp.org/news/a-beginners-guide-to-rapid-prototyping-71e8722c17df/ 2. https://www.lynda.com/3D-Printing-tutorials/Rapid-Prototyping-Product-Design/169615-2.html 3. https://nptel.ac.in/courses/112104265/				

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**2**	–	–	–	**1**	–	–	–	–	–	**3**	–
CO 2	**2**	–	–	–	**1**	–	–	–	–	–	**3**	–
CO 3	**2**	–	–	–	**1**	–	–	–	–	–	**3**	–
CO 4	**2**	–	–	–	**1**	–	–	–	–	–	**3**	–
CO 5	**1**	–	–	–	**1**	–	–	–	–	–	**3**	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	**3**	**1**	–
CO 2	**3**	**1**	–
CO 3	**3**	**1**	–
CO 4	**3**	**1**	–
CO 5	**3**	**1**	–

Code: MPDEME1107	Design Thinking and Innovation	3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO1 Bring awareness on innovative design and new product development.

CO2 Explain the basics of design thinking

CO3 Create and develop design ideas through different technique.

CO4 Identify the significance of reverse Engineering to Understand products.

CO5 Analyze product planning and product development process.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction to Design Thinking	7
2.	Historical Development	8
3.	Design Thinking and Innovation	7
4.	Reverse engineering	6
5.	Product Development	8

B. DETAILED SYLLABUS

Unit	Unit Detail
1	**Introduction to Design Thinking**
	Science to Engineering: Job of engineers, engineering units and measurement, elements of engineering analysis,forces and motion, energy, kinematics and motion, conversion of linear motion to rotary and vice versa, motion transmission. Physics to Engineering: Application of Newton laws, Pascal's law, Bouncy, Bernoulli's theorem, Ohm's law, electrical induction in engineering products.
2	**Historical Development**
	Historical Development: Invention wheel, early mechanics in design, mechanical advantages, industrial revolution, steam and petrol for mobility. Innovations in Electrical and Electronics: Electrical energy generation, electrical bulb, electrical equipment, electronics and automation, computing for early days to present, innovationsin communications.
3	**Design Thinking and Innovation**
	Systematic approach to product development: Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design.
4	**Reverse engineering**
	Reverse engineering in product development: Reversing engineering methods, identifying the bad features in aproduct, reduction in size and weight, usage of new materials, 3D printing, study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, safety considerations in design.
5	**Product Development**
	Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling ofgroundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates, smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

C. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1.	Exploring Engineering: An Introduction to Engineering and Design	Philip Kosky, Robert T. Balmer, William D. Keat,George Wise	Fourth	Elsevier
2.	History of Modern Design	David Ralzman	2018	Laurence King Publishing Ltd.
3.	Design Thinking	AVA Book	latest	AVA Publishing

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**2**	–	**2**	**1**	–	–	–	–	–	–	–	–
CO 2	**2**	–	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**2**	–	**1**	**1**	–	–	–	–	–	–	–	–
CO 4	**2**	–	**1**	**1**	–	–	–	–	–	–	–	–
CO 5	**3**	–	**2**	**1**	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	2	–	–
CO 2	2	–	–
CO 3	2	–	–
CO 4	2	–	–
CO 5	2	–	–

Code: MPEEME1108 Manufacturing Processes Design & Simulation 3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO1 Apply the concept of simulation and queue theory and their application

CO2 Analyze the concept of probability distribution

CO3 Apply the concept of discrete simulation and their application

CO4 Analyze the verification process of simulation model

CO5 Analyze the various simulation model

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction to Simulation & Queuing Models	7
2.	Generation of (Pseudo) random number	9
3.	Discrete Simulation	9
4.	Simulation Model	9
5.	Analysis of Simulation	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Simulation & Queuing Models:**
	Introduction to Simulation, Systems, Models, Data Collection and Analysis, Monte Carlo Simulation, Types of systemsimulation, Decision making with simulation, applications. Queuing Models: Characteristics of queuing systems, queuing notions, long run measures of performance of queuing systems, steady state behavior of Markovian models (M/G/1, M/M/1, M/M/c) overview of finite capacity and finite calling population models, Network of queues. MonteCarlo simulation and its applications in Manufacturing ProcessesSimulation.
2.	**Generation of (Pseudo) random number**
	Generation of (Pseudo) random numbers, Probability distributions and Probability densities, Sampling from probability distribution: Inverse method, Convolution method, Acceptance rejectionmethod.
3.	**Discrete Simulation**
	Discrete Simulation, Continuous Simulation, Combined Simulation, Problem formulation, Mechanics of discrete simulation- discrete events, representation of time, generation of arrival pattern, simulation examples, simulation programming tasks, gathering statistics, measuring utilization and occupancy recording distributions and transit times, case studies.
4.	**Simulation Model**
	Steps to build a useful model of input data, data collection, verification of simulation models, validation process, simulation software, classification of simulation software and desirable softwarefeatures, comparison of simulation packages with programming languages, general purpose simulation packages, object oriented packages, case studies.
5.	**Analysis of Simulation**
	Analysis of Simulation output, Importance of the variance of the sample mean, Procedure for estimating variance, Subinterval method, Replication Method, Regenerative method; Variance reduction techniques, Start up policies, Stopping rules, Statistical inferences, Design of experiments, Manufacturing Processes, Simulation case studies

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Simulation Modeling and Analysis	Law A. M., and Kelton, W. D.	3rd Edition	McGraw-Hill.
2.	System Simulation	Gordon G	2nd Edition	PHI Learning
3.	Theory Of Modeling and Simulation	Bernard	Latest	Academic Press, 2000
4.	Probability and Statistics with Reliability	Trivedi K. S	Latest	PHI
5.	Performance Modeling of Automated Manufacturing Systems	Viswandhan N. and Narhari Y.	Latest	PHI India
Websites				
1. https://nptel.ac.in/courses/112/104/112104230/				
2. https://nptel.ac.in/courses/112/104/112104195/				

D. CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	–	–	–	–	–	–	–	–
CO2	3	2	1	1	–	–	–	–	–	–	–	–
CO3	3	2	2	2	–	–	–	–	–	–	–	–
CO4	3	1	1	1	–	–	–	–	–	–	–	–
CO5	3	2	2	2	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	2	–	–
CO2	1	–	–
CO3	2	–	–
CO4	2	–	–
CO5	2	–	–

Course Outcomes:

Student will be able to

CO 1 Apply the mathematical tools for research analysis problems.

CO 2 Apply the statistical measures and basic multivariate analysis techniques.

CO 3 Analyze the various techniques or methods for design and analysis of experiments.

CO 4 Create the algorithmic research problems and types of solution procedures.

CO 5 Apply the techniques of report writing and presentation.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Overview of Research Methodology	8
2.	Review of Basic Statistical Measures & Basic Multivariate Analysis	10
3.	Design and Analysis of Experiments	10
4.	Algorithmic Research & Simulation	10
5.	Report Writing and Presentation	10

B. DETAILED SYLLABUS

Unit	Contents
1.	**Overview of Research Methodology**
	Introduction, Mathematical tools for analysis, Research problems in management, Types of research, Research Process, Data Collection & Presentation: Introduction, Primary data, Secondary data, Data Presentation
2.	**Review of Basic Statistical Measures & Basic Multivariate Analysis**
	Introduction, Measures of Central Tendencies, Measures of Variation, Measures of Skewness. Basic Multivariate Analysis: Introduction, Correlation analysis, Forecasting, Linear regression & Time series
3.	**Design and Analysis of Experiments**
	Introduction, Analysis of Variance, Completely Randomized design, Randomized complete block design, Latin square design, Duncan"s multiple Range Test, Functional design, second factorial experiment, Expected Mean Square
4.	**Algorithmic Research & Simulation**
	Introduction, Algorithmic Research Problems, Types, Types of Solution Procedures, Steps of development, Steps of Algorithmic Research, Design of Experiments, Meta Heuristics for Combinational Problems. Simulation: Introduction, Need for simulation, Types, Simulation Languages, case study.
5.	**Report Writing and Presentation**
	Introduction, Types of report, Guidelines for review draft, Report format, Typing Instructions, Oral Presentations

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Research Methodology	R. Panneerselvam,	Latest	Prentice Hall India
2.	Research Methodology: Methods and Trends	Dr. C. R. Kothari	Latest	New Age International publisher
3.	Research Methodology: A Step by Step Guide for Beginners	Ranjit Kumar	Latest	Sage Publishing
Websites				
1. https://nptel.ac.in/courses/121/106/121106007/				
2. https://nptel.ac.in/courses/109/105/109105115/				

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	–	2		–	1	–	–	1	–	3	2
CO2	2	–	2		–	1	–	–	2	–	3	2
CO3	2	–	1		–	1	–	–	1	–	3	1
CO4	2	–	1		–	1	–	–	1	–	3	2
CO5	2	–	1		–	1	–	–	1	–	3	2

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	2	2
CO 2	–	2	1
CO 3	–	2	2
CO 4	–	2	2
CO 5	–	2	1

Code: MULCHM1101	Soft Skills-I	1 Credit [LTP: 0-0-2]

Course Outcomes:

The student would be able to

CO1 Present themselves in an effective manner and know about their short-term and long-term goals.

CO2 Work in a team by managing time properly and focus on personal grooming, etiquettes and bodylanguage.

CO3 Demonstrate their abilities by improving skills of LSRW (Listening /Speaking/Reading/Writing).

CO4 Present different viewpoints or ways of thinking about a situation , expand their abilities to resolve situations and get experience within the given context

CO5 Enhance their employability skills by working on the presentation of Résumé and giving impactful performance during Group Discussion.

A. DETAILED SYLLABUS

Unit	Unit Details
1	Personality Enhancement Self-Awareness, Self Esteem & Confidence , Attitude Branding Yourself: Assertiveness and Confidence, The Corporate Fit-Dressing and Grooming, Corporate Dressing – Dress for Success, Etiquette: Social etiquette, business etiquette – civic sense – social norms
2	Effective Management Skills Time & Stress Management: Act in time on commitment Planning &Prioritizing, Emotional Intelligence: Managing Emotions
3	Art of Communication Interview Skills: Fluency & Expression, Group Discussions: Structured &Unstructured, Presentations: Voice, Body Language, Content and Visual Aids, Audience Management
4	Interpersonal Skills The Team Concept & Elements of Teamwork, Stages of Team Formation, & an Effective Team, Essential Building Blocks of Effective Teams Leadership Skills: style and traits
5	Written & Oral Communication Writing Skills: Picture perception & Story Making, Storytelling, Extempore & Paper Presentations.

B. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	–	–	–	–	–	–	–	1	–	3	–	2
CO2	–	–	–	–	–	–	–	1	–	3	–	2
CO3	–	–	–	–	–	–	–	2	–	3	–	1
CO4	–	–	–	–	–	–	–	2	–	3	–	1
CO5	–	–	–	–	–	–	–	1	–	3	–	2

C. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	1	–	–
CO2	2	–	–
CO3	1	–	–
CO4	2	–	–
CO5	1	–	–

Code: MPDCME1401	Seminar-I	1 Credit [LTP: 0-0-2]

A. DETAILED SYLLABUS

Unit	Contents
	Students will be grouped in two to three, will have to decide final thesis area, download research papers from IEEE, ACM, Elsevier, Springer etc. Summarizing paper – Reading abstracts and finding ideas, conclusion, Advantages of Their approach, the drawbacks ofthe papers. Generalize results from a research paper to related research problems. Comparing the approach - Identify weaknesses and strengths in recent research articles inthe subject. Practice sessions on how to read, analyze and summarize research papers. Students in group will have to deliver seminar, prepare a report and a review paper based on analysis.

B. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	–	–	–	–	1	–	2	3	1	–	2
CO 2	2	–	–	–	–	2	–	2	3	1	–	2
CO 3	2	–	–	–	–	1	–	2	3	1	–	2
CO 4	1	–	–	–	–	2	–	2	3	1	–	2
CO 5	1	–	–	–	–	1	–	2	3	1	–	2

C. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	2	–
CO 2	–	2	–
CO 3	–	2	–
CO 4	–	2	–
CO 5	–	2	–

SECOND SEMESTER

Code: MPDCME2101	Design for Manufacturing and Assembly	3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO 1 Apply the DFMA and evaluate the requirements of material.

CO 2 Apply the engineering design and datum features.

CO 3 Analyse the various machining and casting considerations.

CO 4 Create design for manufacturing process.

CO 5 Apply the three datum concepts of dimensioning.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Material and process selection	10
2.	Engineering Design & Datum features	9
3.	Component design – Machining & Casting Considerations	9
4.	Design for Manufacturing Process	9
5.	Assembly Process	9

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Material and process selection**
	Material and process selection Introduction, Advantages of applying DFMA, General requirements of early materials and process selection, Selection of Manufacturing processes, Processcapabilities, Selection of materials, Primary process/ materials selection, Systematic selection of processes and materials.
2.	**Engineering Design & Datum features.**
	Engineering Design features. – Dimensioning, Tolerances, General Tolerance, Geometric Tolerances, Assembly limits, achieving larger machining tolerances. Screw threads, Groundsurfaces, holes. Examples. **Datum features** – Functional datum, machining sequence, manufacturing datum, changing thedatum. Examples.
3.	**Component design – Machining & Casting Considerations**
	Component design - Machining Considerations – Drills, Milling cutters, Drilling, Keyways, Dowels, Screws, Reduction in machining areas, simplification by separation and amalgamation,work piece holding, surface grinding, Examples. **Component design – Casting Considerations –** Pattern, Mould, parting line, cast holes, machinedholes, identifying parting line, special sand cores, designing to obviate sand cores. Examples.
4.	**Design for Manufacturing Process**
	Design for Injection molding and Sheet metal working – Injection molding materials, Molding cycle, Systems, molds, machine size, cycle time, Cost estimation, Insert molding, Design guidelines,Introduction to sheet metalworking,Dedicated Dies and Press working, Press selections, Design Rules. **Design for Die casting and Powder metal processing –** Die casting alloys, cycle, machines, dies,finishing, Assembly techniques, Design principles, Powder metallurgy processing, stages, compaction characteristics, Tooling,Sintering, Design guidelines.
5.	**Assembly Process**
	Introduction to Assembly –The assembly process, Characteristics and applications, Example of common assembly, Economic significance of assembly, General taxonomies of assembly operation and systems, Assembling a product, **Design for Assembly**: Introduction, Design consideration

C. RECOMMENDED STUDY MATERIAL:

S. No.	Title of the Book	Author
1.	Product Design for Manufacture and Assembly	Geoffrey Boothroyd - Peter Dewhurst - Winston Knight-Marcel Dekker, Inc. – Newyork - Second Revison, ISBN 0-8247-0584-X.
2.	Designing for Manufacturing	Harry Peck - Pitman Publications – 1983.
3.	Dimensioning and Tolerancing forQuantity Production	Merhyle F Spotts –Inc. Englewood Cliffs – New Jersey - Prentice Hall, 5th edition.
4.	Design for Manufacturing and Assembly	O. Molloy,S. Tilley and E.A. Warman (1998) - Chapman & Hall, London, UK, First Edition

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	–	–	–	–	–	–	–	–
CO 2	3	2	1	1	–	–	–	–	–	–	–	–
CO 3	2	2	1	1	–	–	–	–	–	–	–	–
CO 4	3	2	1	1	–	–	–	–	–	–	–	–
CO 5	3	2	1	1	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	2	2
CO 2	–	2	1
CO 3	–	2	2
CO 4	–	2	2
CO 5	–	2	1

Code: MPDCME2102	Automation and Robotics	3 Credits [LTP: 3-0-0]

COURSE OUTCOMES:

Student will be able to

CO 1 Identify the potential areas for automation and justify the need for automation.

CO 2 Analyze the automated production lines, transfer lines and inspection methods.

CO 3 Explain the law of robotics and classification of robots.

CO 4 Classify the various types of sensors and end effectors used in robots.

CO 5 Apply the control of robots for some specific applications.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to automation	8
2.	Automated production Lines	8
3.	Robotics	7
4.	Robot sensor and end efforts	8
5.	Robot Control and Applications	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Automation**
	Basic elements of an automated system, advanced automation functions, levels of automation, process industries versus discrete manufacturing industries, FMS. Hardware components for automation and process control, sensors, actuators. Social issues of automation, types of automation, reasons of automation. Basic elements of fluid power system, advantages and disadvantages of fluid power, application of fluid power. Pneumatic vs. hydraulics, Advantages and disadvantages of pneumatics and hydraulics.
2.	**Automated production Lines**
	Fundamentals of automated production lines, application of automated production lines, analysis of transfer lines, types of assembly lines, reasons for using automated assembly lines, fundamentals of automated assembly systems, barcode technology, RFID etc. Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, other optical Inspection Methods.
3.	**Robotics**
	History of robots. Definition of robots. Industrial robots, law of robotics. Advantages and disadvantages of robots. Characteristics of an industrial robot, components of an industrial robot. Classification of robots- Robot classification on the basis of co-ordinate system, basics of power supply, basis of method of control, basis of programming method. Robotic safety, maintenance.
4.	**Robot sensor and end efforts**
	Types of sensors in robots. Tactile sensor, Proximity sensor (Position sensor), Range sensor, Machine vision sensor, Velocity sensor. Robot end effectors- End effectors, classification of end effector, gripper, selection of gripper, Types of grippes, Finger gripper, Mechanical grippers.
5.	**Robot Control and Application**
	Basics of control: open loop- closed loop, Transfer functions. Types and components of a robot, Embedded systems: Microcontroller Architecture, Kinematic Modeling: Translation and Rotation Representation, Coordinate transformation. Robot capabilities, application of robots, manufacturing applications, material handling applications.

C. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1.	Robotics and Control	Nagrath and Mittal	Latest	Tata McGraw-Hill
2.	Robot Dynamics and Control	Spong and Vidhyasagar	Latest	John Wiley and sons
3.	Introduction to Robotics – Analysis, Systems and Application	Saeed B. Niku	Latest	PHI
4.	Robotics for Engineers	YoramKoren	Latest	McGraw Hill International
5.	Robotic Engineering – An Integrated Approach	Klafter, Chmielewski and Negin	Latest	PHI
Important Web links:				
1	https://nptel.ac.in/courses/112101098/			
2	https://nptel.ac.in/courses/112105249/			

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	1	—	—	—	—	—	—	—
CO 2	2	2	1	-	1	—	—	—	—	—	—	—
CO 3	2	1	-	-	1	—	—	—	—	—	—	—
CO 4	3	1	-	-	1	—	—	—	—	—	—	—
CO 5	2	2	-	-	1	—	—	—	—	—	—	—

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	-	2	2
CO 2	—	2	3
CO 3	—	2	-
CO 4	—	1	2
CO 5	—	2	2

Code: MPDCME2103	AI/ML in Smart Manufacturing	3 Credits [LTP: 3-0-0]

COURSE OUTCOMES:

Student will be able to

CO 1 Understand the capability of AI for production planning and decision making.

CO 2 Understand the fundamental concepts of manufacturing scheduling and role of robot control system in manufacturing.

CO 3 Apply the machine learning to industrial planning and decision making.

CO 4 Develop a practical understanding of effective scheduling.

CO 5 Develop integrated software system for intelligent manufacturing.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction of AI and ML	8
2	AI in Manufacturing	7
3	ML in manufacturing	7
4	Intelligent Automation	7
5	Industrial robot integrated with AI/ML	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction of AI and ML**
	Application of Machine Learning to Industrial Planning and Decision Making, Special Purpose Resource Design in Planning to Make More Efficient Plans
2.	**AI in Manufacturing**
	Geometric Reasoning Using a Feature Algebra, Backward Assembly Planning Symmetry Groups in Solid Model-Based Assembly Planning, An Expert System Approach for Economic Evaluation of Machining Operation Planning, Interactive Problem Solving for Production Planning
3.	**ML in manufacturing**
	An Abstraction-Based Search and Learning Approach for Effective Scheduling, ADDYMS: Architecture for Distributed Dynamic Manufacturing Scheduling, An Architecture for Real-Time Distributed Scheduling, Exploiting Local Flexibility During Execution of Pre-computed Schedules
4.	**Intelligent Automation**
	An Architecture for Integrating Enterprise Automation; An Intelligent Agent Framework for Enterprise Integration; Teamwork Among Intelligent Agents: Framework and Case Study in Robotic Service
5.	**Industrial robot integrated with AI/ML**
	Symbolic Representation and Planning for Robot Control Systems in Manufacturing; Integrated Software System for Intelligent Manufacturing; Enterprise Management Network Architecture: A Tool for Manufacturing Enterprise Integration; Design and Manufacturing: Integration through Quality

C. RECOMMENDEDSTUDYMATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Artificial Intelligence Applications in Manufacturing	A. Fazel Famili, Dana S. Nau , Steven H. Kim	Latest	AAAI Press
2.	The Future Computed: AI and Manufacturing; Global Lead, Manufacturing and Resources Industry	Çaglayan Arkan	Latest	Microsoft
Important Web Links				
1	https://nptel.ac.in/courses/113104517			
2	https://archive.nptel.ac.in/courses/112/103/112103280/			

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	—	—	—	—	—	—	—	—
CO 2	3	3	-	-	2	—	—	—	—	—	—	—
CO 3	3	3	-	2	2	—	—	—	—	—	—	—
CO 4	3	3	2	3	-	—	—	—	—	—	—	—
CO 5	3	3	2	-	2	—	—	—	—	—	—	—

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	3	-	-
CO 2	3	2	-
CO 3	3	2	-
CO 4	3	-	2
CO 5	3	-	2

Code: MPDCME2201	Computer Aided Engineering Lab	1 Credits [LTP: 0-0-2]

COURSE OUTCOMES:

Student will be able to

CO 1 Apply FEA tools to perform static and dynamic analysis of 2D and 3D structures under various loads and boundary conditions.

CO 2 Develop appropriate 2D and 3D meshes using suitable element types and sizes for accurate simulation..

CO 3 Analyze trusses, beams, plates, and shells for stress, strain, deformation, and failure under static, thermal, and combined loads.

CO 4 Evaluate the mechanical components through modal, thermal, buckling, and nonlinear analysis for performance and stability.

CO 5 Interpret coupled field simulation results to support design and product development decisions.

A. LIST OF EXPERIMENT

Exp No.	Name of Experiment
1	2D static linear cantilever beam analysis with different sections, different materials for different loading conditions.
2	2D static analysis of truss structure for determining the deflection and stresses.
3	Static analysis of plate with a hole for determining the deformations and maximum stress distribution.
4	Static analysis of a rectangular L section bracket for determine the deformations and maximum stress distribution.
5	Modal analysis of beams for natural frequencies and mode shapes.
6	Modal analysis of shaft for natural frequencies and mode shapes.
7	Buckling analysis of a given specimen for static, fatigue and buckling failures.
8	Steady state conductive heat transfer analysis of a given specimen.
9	Steady state convective heat transfer analysis of a given specimen.
10	Steady state thermal analysis of heat sink with given initial conditions.

Important Web Links	
1	https://www.ansys.com/en-in/academic/learning-resources

B. CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	-	-	-	-	-	-	-
CO2	3	2	1	2	3	-	-	-	-	-	-	-
CO3	3	2	-	2	3	-	-	-	-	-	-	-
CO4	3	3	2	3	3	-	-	-	-	-	-	-
CO5	3	2	1	2	3	-	-	-	-	-	-	-

C. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	-	3	2
CO 2	-	3	2
CO 3	-	3	2
CO 4	-	3	2
CO 5	-	3	2

Code: MPDEME2101	Finite Element Methods	3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO 1 Apply the concept of FEM

CO 2 Apply the principle of FEM in two dimensional object

CO 3 Analyze the problem for steady state condition

CO 4 Analyze the solution of structure problem

CO 5 Analyze the solution of FEM

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Basic concepts of FEM	7
2.	Interpolation Polynomials	8
3.	Field problems & Steady state problems	7
4.	Finite element Solution of structural problems	7
5.	Higher Order Elements and Numerical Methods	8

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Basic concepts of FEM**
	Basic concepts - Different methods in Finite Element Methods - Steps involved in FEM.
2.	**Interpolation Polynomials**
	Interpolation Polynomials - Linear elements Shape function - Element and Global matrices - Twodimensional elements, triangular and rectangular elements - Local and Global Coordinate systems.
3.	**Field problems & Steady state problems**
	Field problems, Steady state problems - Torsional problem - Fluid flow and Heat transfer problems - Acoustic vibrations – Application in manufacturing problems – metal cutting and metal forming.
4.	**Finite element Solution of structural problems**
	Finite element Solution of structural problems - Two dimensional elasticity problems –Axisymmetric problem.
5.	**Higher Order Elements and Numerical Methods**
	Higher Order Elements and Numerical Methods - Evaluation of shape functions - NumericalIntegration, Gauss Legendre quadrature - Solution of finite element equations - Cholesky decomposition, Skyline storage - Computer implementation-Use of FEM software.

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Applied Finite Element Analysis	Larry J Segerlind	Latest	John Wiley
2.	Finite Element Procedures	Bathe KJ	Latest	Prentice Hall
3.	An Introduction to the Finite Element Method	J.N.Reddy	Second Edition	McGraw Hill
Websites				
1. https://nptel.ac.in/courses/112/104/112104116/				
2. https://nptel.ac.in/courses/112/104/112104193/				

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 2	**3**	**3**	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**3**	**2**	**2**	**1**	–	–	–	–	–	–	–	–
CO 4	**3**	**2**	**2**	**1**	–	–	–	–	–	–	–	–
CO 5	**2**	**2**	**1**	**1**	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	–	**3**
CO 2	–	–	**3**
CO 3	–	–	**3**
CO 4	–	–	**3**
CO 5	–	–	**3**

Code: MPDEME2102	Computer Applications in Design	3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to
CO1 Analyze the concepts of CAD/CAM/CAE Systems.
CO2 Analyze the aspect of Graphics Programming and Geometric Modeling.
CO3 Create the Curves equations and evaluation of NURBS curve.
CO4 Evaluate the CAD and CAM Integration
CO5 Analyze the Standards for Communicating Between Systems

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction to CAD/CAM/CAE Systems	7
2.	Basic Concepts of Graphics Programming	8
3.	Representation and Manipulation of Curves	7
4.	CAD and CAM Integration	6
5.	Standards for Communicating Between Systems	8

B. DETAILED SYLLABUS

Unit	Unit Detail
1	**Introduction to CAD/CAM/CAE Systems**
	Introduction to CAD/CAM/CAE Systems: Overview, Definitions of CAD. CAM and CAE, Integrating the Design and Manufacturing Processes through a Common Database-A Scenario, Using CAD/CAM/CAE Systems for Product Development-A Practical Example. **Components of CAD/CAM/CAE Systems**: Hardware Components, Vector-Refresh (Stroke- Refresh) Graphics Devices, Raster Graphics Devices, Hardware configuration, Software Components, Windows-Based CAD Systems.
2	**Basic Concepts of Graphics Programming**
	Basic Concepts of Graphics Programming: Graphics Libraries, Coordinate Systems, Window and Viewport, Output Primitives - Line, Polygon, Marker Text, Graphics Input, Display List, Transformation Matrix, Translation, Rotation, Mapping, Other Transformation Matrices, Hidden-Line and Hidden-Surface Removal, Back-Face Removal Algorithm, Depth-Sorting, or Painters Algorithm, Hidden- Line Removal Algorithm, z-Buffer Method, Rendering, Shading, Ray Tracing, Graphical User Interface, X Window System. **Geometric Modeling Systems**: Wireframe Modeling Systems, Surface Modeling Systems, Solid Modeling Systems, Modeling Functions, Data Structure, Euler Operators, Boolean Operations, Calculation of Volumetric Properties, Non-manifold Modeling Systems, Assembly Modeling Capabilities, Basic Functions of Assembly Modeling, Browsing an Assembly, Features of Concurrent Design, Use of Assembly models, Simplification ofAssemblies, Web-Based Modeling.
3	**Representation and Manipulation of Curves**
	Representation and Manipulation of Curves: Types of Curve Equations, Conic Sections, Circle or Circular Arc, Ellipse or Elliptic Arc, Hyperbola, Parabola, Hermite Curves, Bezier Curve, Differentiation of a Bezier Curve Equation, Evaluation of a Bezier Curve, B-Spline Curve, Evaluation of a B-Spline Curve, Composition of B-Spline Curves, Differentiation of a B-Spline Curve, Non-uniform Rational B-Spline (NURBS) Curve, Evaluation of a NURBS Curve, Differentiation of a NURBS Curve, Interpolation Curves, Interpolation Using a Hermite Curve, Interpolation Using a B-Spline Curve, Intersection of Curves.
4	**CAD and CAM Integration**
	Representation and Manipulation of Surfaces: Types of Surface Equations, Bilinear Surface, Coon's Patch, Bicubic Patch, Bezier Surface, Evaluation of a Bezier Surface, Differentiation of a Bezier Surface, B-Spline Surface, Evaluation of a-B-Spline Surface, Differentiation of a B-Spline Surface, NURBS Surface, Interpolation Surface, Intersection of Surfaces. **CAD and CAM Integration** : Overview of the Discrete Part Production Cycle, Process Planning, Manual Approach, Variant Approach, Generative Approach, Computer-Aided Process Planning Systems, CAM-I CAPP, MIPLAN and Multi CAPP, Met CAPP, ICEM-PART, Group Technology, Classification and Coding, Existing Coding Systems, Product Data Management (PDM) Systems
5	**Standards for Communicating Between Systems**
	Standards for Communicating Between Systems: Exchange Methods of Product Definition Data, Initial Graphics Exchange Specification, Drawing Interchange Format, Standard for the Exchange of Product Data. Tutorials, Computational exercises involving Geometric Modeling of components and their assemblies

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Principles of CAD/CAM/CAE systems	Kunwoo - Lee Addison.	Latest	Wesley
2.	CAD/CAM/CIM	Radhakrishnan P. et al.	2014	New Age International
3.	CAD/CAM – Theory & Practice	Ibrahim Zeid	Latest	McGraw Hill
4.	Computer Integrated Design and Manufacturing	Bedworth, Mark Henderson & Philip Wolfe	Latest	McGraw Hill
5.	Part modeling Users Guide	Pro-Engineer	Latest	
Websites				
1. https://nptel.ac.in/courses/112/104/112104265/				
2. https://nptel.ac.in/courses/108/108/108108115/				

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	–	–	–	–	–	–	–	–
CO 2	3	3	1	1	–	–	–	–	–	–	–	–
CO 3	2	2	1	1	–	–	–	–	–	–	–	–
CO 4	3	2	1	1	–	–	–	–	–	–	–	–
CO 5	3	2	1	1	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	2	3
CO 2	–	1	3
CO 3	–	1	3
CO 4	–	2	3
CO 5	–	1	3

Code: MPDEME2103 Non-Traditional Machining Processes 3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO1 Understand the importance and classification of non-traditional machining.
CO2 Analyse the various process parameters of mechanical energy techniques of non-traditional machining.
CO3 Illustrate the operating principles of electrical energy techniques of non-traditional machining.
CO4 Examine the parameters influencing metal removal through thermal energy of non-traditional machining.
CO5 Illustrate the chemical and hybrid machining processes.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction to Non-Traditional Machining Processes	07
2.	Mechanical Energy Techniques	08
3.	Electrical Energy Techniques	07
4.	Thermal and Thermo-Electrical Energy Techniques	09
5.	Chemical and Hybrid Machining Techniques	07

B. DETAILED SYLLABUS:

Unit	Unit Detail
1	**Introduction to Non-Traditional Machining Processes**
	Introduction: Introduction to non-traditional machining methods, need for non-traditional machining, Sources of metal removal, Classification on the basis of energy sources, Parameters influencing selection of process. Limitations of conventional manufacturing processes, future possibilities.
2	**Mechanical Energy Techniques**
	Abrasive Jet Machining (AJM): Operating principles, Equipment, Parameters influencing metal removal, Applications, Advantages and Limitations. **Water Jet Machining (WJM):** Operating principles, Equipment, Parameters influencing metal removal, Applications, Advantages and limitations. **Ultra Sonic Machining (USM):** Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations.
3	**Electrical Energy Techniques**
	Electro Chemical Machining (ECM): Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations, Current developments in ECM. **Electro Chemical Grinding (ECG):** Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations.
4	**Thermal and Thermo-Electrical Energy Techniques**
	Thermal Energy Techniques: Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations of Electron Beam Machining (EBM), Plasma Arc Machining (PAM) and Laser Beam Machining (LBM). **Thermo-Electrical Energy Techniques:** Electrical Discharge Machining (EDM) and Wire Cut Electrical Discharge Machining (WCEDM): Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations. Electrical Discharge Grinding (EDG): Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations.
5	**Chemical and Hybrid Machining Techniques**
	Chemical Machining: Elements of the process: Resists (maskants), Etchants. Types of chemical machining process- chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process. **Hybrid Machining Processes:** Concept, classification, process capabilities, and applications of various hybrid machining methods based on USM, EDM, ECM, etc.

C. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1.	Production Technology	HMT	2015	Tata Mc Graw Hill - ISBN-10; 0070964432
2.	Modern Machining Process	P.C Pandy & H.S. Shan	2020	Tata McGraw Hill - ISBN: 0070965536
3.	High Velocity Forming of Metals	F.M Wilson	2020	ASTME Pretice Hall.
4.	Modern Manufacturing Method	Adithan	2018	New Age International (p) Limited - ISBN**:** 8122408176.
5.	Modern Machining Processes	P.K. Mishra	2018	Narosa Publishing House
Websites				
1. https://nptel.ac.in/courses/112/104/112104265/				
2. https://nptel.ac.in/courses/108/108/108108115/				

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	—	—	—	—	—	—	—	—
CO 2	2	3	2	-	—	—	—	—	—	—	—	—
CO 3	3	2	2	-	—	—	—	—	—	—	—	—
CO 4	2	3	2	-	-	—	—	—	—	—	—	—
CO 5	3	2	1	-	—	—	—	—	—	—	—	—

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	-	-	3
CO 2	—	-	3
CO 3	—	-	3
CO 4	—	1	3
CO 5	—	-	3

Code: MPDEME2104	Machine Tool Design	3 Credits [LTP: 3-0-0]

COURSE OUTCOME:

At the end of the course students will be able to:

CO1 Apply the concept of tool materials and its role in machining.

CO2 Evaluate the kinematics of machineries and design kinematics of machine system.

CO3 Apply the concept of layout of bearings and spindles.

CO4 Create the part programming using computer aided modelling system.

CO5 Evaluate the characteristics of tooling for CNC machines.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Tool Materials	8
2.	Kinematics of Machine Tools	8
3.	Analysis of Spindles, Bearings	9
4.	Computer- Aided Programming	7
5.	Tooling for CNC Machines	8

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Tool Materials**
	Desirable Properties of tool materials, Types of Cutting Tool Materials, Indexable inserts, Coated tools, Orthogonal and Oblique cutting, Classifications of cutting tools, Chip formation, Types of chips, Cutting tool geometry, various methods of tool nomenclature and their relationships. Theoretical Determination of shear angle and cutting forces
2	**Kinematics of Machine Tools**
	Shaping of geometrical and real surfaces, Developing and designing of kinematic schemes of machine tools, kinematicsstructures of lathe, drilling, milling, grinding, gear shaping and gear hobbing machines.
3	**Analysis of Spindles, Bearings**
	Design of spindles subjected to combined bending and torsion. Layout of bearings. Pre-loading. Anti-friction slide ways.Rolling contact hydrodynamic, hydrostatic, Hydrodynamic design of Journal bearings, Magneto bearings.
4	**Computer- Aided Programming**
	General information, APT programming, Examples apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors introduction to CAD/CAM software,automatic Tool Path generation.
5	**Tooling for CNC Machines**
	Interchangeable tooling system, present and qualifies tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control; Introduction, type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization

C. RECOMMENDED STUDY MATERIAL:

S. No.	Book	Author	Publication
a. Reference Books			
1.	Machine Tool Design and Numerical Control	N.K. Mehta	Tata McGraw Hill
2.	Principles of Machine Tools	Sen and Battacharya	Central book publishers
3.	Principles of Machine Tool Design	SK BASU	Oxford & IBH Publishing
b. Important Web Links:			
1.	https://youtu.be/A0dTvf_Q8BA		
2.	https://youtu.be/Dcx1Vf_1Z3o		

D. CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	2	2	–	–	–	–	–	–	–
CO2	2	1	1	2	3	–	–	–	–	–	–	–
CO3	2	2	2	1	2	–	–	–	–	–	–	–
CO4	3	2	2	1	2	–	–	–	–	–	–	–
CO5	2	2	1	1	2	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	–	2	–
CO2	–	3	–
CO3	–	2	–
CO4	–	2	–
CO5	–	2	–

Code: MPDEME2105	Industrial Tribology	3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO 1 Analyze the friction forces between engineering materials

CO 2 Analyze the various wear and their application

CO 3 Analyze the various lubrication processes

CO 4 Apply the concept of viscous force between plates

CO 5 Analyze the effect of unloaded and loaded journal bearing

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Surfaces And Friction	7
2.	Wear	8
3.	Lubricants And Lubrication	7
4.	Film Lubrication Theory	7
5.	High Speed Unloaded Journal Bearings	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Surfaces And Friction:**
	Surfaces And Friction: Topography of engineering surfaces, contact between surfaces,sources of sliding Friction Energy dissipation mechanisms Friction Characteristics of metals, Friction of non-metals, Friction of lamellar solids friction of Ceramic materials and polymers Rolling Friction, Source of Rolling Friction, Stick slip motion, Measurement of Friction.
2.	**Wear**
	WEAR: Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear –Materials for Adhesive and Abrasive wear situations - Corrosive wear - SurfaceFatigue wear situations - BrittleFracture - wear - Wear of Ceramics and Polymers - Wear Measurements
3.	**Lubricants And Lubrication**
	Lubricants And Lubrication: Types and properties of Lubricants - Testing methods -Hydrodynamic Lubrication – Elasto-hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication- Hydrostatic Lubrication.
4.	**Film Lubrication Theory**
	Film Lubrication Theory: Fluid film in simple shear - Viscous flow between very closeparallel plates –Shear stress variation Reynolds Equation for film Lubrication.
5.	**High Speed Unloaded Journal Bearings**
	High speed unloaded journal bearings - Loaded journal bearings – Reaction torque on the bearings - Virtual Co-efficient of friction - The Summerfield diagram.

C. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Bearing Design inMachinery	A. Harnoy	Latest	Marcel Dekker Inc, NewYork
2.	Applied Tribology	M.M.Khonsari & E.R.Booser	Latest	John Willey & Sons, NewYork
3.	Friction and Lubrication	E.P.Bowden and Tabor.D	Second Edition	Heinemann Educational Books Ltd
4.	Basic Lubrication theory	A.Cameron	Latest	Longman, U.K..
5.	Tribology Handbook	M.J.Neale	Latest	Newnes. Butter worth, Heinemann, U.K.
Websites				
1. https://nptel.ac.in/courses/112/102/112102015/				
2. https://nptel.ac.in/courses/112/102/112102014/				

D. CO- PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 2	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**2**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 4	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–
CO 5	**3**	**2**	**1**	**1**	–	–	–	–	–	–	–	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	**2**	**2**
CO 2	–	**2**	**1**
CO 3	–	**2**	**2**
CO 4	–	**2**	**2**
CO 5	–	**2**	**1**

Code: MPDEME2106 Manufacturing System Engineering 3 Credits [LTP: 3-0-0]

COURSE OUTCOME

The student will be able to:

CO1 Analyze the fundamental knowledge of manufacturing system engineering for productivity and work study.

CO2 Apply the principles of various quality aspects and inventory control.

CO3 Illustrate the scheduling process, forecasting and Just in Time method.

CO4 Recommend the importance of costing involved in manufacturing and break even analysis.

CO5 Examine the concept of plant layout, site selection process and factor influencing plant layout.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Productivity and Work Study	7
2.	Quality and Inventory Control	8
3.	Production Planning & Control	7
4.	Manufacturing Cost Analysis	7
5.	Plant Layout and Material Handling	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Productivity and Work Study**
	Productivity: Introduction, definition, various method of measurement, factors effecting productivity, strategies forimproving productivity. **Work Study:** Objectives, Method study, Principle of motion economy, Techniques of method study - Various charts, THERBLIGS, Work measurement - various methods, time study, determining time, Work sampling
2.	**Quality and Inventory Control**
	Quality control: Definition of quality, Various approaches, Concept of quality assurance systems, Costs of quality, Statistical quality Control (SQC), Variables & Attributes, X, R, P & C - charts, Acceptance sampling, OC -curve, Sampling plan - Single, Double & sequential. **Inventory control:** Inventory control models - Economic order quantity (EOQ), Economic batch quantity (EBQ) with & without shortage, Purchase discounts, Sensitivity analysis, Inventory control systems - P,Q,Ss Systems, Service level, Stock out risk, determination of order point & safety stock, Selective inventory control - ABC, FSN,SDE, VED and three dimensional
3.	**Production Planning & Control**
	Production **Planning & Control**: Introduction to Forecasting - Simple & Weighted moving average methods, Objectives & variables of PPC, Aggregate planning - Basic Concept, Decision options - Basic & mixed strategies,Master production schedule (MPS), Scheduling Operations, Gantt chart, Sequencing – Johnson algorithm for n- Jobs-2 machines, n- Jobs-3 machines, 2 Jobs n-machines, n-Jobs m-machines Various means of measuring effectiveness of PPC, Introduction to JIT
4.	**Manufacturing Cost Analysis**
	Manufacturing Cost Analysis: Fixed & variable costs, Direct, indirect & overhead costs, & Job costing, Recoveryof overheads, Standard costing, Cost control, Cost variance Analysis - Labour, material, overhead in volume, rate& efficiency, Break even Analysis, Marginal costing & contribution
5.	**Plant Layout and Material Handling**
	Plant Layout and Material Handling: Plant location, site selection- Plant layout types, need, factors influencing thelayout - Tools and techniques for developing layout, process chart, flow diagram, string diagram, Template and Scale models- Layout Planning procedure- Assembly line balancing. Material Handling, scope and importance- Types of material handling systems-factors influencing material handling- methods of material handling. Material Requirements Planning (MRP): Introduction, MRP system structure, master production schedule (MPS), bill of materials, inventory status, MRP Procedure.

C. RECOMMENDED STUDY MATERIAL

Sr. No	Reference Book	Author	Edition	Publication
1	Industrial Engineering and Management	Khanna O. P	Latest	Khanna publishers, NewDelhi,
2	Principles and practice of Management	Prasad, L.M.	Latest	Sultan Chand & Sons.
3	Works Organisation& Management	Sushil Kumar Basu, K. C. Sahu, N. K. Datta	Latest	Oxford & IBH
4	Principles of Industrial Organization	Dexter S. Kimball	Latest	Read Books.
5	Essentials of Industrial Management	Lawrence L. Bethel	Latest	McGraw-Hill.
Important Web Links				
1	www.nptel.com			
2	https://link.springer.com/journal/40092/volumes-and-issues			

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**2**	–	**2**	**1**	–	–	–	–	–	–	–	–
CO 2	**2**	–	**1**	**1**	–	–	–	–	–	–	–	–
CO 3	**2**	–	**1**	**1**	–	–	–	–	–	–	–	–
CO 4	**2**	–	**1**	**1**	–	–	–	–	–	–	–	–
CO 5	**3**	–	**2**	**1**	–	–	–	–	–	–	–	–

E. .CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	2	–	–
CO 2	2	–	–
CO 3	2	–	–
CO 4	2	–	–
CO 5	2	–	–

Code: MPDEME2107	Quality Systems Engineering	3 Credits [LTP: 3-0-0]

Course Outcomes:

Student will be able to

CO1 Apply the quality check process

CO2 Analyze the various standards of quality

CO3 Apply the causes of failure and their remedies

CO4 Analyze the sampling inspection method

CO5 Analyze the effect of failure mode

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Basics of quality	7
2.	Quality standards	8
3.	Reliability	7
4.	IS2500 plans	7
5.	Quality function deployment	7

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Basics of quality**
	Basics of quality – process capability analysis – quality gurus and their philosophies.
2	**Quality standards**
	Quality standards – ISO 9000 series and 14000 series – Design of experiments – Anova analysis
3	**Reliability**
	Reliability – MTBF – MTTR - Acceptance sampling by variables and attributes – ASN – ATI –AOQL
4	**IS2500 plans**
	IS2500 plans – MIL STD 105E – Control charts for variables and attributes - Taguchi methods,cases Concurrent engineering.
5	**Quality function deployment**
	Quality function deployment – FMEA – Quality circles - Total quality management –Kaizen. .

C. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1.	Quality Planning and analysis	Juran J.M and Frank MGryna	Latest	McGraw-Hill.
2.	Quality Engineering in Production System	Genichi Taguchi et all	Latest	McGraw-Hill
3.	Quality Process Management	Bernard	Latest	Prentice Hall
Websites				
1. https://nptel.ac.in/courses/110/104/110104074/				
2. https://nptel.ac.in/courses/110/101/110101010/				

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	–	2	–	–	1	–	–	1	–	3	2
CO2	2	–	2	–	–	1	–	–	2	–	3	2
CO3	2	–	1	–	–	1	–	–	1	–	3	1
CO4	2	–	1	–	–	1	–	–	1	–	3	2
CO5	2	–	1	–	–	1	–	–	1	–	3	2

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	2	2
CO 2	–	2	1
CO 3	–	2	2
CO 4	–	2	2
CO 5	–	2	1

Code: MPDEME2108	Operation Management	3 Credits [LTP: 3-0-0]

COURSE OUTCOMES

The student will able to:

CO1 Analyze the scope of operation management and demand forecasting.

CO2 Analyze the various types of production system and capacity planning.

CO3 Analyze the production planning objectives and techniques.

CO4 Analyze the concepts of production control system, JIT, pull system etc.

CO5 Apply the concept of material management, requirement, functions.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Basics of Operation Management	7
2.	Production Systems	8
3.	Production Planning	7
4.	Production Control	7
5.	Material Management	7

B. DETAILED SYLLABUS

Unit	Unit Details
1.	**Basics of Operation Management**
	Introduction: Scope of Operations Management, operations manager and the management process. Operations Strategy, Competitiveness and Productivity. Demand Forecasting: components of forecasting demand, Approaches to forecasting: Qualitative methods, Time series methods, Regression methods, Selection of forecasting technique.
2.	**Production Systems**
	Products and Services, Process, Types of Production Systems: Mass, Batch, Job shop production. Product andprocess matrix. Process planning and Process analysis. **Capacity Planning:** Defining and measuring capacity, steps in capacity planning process, determining capacityrequirements, Capacity alternatives.
3.	**Production Planning**
	Production Planning: Production planning objective and functions, Bill of material, Capacity and man powerrequirement planning, Planning levels: long range, Intermediate range and Short range planning, aggregate planning; Objective, Strategies.
4.	**Production Control**
	Production Control: Capacity control and priority control, production control functions; Routing, scheduling,dispatching, expediting and follow up, batch production and mass production systems, **Just in Time and Lean Production** Basic element in JIT, Pull system, Push system, Kanban production control system, Benefits of JIT.
5.	**Material Management**
	Material Management: Objectives, scope and functions of material management, planning, procurement, storing ending and inventory control. Purpose of inventory, inventory cost, inventory control systems, Selective inventory control systems, Determination of EOQ, Lead time and reorder point.

C. RECOMMENDED STUDY MATERIAL

S. No.	Book	Author	Edition	Publication
Reference Books				
1.	Operations Management	Krajewski,Ritzman,Kansal	Latest	Pearson
2.	Operations Management	Roberta S. Russell	Latest	Pearson/ PHI
3.	Production and Operations Management	Everette. Adam Jr., Ronald J.Ebert	Latest	PHI
4.	Operations Management	Russell & Taylor III	Latest	Pearson
5.	Operations Management	McGregor D	Latest	McGraw-Hill
6.	Operations Management	Chase, Jacobs, Aquilano, Agarwal		TMH
Important Web Links				
•	https://nptel.ac.in/courses/112107238/			
•	https://nptel.ac.in/courses/110106046/			
•	https://nptel.ac.in/courses/110106045/			

D. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	1	1	1	–	–	–	–	–	–	3	–
CO2	2	1	1	1	–	–	–	–	–	–	3	–
CO3	2	2	2	1	–	–	–	–	–	–	3	–
CO4	3	2	2	1	–	–	–	–	–	–	3	–
CO5	3	1	1	1	–	–	–	–	–	–	3	–

E. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	3	–	3
CO 2	3	–	3
CO 3	3	–	3
CO 4	3	–	3
CO 5	3	–	3

Code: MULEBX2109	Soft Skills-II	1 Credit [LTP: 0-0-2]

COURSE OUTCOME

The student would be able:

CO1 To present themselves in an effective manner and know about their short-term and long-term goals.

CO2 To work in a team by managing time properly and focus on personal grooming, etiquettes and body language.

CO3 To demonstrate their abilities by improving skills of LSRW (Listening /Speaking/Reading/Writing).

CO4 To present different viewpoints or ways of thinking about a situation , expand their abilities to resolve situations and get experience within the given context

CO5 To enhance their employability skills by working on the presentation of Résumé and giving impactful performance during Group Discussion

A. DETAILED SYLLABUS

Unit	Unit Details
1.	Interpersonal Skills/ Applying Others Developing interpersonal relationship- Team building-group dynamics-Networking Improved work relationship
2.	Corporate Skills / Working with Others Developing body language-Practicing etiquette and mannerism Time management Stress management
3.	Attitude Planning & Prioritizing, Emotional Intelligence: Managing Emotions
4.	Motivation Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.
5.	Selling Self / Job Hunting Writing resume/cv-interview skills - Group discussion- Mock interview / Mock GD – Goal setting - Career planning

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Developing the leader within you	John c Maxwell
2.	Good to Great	Arthur Jim Collins
3.	The seven habits of highly effective people	Stephen Covey
4.	Emotional Intelligence	Daniel Goleman
5.	You can win	Shive Khera
6.	Principle centered leadership	Stephen Covey

C. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	–	–	–	–	–	–	–	1	–	3	–	2
CO 2	–	–	–	–	–	–	–	1	–	3	–	2
CO 3	–	–	–	–	–	–	–	2	–	3	–	1
CO 4	–	–	–	–	–	–	–	2	–	3	–	1
CO 5	–	–	–	–	–	–	–	1	–	3	–	2

D. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	1	–	–
CO 2	2	–	–
CO 3	1	–	–
CO 4	2	–	–
CO 5	1	–	–

Code: MPDCME2401	SEMINAR-II	1 Credit [LTP: 0-0-2]

A. DETAILED SYLLABUS

Unit	Contents
	Students grouped in two to three during Semester I, will now continue to download further the research papers in the area, analyze, allocate individually, the set of papers, **Literature survey** Overview – What is literature survey, Functions of literature survey, maintaining a notebook, developing a Bibliography Methods of data collection – Observation, survey, contact methods, experimental, determining sample design Searching for publications – Publication databases, search engines and patent databases, Find some/all of the references for a given paper, including those that are not on the web Online tools – google, CiteSeer, ACM Digital Library, IEEE, The on-line Computer Science bibliography, Survey papers, Finding material not on the web, Searching patents **Publishing a paper** How to write scientific paper Structure of a conference and journal paper, how (and How Not) to write a Good Systems Paper: Abstract writing, chapter writing, discussion, conclusion, references, bibliography, and In-class discussion of technical writing examples, Poster papers, review papers, how to organize thesis Project report, How to write a research proposal? How research is funded? Research ethics – Legal issues, copyright, and plagiarism General advice about writing technical papers in English Tips for writing correct English Practice sessions on above will be conducted. Students will have to deliver seminar, prepare a report and a review paper based on analysis individually.

B. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	–	–	–	–	1	–	2	3	1	–	2
CO 2	2	–	–	–	–	2	–	2	3	1	–	2
CO 3	2	–	–	–	–	1	–	2	3	1	–	2
CO 4	1	–	–	–	–	2	–	2	3	1	–	2
CO 5	1	–	–	–	–	1	–	2	3	1	–	2

C. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	2	–
CO 2	–	2	–
CO 3	–	2	–
CO 4	–	2	–
CO 5	–	2	–

THIRD SEMESTER
CORE THEORY SUBJECTS

MPDCME3404	DISSERTATION PART I	6 Credits [LTP: 0-0-12]

A. DETAILED SYLLABUS

Unit	Content
	• Dissertation Part I consist of Finalization of thesis title based on literature review carried out during Semester I and II • Objective finalization & presentation • Design & experimentation details • Experimentation work (partial) • Part I thesis preparation • Presentation and submission of research prepare based on experimentation carried out.

B. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	–	–	–	–	2	–	2	3	1	–	2
CO 2	2	–	–	–	–	2	–	2	3	1	–	2
CO 3	2	–	–	–	–	1	–	2	3	1	–	2
CO 4	2	–	–	–	–	2	–	2	3	1	–	2
CO 5	2	–	–	–	–	1	–	2	3	1	–	2

C. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	2	3
CO 2	–	2	3
CO 3	–	2	3
CO 4	–	2	3
CO 5	–	2	3

FOURTH SEMESTER

MPDCME4401	DISSERTATION PART II	20 Credits [LTP: 0-0-30]

A. DETAILED SYLLABU

Unit	Content
	• Dissertation Part II consist of Finalization of thesis title based on literature review carried out duringSemester I and II • Objective finalization & presentation • Design & experimentation details • Experimentation work (partial) • Part II thesis preparation • Presentation and submission of research prepare based on experimentation carried out.

B. CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	–	–	–	–	2	–	2	3	1	–	2
CO 2	2	–	–	–	–	2	–	2	3	1	–	2
CO 3	2	–	–	–	–	1	–	2	3	1	–	2
CO 4	2	–	–	–	–	2	–	2	3	1	–	2
CO 5	2	–	–	–	–	1	–	2	3	1	–	2

C. CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO 1	–	2	3
CO 2	–	2	3
CO 3	–	2	3
CO 4	–	2	3
CO 5	–	2	3