

GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Coimbatore – 641 013

Curriculum and Syllabi For B.E. PRODUCTION ENGINEERING (Full Time)



OFFICE OF THE CONTROLLER OF EXAMINATIONS GOVERNMENT COLLEGE OF TECHNOLOGY, THADAGAM ROAD, COIMBATORE-641 013

VISION AND MISSION OF THE INSTITUTION

VISION

To emerge as a centre of excellence and eminence by imparting futuristic technical education in keeping with global standards, making our students technologically competent and ethically strong so that they can readily contribute to the rapid advancement of society and mankind.

MISSION

- To achieve academic excellence through innovative teaching and learning practices.
- To enhance employability and entrepreneurship.
- To improve the research competence to address societal needs.
- To inculcate a culture that supports and reinforces ethical and professional behaviors for a harmonious and prosperous society.



VISION AND MISSION OF THE DEPARTMENT

VISION

To be recognized globally for outstanding education, industrial orientation and research leading to grooming competitive engineers, who are innovative, entrepreneurial and successful in advanced fields of engineering and research.

MISSION

- To educate, motivate and prepare the students to know the fundamental and technical skills in Production Engineering through effective teaching learning Methodologies.
- To impart the employability and entrepreneurship skills to the students by industry institute interactions.
- To encourage students to undertake research and development activities for the societal needs with high ethical standards.
- To imbibe communication skills, professional and ethical standards in the minds of the young engineers by continuous learning and professional activities.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Analyze, evaluate, improve and design engineered systems and processes using modern engineering tools and approaches and demonstrate in-depth knowledge of state of art in production engineering practices and problem-solving processes.

PEO 2: Communicate effectively across disciplines and cultures, possess team work skills, management and leadership skills, entrepreneurship abilities and work effectively in diverse environments.

PEO 3: Have professional and ethical attitude, multidisciplinary approach to solve problems, creativity to innovate systems and processes with consideration for societal, ethical and environmental factors and display motivation for life- long learning.



PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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

2. 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.

3. 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.

4. 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.

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

6. 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.

7. 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.

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

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

10. 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.

11. 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.

12. 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: Ability to design manufacturing processes, products, the equipment, tooling and necessary environment for the manufacture of products that meet specific material and other requirements.

PSO 2: Ability to use design, manufacturing and industrial engineering software packages to formulate and solve real time issues.

PSO 3: Ability to analyze, synthesis and control manufacturing operations using statistical methods and to create competitive advantage through the application of manufacturing planning, strategy, quality and control concepts.



GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013 B.E.PRODUCTION ENGINEERING CBCS 2018 REGULATIONS

FIRST SEMESTER

Sl. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks
		Induction Programme	MC	0	0	0
Deta	ils of the Progra	amme:				
Num	ber of Days: 2	1 Days				
Day(): College Adm	ission				
Day	: Orientation P	rogramme				
Day2	2: Registration.	Contraction and				
Day	8 to Day 23 : Inc	duction Programme				
Acti Phys Plays Yoga Liter Tean Lect Fami Bran Moti Taler Quiz Visit	vities: ical activity, ground Events, a Practices, ary, Proficiency n Building, ures by Eminem liarization to de nch oriented info vational speake nt exposure, completion, to local areas	v modules, t people, epartment, ormation, rs, etc.				

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013 B.E.PRODUCTION ENGINEERING CBCS 2018 REGULATIONS

SI	Course			CA	End	Total	He	our	s/we	ek
No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С
		THEORY								
1	18PBS101	Engineering Chemistry	BS	50	50	100	3	1	0	4
2	18PBS102	Calculus and Linear Algebra	BS	50	50	100	3	1	0	4
3	18PES103	Basics of Electrical Engineering	ES	50	50	100	3	0	0	3
		PRACTICAL								
4	18PBS104	Chemistry Laboratory	BS	50	50	100	0	0	3	1.5
5	18PES105	Basics of Electrical Engineering Laboratory	ES	50	50	100	0	0	3	1.5
6	18PES106	Engineering Graphics	ES	50	50	100	2	0	4	4
		TOTAL		300	300	600	11	2	10	18

FIRST SEMESTER

SECOND SEMESTER

SI	Course			CA	End	Total	He	ours	/we	ek
No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С
		THEORY								
1	18PHS201	Communicative English	HS	50	50	100	2	1	0	3
2	18PBS202	Differential Equations and Complex Variables	BS	50	50	100	3	1	0	4
3	18PBS203	Introduction to Electromagnetism and Applied Physics	BS	50	50	100	3	1	0	4
4	18PES204	Python Programming	ES	50	50	100	3	0	0	3
		PRACTICAL								
5	18PBS205	Physics Laboratory	BS	50	50	100	0	0	3	1.5
6	18PES206	Workshop Practice	ES	50	50	100	1	0	4	3
7	18PES207	Python Programming Laboratory	ES	50	50	100	0	0	3	1.5
		TOTAL		350	350	700	12	3	10	20

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE - 641 013

B.E.PRODUCTION ENGINEERING

CBCS 2018 REGULATIONS

THIRD SEMESTER

SI	Course			CA	End	Total	H	[our	s/we	ek
No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С
		THEORY								
1	18PHS301	Business Communication Skills	HS	50	50	100	3	0	0	3
2	18PBS302	Partial Differential Equations, Probability and Statistics	BS	50	50	100	3	1	0	4
3	18PES303	ENGINEERING MECHANICS	ES	50	50	100	3	1	0	4
4	18PES304	Thermal Sciences	ES	50	50	100	3	1	0	4
5	18PPC305	Engineering Metallurgy	PC	50	50	100	3	0	0	3
6	18PPC306	Manufacturing Technology	PC	50	50	100	3	0	0	3
7	18PMC3Z7	Constitution of India	MC	50	50	100	3	0	0	0
		PRACTICAL		~						
8	18PPC308	Metallurgy Laboratory and Thermal Science Laboratory	PC	50	50	100	0	0	3	1.5
9	18PPC309	Manufacturing Processes Laboratory	PC	50	50	100	0	0	3	1.5
		TOTAL	$\langle \rangle$	450	450	900	21	3	6	24

FOURTH SEMESTER

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SI.	Course		2010	CA	End	Total	H	our	s/we	eek
No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С
		THEORY								
1	18 DHS /01	Total Quality Management	цс	50	50	100	3	0	0	3
1	101113401	Concepts	115	50	50	100	5	0	0	5
2	18PBS402	Waves and Optics	BS	50	50	100	3	0	0	3
3	18PES403	Basic Electronics Engineering	ES	50	50	100	3	0	0	3
4	18PPC404	Fluid Mechanics and Machinery	PC	50	50	100	3	0	0	3
5	18PPC405	Mechanics of Materials	PC	50	50	100	3	0	0	3
6	18PPC406	Machine Tools and Processes	PC	50	50	100	3	0	0	3
7	18PMC/77	Environmental Sciences and	MC	50	50	100	3	0	0	0
/	101 1/10427	Engineering	WIC	50	50	100	5	0	0	0
		PRACTICAL								
8	18PPC/08	Strength of Materials and Fluid	PC	50	50	100	0	0	3	15
0	1011 C400	Machinery Laboratory	IC	50	50	100	0	0	5	1.5
9	18PPC409	Production Drawing	PC	50	50	100	0	0	3	1.5
		TOTAL		450	450	900	21	0	6	21

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SI	Course		CAT	CA	End	Total	H	loui	·s/w	eek
No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С
		THEORY								
1	1804501	Operations Research	цс	50	50	100	3	1	Δ	4
1	10110201	Techniques	пз	50	30	100	3	1	U	4
2	18000502	Production Planning and	DC	50	50	100	3	Δ	Δ	3
2	10110.302	Control	гС	50	50	100	5	0	U	3
3	18PPC503	Mechanics of Machines	PC	50	50	100	3	0	0	3
4	18PPC504	Metrology and Computer	PC	50	50	100	3	Δ	Ο	3
4	1011 0.004	Aided Inspection	The second	50	50	100	5	0	U	5
5	18PPE5XX	Professional Elective I	PE	50	50	100	3	0	0	3
6	18#OE5XX	Open Elective I	OE	50	50	100	3	0	0	3
		PRACTICAL		-						
7	18PPC507	Metrology Laboratory	PC	50	50	100	0	0	3	1.5
		Skill Development on								
8	18PEE508	Industrial Practices /	EEC	50	50	100	0	0	4	2
		Technical Projects		11						
		TOTAL		400	400	800	18	1	7	22.5

FIFTH SEMESTER

SIXTH SEMESTER

SI	Course		55 - 15	CA	End	Total	H	our	s/we	ek
No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С
		THEORY								
1	18PPC601	Machine Elements Design	PC	50	50	100	3	1	0	4
2	18PPC602	Automation and CIM	PC	50	50	100	3	0	0	3
3	18PPC603	Fluid Power Drives and Controls	PC	50	50	100	3	0	0	3
4	18PPE6XX	Professional Elective II	PE	50	50	100	3	0	0	3
5	18#OE6XX	Open Elective II	OE	50	50	100	3	0	0	3
6	18#OE6XX	Open Elective III	OE	50	50	100	3	0	0	3
		PRACTICAL								
7	18PPC607	Modelling Laboratory	PC	50	50	100	0	0	3	1.5
8	18PEE608	Automation and Control Systems Laboratory	EEC	50	50	100	0	0	3	1.5
		TOTAL		400	400	800	18	1	6	22

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013 B.E.PRODUCTION ENGINEERING CBCS 2018 REGULATIONS

SEVENTH SEMESTER

SI	Course			CA	End	Total	H	Iour	·s/wee	ek
No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С
		THEORY								
1	18PPC701	Additive Manufacturing	PC	50	50	100	3	0	0	3
2	18PPC702	Production of Automotive Components	PC	50	50	100	3	0	0	3
3	18PPC703	Jigs, Fixtures and Press Tools	PC	50	50	100	3	0	0	3
4	18PPE7XX	Professional Elective III	PE	50	50	100	3	0	0	3
5	18PPE7XX	Professional Elective IV	PE	50	50	100	3	0	0	3
6	18#OE7XX	Open Elective IV	OE	50	50	100	3	0	0	3
		PRACTICAL	500 811 110	う						
7	18PPC707	Simulation Laboratory	PC	50	50	100	0	0	3	1.5
8	18PEE708	Mini Project	EEC	50	50	100	0	0	8	4
		TOTAL	1	400	400	800	18	0	11	23.5

EIGHTH SEMESTER

SI	Course	urse Course title	S	CA	End	Total	I	Iou	rs/we	ek
No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С
		THEORY		5						
1	18PPE8XX	Professional Elective V	PE	50	50	100	3	0	0	3
2	18PPE8XX	Professional Elective VI	PE	50	50	100	3	0	0	3
		PRACTICAL								
3	18PEE803	Project Work	EEC	50	50	100	0	0	16	8
		TOTAL		150	150	300	6	0	16	14

SI.	Course	Course Course title		CA	End	Total	H	Hours/week					
No.	Code	Course title	CAT	CA Marks	sem marks	marks	L	Т	Р	С			
1	18PHS201	Communicative English	HS	50	50	100	2	1	0	3			
2	18PHS301	Business Communication Skill	HS	50	50	100	3	0	0	3			
3	18PHS401	Total Quality Management Concepts	HS	50	50	100	3	0	0	3			
4	18PHS501	Operations Research Techniques	HS	50	50	100	3	1	0	4			

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (HS)

BASIC SCIENCES (BS)

SI	Course			CA	End	Total	Η	ours	s/we	ek
No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С
1	18PBS101	Engineering Chemistry	BS	50	50	100	3	1	0	4
2	18PBS102	Calculus and Linear Algebra	BS	50	50	100	3	1	0	4
3	18PBS104	Chemistry Laboratory	BS	50	50	100	0	0	3	1.5
4	18PBS202	Differential Equations and Complex Variables	BS	50	50	100	3	1	0	4
5	18PBS203	Introduction to Electromagnetism and Applied Physics	BS	50	50	100	3	1	0	4
6	18PBS205	Physics Laboratory	BS	50	50	100	0	0	3	1.5
7	18PBS302	Partial Differential Equations, Probability and Statistics	BS	50	50	100	3	1	0	4
8	18PBS402	Waves and Optics	BS	50	50	100	3	0	0	3
			6022	icuo)						

ENGINEERING SCIENCES (ES)

CI	Course	Course Course title			End	Tatal	Hours/week						
51. No.	Code	Course title	CAT	CA Marks	sem marks	marks	L	Т	Р	С			
1	18PES103	Basics of Electrical Engineering	ES	50	50	100	3	0	0	3			
2	18PES105	Basics of Electrical Engineering laboratory	ES	50	50	100	0	0	3	1.5			
3	18PES106	Engineering Graphics	ES	50	50	100	2	0	4	4			
4	18PES204	Python Programming	ES	50	50	100	3	0	0	3			
5	18PES206	Workshop Practice	ES	50	50	100	1	0	4	3			
6	18PES207	Python Programming Laboratory	ES	50	50	100	0	0	3	1.5			
7	18PES303	Engineering Mechanics	ES	50	50	100	3	1	0	4			
8	18PES304	Thermal Sciences	ES	50	50	100	3	1	0	4			
9	18PES403	Basic Electronics Engineering	ES	50	50	100	3	0	0	3			

PROFESSIONAL CORE (PC)

SI.	Course	Correct 441-		СА	End	Total	ł	Iour	s/we	ek
No.	Code	Course title	CAT	Marks	sem	marks	L	Т	Р	С
					marks					
1	18PPC305	Engineering Metallurgy	PC	50	50	100	3	0	0	3
2	18PPC306	Manufacturing Technology	PC	50	50	100	3	0	0	3
3	18PPC308	Metallurgy Laboratory and Thermal Science Laboratory	PC	50	50	100	0	0	3	1.5
4	18PPC309	Manufacturing Processes Laboratory	PC	50	50	100	0	0	3	1.5
5	18PPC404	Fluid Mechanics and Machinery	PC	50	50	100	3	0	0	3
6	18PPC405	Mechanics of Materials	PC	50	50	100	3	0	0	3
7	18PPC406	Machine Tools and Processes	PC	50	50	100	3	0	0	3
8	18PPC408	Strength of Materials and Fluid Machinery Laboratory	PC	50	50	100	0	0	3	1.5
9	18PPC409	Production Drawing	PC	50	50	100	0	0	3	1.5
10	18PPC502	Production Planning and Control	PC	50	50	100	3	0	0	3
11	18PPC503	Mechanics of Machines	PC	50	50	100	3	0	0	3
12	18PPC504	Metrology and Computer Aided Inspection	PC	50	50	100	3	0	0	3
13	18PPC507	Metrology Laboratory	PC	50	50	100	0	0	3	1.5
14	18PPC601	Machine Elements Design	PC	50	50	100	3	1	0	4
15	18PPC602	Automation and CIM	PC	50	50	100	3	0	0	3
16	18PPC603	Fluid Power Drives and Controls	PC	50	50	100	3	0	0	3
17	18PPC607	Modelling Laboratory	PC	50	50	100	0	0	3	1.5
18	18PPC701	Additive Manufacturing	PC	50	50	100	3	0	0	3
19	18PPC702	Production of Automotive Components	PC	50	50	100	3	0	0	3
20	18PPC703	Jigs, Fixtures and Press Tools	PC	50	50	100	3	0	0	3
21	18PPC707	Simulation Laboratory	PC	50	50	100	0	0	3	1.5

Sl. Course				CA	End	Total	Η	ours	s/we	ek
No.	Code	Course title	САТ	Marks	sem	marks	L	т	Р	С
1100	coue		0.111	iviui iss	marks	marks	Ľ			Ŭ
1	18PPE\$01	Mechatronic Systems	PE	50	50	100	3	0	0	3
2	18PPE\$02	Finite Element Techniques	PE	50	50	100	3	0	0	3
3	18PPE\$03	Unconventional Manufacturing Processes	PE	50	50	100	3	0	0	3
4	18PPE\$04	CNC Technology	PE	50	50	100	3	0	0	3
5	18PPE\$05	Power Plant Engineering	PE	50	50	100	3	0	0	3
6	18PPE\$06	Robust Design	PE	50	50	100	3	0	0	3
7	18PPE\$07	Statistical Quality Control and Reliability Engineering	PE	50	50	100	3	0	0	3
8	18PPE\$08	Advanced Welding Technology	PE	50	50	100	3	0	0	3
9	18PPE\$09	Product Design and Process Engineering	PE	50	50	100	3	0	0	3
10	18PPE\$10	Design for Manufacture and Assembly	PE	50	50	100	3	0	0	3
11	18PPE\$11	Human Values and Professional Ethics II	PE	50	50	100	3	0	0	3
12	18PPE\$12	Plant Layout and Material Handling	PE	50	50	100	3	0	0	3
13	18PPE\$13	Non Destructive Testing Techniques	PE	50	50	100	3	0	0	3
14	18PPE\$14	Supply Chain Management	PE	50	50	100	3	0	0	3
15	18PPE\$15	Production Management	PE	50	50	100	3	0	0	3
16	18PPE\$16	Lean Manufacturing	PE	50	50	100	3	0	0	3
17	18PPE\$17	Micro manufacturing Processes	PE	50	50	100	3	0	0	3
18	18PPE\$18	Theory of Metal Cutting	PE	50	50	100	3	0	0	3
19	18PPE\$19	Advanced Casting Technology	PE	50	50	100	3	0	0	3
20	18PPE\$20	Total Productive Maintenance	PE	50	50	100	3	0	0	3
21	18PPE\$21	Green Manufacturing	PE	50	50	100	3	0	0	3
22	18PPE\$22	Computer Aided Design	PE	50	50	100	3	0	0	3
23	18PPE\$23	Robotics and Machine Vision System	PE	50	50	100	3	0	0	3
24	18PPE\$24	Investment Casting	PE	50	50	100	3	0	0	3
25	18PPE\$25	Electronics Manufacturing Technology	PE	50	50	100	3	0	0	3
26	18PPE\$26	Smart Manufacturing	PE	50	50	100	3	0	0	3

OPEN ELECTIVES (O.E)

Sl. Course			САТ	CA	End	Total	Ho	ours	s/W	eek
No.	Code	Course Title	CAT	Marks	Sem. Marks	Marks	L	Т	Р	С
1.	18COE\$01	Climate Change and Adaptation	OE	50	50	100	3	0	0	3
2.	18COE\$02	Disaster Management and Mitigation	OE	50	50	100	3	0	0	3
3.	18COE\$03	Energy Efficient Buildings	OE	50	50	100	3	0	0	3
4.	18MOE\$04	Nanotechnology and Surface Engineering	OE	50	50	100	3	0	0	3
5.	18MOE\$05	Mechatronics	OE	50	50	100	3	0	0	3
6.	18EOE\$07	Renewable Power Generation Systems	OE	50	50	100	3	0	0	3
7.	18EOE\$08	Electric Vehicles	OE	50	50	100	3	0	0	3
8.	18EOE\$09	Smart Grid Systems	OE	50	50	100	3	0	0	3
9.	18LOE\$10	Mobile Communication	OE	50	50	100	3	0	0	3
10.	18LOE\$11	Introduction to VLSI System Design	OE	50	50	100	3	0	0	3
11.	18LOE\$12	Microcontroller and Applications	OE	50	50	100	3	0	0	3
12.	18POE\$13	Rapid Prototyping	OE	50	50	100	3	0	0	3
13.	18POE\$14	Managerial Economics	OE	50	50	100	3	0	0	3
14.	18POE\$15	Hydraulics and Pneumatics	OE	50	50	100	3	0	0	3
15.	18NOE\$16	Measurement and Control	OE	50	50	100	3	0	0	3
16.	18NOE\$17	Industrial Automation	OE	50	50	100	3	0	0	3
17.	18NOE\$18	Virtual Instrumentation	OE	50	50	100	3	0	0	3
18.	18SOE\$19	Programming in Java	OE	50	50	100	3	0	0	3
19.	18SOE\$20	Cyber Security	OE	50	50	100	3	0	0	3
20.	18SOE\$21	Network Essentials	OE	50	50	100	3	0	0	3
21.	18IOE\$22	Programming in Python	OE	50	50	100	3	0	0	3
22.	18IOE\$23	Big Data Science	OE	50	50	100	3	0	0	3
23.	18IOE\$24	Object Oriented Programming Using C++	OE	50	50	100	3	0	0	3
24.	18BOE\$25	Computational Biology	OE	50	50	100	3	0	0	3
25.	18BOE\$26	Fundamental Concepts of Biology for Engineers	OE	50	50	100	3	0	0	3
26	18BOE\$27	Fundamentals of Bioengineering	OE	50	50	100	3	0	0	3

	PROJECT WORK												
C1	Course			CA	End	Total	I	Iou	rs/wee	ek			
51. No.	Code	Course title	CAT	Marks	sem marks	marks	L	Т	Р	С			
1	18PEE508	Skill Development on Industrial Practices / Technical Projects	EEC	50	50	100	0	0	4	2			
2	18PEE608	Automation and Control Systems Laboratory	EEC	50	50	100	0	0	3	1.5			
3	18PEE708	Mini Project	EEC	50	50	100	0	0	8	4			
4	18PEE803	Project Work	EEC	50	50	100	0	0	16	8			

EMPLOYABILITY ENHANCEMENT COURSES (EEC) – PRACTICAL COURSES AND PROJECT WORK

MANDATORY COURSES (MC)

SI	Common			CA	End	Total	Hours/week					
51. No.	Code	Course title	CAT	CA Marks	sem marks	marks	L	Т	Р	С		
1	18PMC3Z7	Constitution of India	MC	50	50	100	3	0	0	0		
2	18PMC4Z7	Environmental Sciences and Engineering	MC	50	50	100	3	0	0	0		
		Contransion (ALL DO DO	(v)								

VALUE ADDED COURSES (ONE CREDIT) (VA)

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SI	Course			CA	End	Total	H	lours	s/we	ek
No.	Code	Course title	САТ	Marks	sem marks	marks	L	Т	Р	С
1	18PVA\$01	Human Values I	VA	100	-	100	1	0	0	1
2	18PVA\$02	Human Values and Professional Ethics	VA	100	-	100	1	0	0	1
3	18PVA\$03	Yoga for Youth Empowerment	VA	100	-	100	1	0	0	1
4	18PVA\$04	Basics of Civil Engineering	VA	100	-	100	1	0	0	1
5	18PVA\$05	Metallography	VA	100	-	100	1	0	0	1
6	18PVA\$06	Design of Experiments using Taguchi Concept	VA	100	-	100	1	0	0	1
7	18PVA\$07	Entrepreneurship Development	VA	100	-	100	1	0	0	1
8	18PVA\$08	Patents System in Engineering	VA	100	-	100	1	0	0	1
9	18PVA\$09	Industrial case studies	VA	100	-	100	1	0	0	1
10	18PVA\$10	Project Management	VA	100	-	100	1	0	0	1
11	18PVA\$11	Industrial safety	VA	100	-	100	1	0	0	1
12	18PVA\$12	Six Sigma	VA	100	-	100	1	0	0	1
13	18PVA\$13	Professional Skills	VA	100	-	100	1	0	0	1
14	18PVA\$14	Solar Energy Systems	VA	100	-	100	1	0	0	1
15	18PVA\$15	Wind Energy Systems	VA	100	-	100	1	0	0	1
16	18PVA\$16	Refrigeration Systems	VA	100	-	100	1	0	0	1
17	18PVA\$17	Air Conditioning Systems	VA	100	-	100	1	0	0	1

CURRICULAM DESIGN FOR CBCS 2018 REGULATIONS

FULL TIME B.E PRODUCTION ENGINEERING (U.G)

SUMMARY

S.No	Category				Total Credits	% of Credits	AICTE Suggested Credits					
		Ι	II	III	IV	V	VI	VII	VIII			
1	HS		3	3	3	4				13	7.88	12
2	BS	9.5	9.5	4	3					26	15.76	25
3	ES	8.5	7.5	8	3					27	16.36	24
4	PC			9	12	10.5	11.5	10.5		53.5	32.42	48
5	PE					3	3	6	6	18	10.91	18
6	OE					3	6	3		12	7.27	18
7	EEC					2	1.5	4	8	15.5	9.39	15
8	MC	0		0	0	0	(a)			0	0	0
Т	otal	18	20	24	21	22.5	22	23.5	14	165	100	160
			•	•	A	The						•

HS	Humanities and Social Sciences including Management
BS	Basic Science
ES	Engineering Science
PC	Professional Core
PE	Professional Elective
OE	Open Elective
EEC	Employability Enhancement Courses
MC	Mandatory Course

18PBS101

SEMESTER I

Category : BS L T P C 3 1 0 4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* The course is aimed at imparting knowledge of Engineering Chemistry topics which would be useful for students to understand chemistry relevant to conventional engineering fields.

UNIT-I: WATER TEC	HNOLOGY		(9+3 Periods)						
Water- sources - types of	impurities, hardness - tem	porary and permanent – un	its - ppm and mg/L -						
estimation of hardness -	EDTA method- problems	s- Boiler troubles- internal	treatment - external						
treatment- lime soda proc	cess and ion exchange pr	cocess- Drinking water - cl	naracteristics- colour,						
odour, turbidity, chloride	- treatment - preliminary,	primary and disinfection m	ethods- chlorination-						
breakpoint chlorination, d	esalination – reverse osmo	SIS. Mark							
UNIT-II : SPECTROSC	COPIC TECHNIQUES A	ND APPLICATIONS	(9+3 Periods)						
Beer Lambert's law -UV	visible spectroscopy and	IR spectroscopy - princip	les – instrumentation						
(block diagram only)- flame photometry- principle - instrumentation (block diagram only)-									
estimation of sodium by flame photometry- Atomic absorption spectroscopy - principles -									
instrumentation(block diagram only) – estimation of nickel by atomic absorption spectroscopy.									
UNIT-III : FUELS AND COMBUSTION (9+3 Periods)									
Fuels- classifications - ca	lorific value - Gross and N	Net calorific value - combus	stion -theoretical air-						
principle and calculations - solid fuels - Coal-proximate and ultimate analysis- significance- Coke-									
characteristics- manufacture by Otto Hoffman method - Liquid fuels - petroleum fractionation -									
petrol and diesel - knock	king of ic engines and die	esel engines - octane and	cetane number- anti-						
knocking agents – Biogas	– biodiesel.								
UNIT-IV : ENGINEER	ING MATERIALS		(9+3 Periods)						
Refractories – classificati	on - properties and manufa	acture of silica and magnes	ia bricks; Abrasives-						
Classification, properties	- manufacture of SiC	-; Lubricants -solid lub	ricants (Graphite &						
Molybdenum sulphide) h	ydrodynamic mechanism o	of lubrication – Cement – 1	manufacture - setting						
and hardening of cement -	 special cements - Alumina 	a cement and waterproof cen	nent.						
UNIT-V: CORROSION	N		(9+3 Periods)						
Corrosion – Spontaneity -	Chemical corrosion- mech	anism, nature of oxides – P	illing Bedworth rule -						
Electrochemical corrosion- mechanism - Galvanic series and importance - Prevention methods -									
design of materials, cathodic protection techniques (sacrificial anode and impressed current									
cathode), Inhibitors - Protective coatings -Inorganic coating- electroplating - surface preparation and									
plating method applied to Cr and Ni and galvanizing – Organic coating - paints- constituents and									
functions.									
Contact periods:		1							
Lecture: 45 Periods	Tutorial:15 Periods	Practical: 0 Periods	Total: 60 Periods						

TEXT BOOKS:

- 1. Jain. P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publications Pvt. Ltd, New Delhi, 16th Edition, 2017.
- 2. Vairam.S, Subha Ramesh, "Engineering Chemistry", Wiley India, 2015.

REFERENCE BOOKS:

- 1. Dara. S.S, Umarae, "TEXT BOOKS of Engineering Chemistry", S. Chand Publications, 2004.
- 2. Agarwal, C.V. "Chemistry of Engineering Materials", 9th Edition, B.S. Publications, 2006.
- 3. Kuriakose, J.C., and Rajaram J, **"Chemistry in Engineering and Technology",** vol.1 & II, Tata Mc Graw Hill Publishing company Pvt.Ltd, New Delhi, 2001
- 4. Y R Sharma, "Elementary Organic Spectroscopy", S. Chand Publications, 2013.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- **CO1:** Understand the nature of impurities and the effects of various sources of water, and apply them in treatment them usable for industrial and domestic purposes.
- **CO2:** Know about the different types of polymeric materials, properties and fabrication which match the specific applications.
- **CO3:** Learn the different types of fuels with their compositions, combustion characteristics In engines and apply them in design of combustion chambers.
- **CO4:** Be familiar with the various engineering materials, refractories, abrasives, lubricants and cements with their properties and manufacturing methods which are used in engineering applications.
- **CO5:** Gain the knowledge about corrosion of the machinery they use in their fields and, also to understand the mechanisms and to adopt the preventive measures by various techniques.

P0/C0	P0 1	PO 2	PO 3	PO 4	РО 5	PO 6	PO 7	РО 8	РО 9	P0 10	P0 11	PO 12	PS0 1	PSO 2	PSO 3
C01	L	М	L	L	М	М	-	-	L						
CO2	L					/	e)	1	8						
CO3	Н	М	L	L	L	1	- U	N.	N.	§		М			
CO4	М	L	L	М	$\mathbf{\Gamma}_{-}$	100	3	E.	10.000	(°	L		Н		L
CO5	L	L		Н	L	94	444		DL.			L	М		L
18PBS101	М	М	L	М	L	L)		L		L	L	L		L

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate (Medium), H-High

Category: BS L T P C 3 1 0 4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To be familiar with differentiation of single variable and its applications.
- * To obtain the knowledge of definite and improper integration and applications.
- * To acquire knowledge of differentiation for more than one variable and vector differentiation.
- * To gain the knowledge of multiple integration and related applications and vector integration including theorems.
- * To know about matrix theory used to solve linear system and diagonalise a matrix by transformation.

UNIT-I: DIFFERENTIAL CALCULUS	(9+3 Periods)									
Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems, indeter	minate forms and									
L'Hospital's rule, Maxima and minima, Evolute of a curve.										
UNIT-II: INTEGRAL CALCULUS	(9+3 Periods)									
Evaluation of definite and improper integrals; Beta and Gamma functions and their properties,										
Applications of definite integrals to evaluate surface areas and volume of revolution.										
UNIT-III: MULTIVARIABLE CALCULUS (DIFFERENTIATION)(9+3 Periods)										
Limit, continuity and partial derivatives, total derivative, Jacobians, Maxima, minima and saddle										
points, Method of Lagrange multipliers, Gradient, curl and divergence.										
UNIT-IV: MULTIVARIABLE CALCULUS (INTEGRATION) (9+3 Periods)										
Multiple integration - Double integrals, change of order of integration in double int	egrals, Change of									
variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (C	artesian), Change									
of variables (Cartesian to spherical polar). Theorems of Green, Gauss and	Stokes, Simple									
applications involving cubes, sphere and rectangular parallelepipeds.										
UNIT-V: MATRICES	(9+3 Periods)									
Inverse and rank of a matrix, System of linear equations, Eigenvalues a	nd eigenvectors,									
Diagonalization of matrices, Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to										
canonical forms.										
Contact periods:										
Lecture: 45 PeriodsTutorial: 15 PeriodsPractical: 0 PeriodsTo	otal: 60 Periods									

TEXT BOOKS:

- 1. Veerarajan T., Engineering Mathematics (for first year), Tata McGraw-Hill, New Delhi, 2008.
- 2. Srimanta Pal and suboth.C.Bhunia, Engineering Mathematics, Oxford university publications, New Delhi, 2015.

REFERENCE BOOKS:

- 1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rdEdition,2015.
- 2. Erwinkreyszig, Advanced Engineering Mathematics,9thEdition, John Wiley & Sons, 2006.

- Sivaramakrishnadas.P, Rukmangadachari.E, Engineering Mathematics, Pearson, Chennai & Delhi, 2nd Edition, 2013.
- 4. James Stewart, Essential Calculus, Cengage Learning, Delhi, 2ndEdition, 2013.
- 5. Howard Anton, IRL Bivens, Stephen Davis, Calculus, Wiley, New Delhi, 10thEdition, 2013.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- **CO1:** Understand the standard theorems and applications like maxima and minima, evolute of a curve using principles of differentiation.
- **CO2:** Acquire fluency in integration of one variable for definite and improper integrals like beta and gamma functions and also applications of area and volumes.
- CO3: Understand the techniques of partial differentiation and vector differentiation.
- **CO4:** Understand multiple integration for finding area, surface and volume and applications to Green's, Stoke's and Gauss theorems on Vector Calculus.
- **CO5:** Solve the linear system of equations by rank of a matrix and matrix inversion and understand the process of diagonalisation by orthogonal transformation.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Н	L	L	-	- 0		-	1		-	-	М	L	-	-
CO2	Н	L	L	-	-	-				-	-	М	L	-	-
CO3	Н	L	L	-	-	//-			-	-	-	М	L	-	-
CO4	Н	L	L	-	-	1 -			-	-	-	М	L	-	-
CO5	Н	L	L	-			Mr.	1		-	-	М	L	-	-
18PBS102	Н	L	L	-				and a	2440	S: _	-	М	L	-	-

COURSE ARTICULATION MATRIX

L – Low, M – Moderate (Medium), H- High

			L T P C 3 0 0 3
RE-REOUISITES: NII	-		
OURSE OBJECTIVES	S:		
* To understand and	d analyze basic electric cire	cuits	
* To Study the wor	king principles of Electrica	al Machines and Transform	ners
* To Study the wor	king principles of power co	onverters and Drives	
UNIT-I: DC CIRCU	ITS		(9 Periods)
Electrical Circuit Eleme	ents – Voltage and Current	Sources– Source transform	nation techniques –
Ohms law, Kirchhoff's	laws – Analysis of simple of	circuits with DC excitation	– Superposition,
Thevenin and Norton's	theorem. Star and Delta tra	ansformation. Time domai	n analysis of first
order RL and RC Circu	its.		, ,
UNIT-II : AC CIRCU	ITS		(9 Periods)
Representation of Sinu	isoidal waveforms, peak,	rms and average value.	Real power, reactive
power, apparent power C, RL, RC, RLC com phenomenon). Three	and power factor. Analyst binations (Series and Para phase circuits – relation	is of single phase AC circulated allel) – Resonance in series between voltage and current series and current	uits consisting of R,L, ies Circuits (Study of rent in star and delta
connections – Three ph	ase balanced circuits.	ALL	
UNIT-III : DC MACH	IINES AND TRANSFOR	MERS	(9 Periods)
Characteristics of motor transformer – Equivaler Regulation and Efficien transformers – Applicat	rs – Applications - Magnet nt circuit – Types of Losses ncy – Auto transformer – T tions.	ic materials – BH characte s in a transformer – No Lo hree phase transformer con	ristics – Single phase ad test and Load test – nnections – Uses of
UNIT-IV: ELECTRIC	CAL MACHINES		(9 Periods)
Construction and Princi	ple of operation of Three r	ohase induction motor – To	orque slip
characteristics - Starting	g and speed control metho	ds – Loss components and	efficiency.
Construction and worki	ng of Single phase induction	on motor – Construction an	nd Working of
Synchronous generators	s and types — Applications	s of all machines.	
UNIT-V: POWER CO	ONVERTERS AND DRI	VES	(9 Periods)
Operation of three phone	e Converter and Inverter ci	ircuits – Working of Chop	per and duty ratio
Operation of three phas			
control – Chopper contr	rol of separately excited De	C motor – Stator voltage c	control of three phase
control – Chopper contr induction motor drives	rol of separately excited Do – Rotor resistance control of	C motor – Stator voltage c of three phase induction m	control of three phase otor – Closed loop
control – Chopper contri induction motor drives - control of slip power re-	rol of separately excited D – Rotor resistance control o covery scheme.	C motor – Stator voltage c of three phase induction m	control of three phase otor – Closed loop
control – Chopper contri induction motor drives – control of slip power re- Contact periods:	rol of separately excited De – Rotor resistance control of covery scheme.	C motor – Stator voltage c of three phase induction m	control of three phase otor – Closed loop

BASICS OF ELECTRICAL ENGINEERING

(Common to MECH & PRODN Branches)

SEMESTER I

Category : ES

TEXT BOOKS:

18PES103

- 1. D.P.Kothari, I.J.Nagrath,, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
- 2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
- 3. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
- 4. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989 **REFERENCE BOOKS:**
 - 1. Nagsarkar T K and Sukhija M S, "Basic Electrical Engineering", Oxford Press (2005).
 - 2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
 - 3. E.Hughes, "Electrical and Electronics Technology", Pearson, 2010.

4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum Outline Series, McGraw Hill, Sixth edition (2014).

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- **CO1:** Verify Ohm's law and Kirchoff's laws for simple electrical circuits.
- **CO2:** Verify Simple network theorems for electrical circuits.
- **CO3:** Solve problems on AC circuits and analyze three phase AC circuits.
- **CO4:** Understand the performance of DC machines and transformers.
- **CO5:** Basic understanding of power electronic circuits and their application in speed control of AC and DC machines.

										r	r	r		r	n
PO/CO	PO	PO	PO	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	1	2	3												
CO1	Η	Η	Μ	Μ	-	L	-	-	-	-	-	-	L	Μ	-
							117.11	Contraction of the							
CO2	Н	Η	Μ	Μ		L	æ	m B	-		-	-	L	Μ	-
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CO3	Η	Η	Μ	Μ	-	\mathbf{L}_{2}	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	10000	のく	0 -	-	-	L	Μ	-
						1º	Land and		2						
CO4	Μ	Μ	Η	Η		M	-	-		S -	-	-	L	Μ	- 1
									T 1/	· · · ·					
CO5	Н	Н	L	Μ	-	L	-	 - Ø 	- //	-	-	-	L	М	-
000													_		
18PES103	Н	Н	Μ	М	-	L	12	VAN V	- 11	-	-	-	L	М	-
						11	AB		11						
							II VIE/	1111228/1008							

COURSE ARTICULATION MATRIX:

L-Low. M-Moderate, H-High



18PBS104

CHEMISTRY LABORATORY (Common to All Branches)

SEMESTER I

Category : BS

PRE-REQUISITES: NIL

L	Т	Р	С
0	0	3	1.5

COURSE OBJECTIVES:

To inculcate practical applications of chemistry to students and make him apply in the fields of engineering and technology.

LIST OF EXPERIMENTS Estimation of hardness by EDTA method. 1. 2 Estimation of chloride by Argentometric method. Conductometric titration of mixture of strong acid and weak acid using strong base. 3. Potentiometric titration of ferrous iron by dichromate. 4. 5. Determination of Saponification value of an oil. Estimation of Iron by Spectrophotometry. 6.

- 7. Estimation of HCl by pH titration.
- Determination of the rate constant of reaction. 8.
- Estimation of Dissolved Oxygen. 9

Contact periods:

Lecture: 0Periods **Tutorial: 0Periods** Practical: 45 Periods Total: 45 Periods **REFERENCE BOOKS:**

- 1. A.O. Thomas, "Practical Chemistry", Scientific Book Centre, Cannanore, 2003. 2. Vogel's "TEXT BOOKS of Quantitative Analysis", Jeffery G H, Basset J. Menthom J,
- Denney R.C., 6th Edition, EBS, 2009.

COURSE OUTCOMES:

Upon the completion of the course, the student will be able to

- **CO1:** Understand the nature of hardness using EDTA Complex
- **CO2** : Iron present in water can be estimated and chloride level, pollution level using

dissolved oxygen content.

- **CO3:** Apply the EMF and conductometric measurements in quantitative analysis of Substances.
- **CO4:** pH of the liquid sample will be analysed and hence strength of the sample can be estimated using pH Meter

P0/C0	РО 1	РО 2	РО 3	P0 4	РО 5	РО 6	РО 7	РО 8	РО 9	P0 10	P0 11	P0 12	PSO 1	PSO 2	PSO 3
C01	L	L	М			L						М	L		М
CO2	L	Н		L											
CO3	М	L		М											L
C04	L	М		L	L								L		
18PBS104	L	М	L	L	L	L						L	L		L

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate (Medium), H-High

Т Р

0 0

L

Category : ES

С

3 1.5

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To familiarize with basic electrical wiring and measurements.
- * To provide basic laboratory experience on electronic circuits, DC machines, AC machines and transformer.
- * To demonstrate internal cut-section views of machines and other advanced measurements devices.

LIST (OF EXPERIMEN	TS		
1.	Introductions to a	measuring instruments –	voltmeter, ammeter, wattme	ter, multimeter and
	Digital Storage C	Oscilloscope.		
2.	Resonance in RL	C circuits, verification of	f laws in electrical circuits.	
3.	Measurement of	phase difference betwee	n voltage and current	
4.	No load test on s	ingle phase transformer	and equivalent test	
5.	Load Test on sin	gle phase transformer		
6.	Three phase trans	sformer connections	my 2	
7.	Voltage - Curren	t relations in three phase	circuit and three phase powe	er measurement
8.	Demonstration of	f cut out section of mach	ines et al.	
9.	Swinburne's Tes	t, Speed Control and Loa	ad test on DC motor	
10.	Direction change	and load test on three p	hase induction motor	
11.	Alternator load to	est and regulation test	//	
12.	Demonstration of	f LT switchgear compon	ents	
13.	Demonstration of	f AC and DC drives 🥏		
Contac	t periods:	8		
Lectur	e: 0Periods	Tutorial: 0Periods	Practical: 45 Periods	Total: 45 Periods

COURSE OUTCOMES:

Upon the completion of the course, the student will be able to

CO1: Making electrical connections by wires of appropriate wires [Usage]

The

- **CO2:** Acquire exposure to common electrical components and measuring instruments. **[Familiarity]**
- CO3: Verify Simple laws using electrical circuits. [Usage]
- CO4: Do experiment to understand the characteristics of transformers and Electrical machines. [Usage]
- **CO5:** Understand the working of Low Tension Switch gear components, AC and DC drives. [Assessment]

COURSE ARTICULATION MATRIX:

PO/CO	PO	PO1	PO1	PO1	PSO	PSO	PSO								
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO1	М	М	Н	Η	-	-	-	-	-	-	M	М	L	М	М
CO2	M	M	H	Η	-	L	-	-	-	-	-	-	L	М	-
CO3	Н	Н	Н	M	-	L	-	-	-	-	-	-	L	Н	-
CO4	М	М	Н	Η	-	L	-	-	-	-	-	-	L	М	-
CO5	M	M	Η	Η	-	-	-	-	-	-	-	-	L	М	-
18PES105	Μ	Μ	Η	Н	-	L	-	-	-	-	M	Μ	L	Μ	M

L-Low. M-Moderate, H-High



PRE-REQUISITES: NIL

L T P C 2 0 4 4

Category : ES

COURSE OBJECTIVES:

- * Geometrical constructions
- * Orthographic projections.
- * Performing section of solids and development of the same.
- * Pictorial view of solids

UNIT-I : GEOMETRICAL CONSTRUCTIONS (6+12 Periods)								
Dimensioning-Lettering-Types of Lines-Scaling conventions-Dividing a given straight line in to								
any number of equal parts- Bisecting a given angle- Drawing a regular polygon given one side-								
Special methods of constr	ructing a pentagon and hex	agon.						
UNIT-II : ORTHOGRA	PHIC PROJECTIONS		(6+12 Periods)					
Introduction to Orthograp	bhic Projection-Projection	of points-Projection of straigl	nt lines with traces					
-Conversion of pictorial v	views to orthographic view	s-Projection of solids						
UNIT-III : SECTION O	F SOLIDS AND DEVEI	OPMENT	(6+12 Periods)					
Section of solids- Develop	pment of surfaces	Strub Strength						
UNIT-IV : PICTORIAL	VIEWS	TERCE	(6+12 Periods)					
Isometric projections - Co	onversion of orthographic	views to pictorial views (simp	le objects).					
UNIT-V : COMPUTER	AIDED DRAFTING		(6+12 Periods)					
Introduction to compu	ter aided drafting page	ckage to make 2-D Dra	wings. OBJECT					
CONSTRUCTION – pag	ge layout – Layers and L	ine type - Creating, Editing	and selecting the					
Geometric Objects MECI	HANICS – Viewing, Anno	otating, Hatching and Dimensi	ioning the drawing					
- Creating Blocks and At	tributes, DRAFTING – Cr	reate 2D drawing. A number c	of chosen problems					
will be solved to illustrate	the concepts clearly.							
(Demonstration purpose of	only, not be included in exa	aminations)						
Contact periods:		E						
Lecture: 30 Periods	Tutorial: 0 Periods	Practical: 60 Periods	Total: 90 Periods					
	CESTON .	De COV						

TEXT BOOKS:

- 1. K.Venugopal, "Engineering Graphics", New Age International (P) Limited, 2015.
- 2. K.L.Narayana and P.Kannaiah, **"TEXT BOOKS on Engineering Drawing,"** 2nd Edition, SciTech Publications (India) Pvt. Ltd, Chennai, 2009.

REFERENCE BOOKS:

- 1. Dhananjay.A.Jolhe, "Engineering Drawing", Tata McGraw Hill Publishing Co., 2007.
- 2. K.V.Nataraajan, "A TEXT BOOKS of Engineering Graphics", Dhanalakashmi Publishers, Chennai, 2006.
- 3. M.B.Shah and B.C. Rana, "Engineering Drawing", Pearson Education, 2005.
- 4. Luzadder and Duff, **"Fundamentals of Engineering Drawing"**, Prentice Hall of India Pvt Ltd, XIth Edition, 2001.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- **CO1:** Construct basic geometric shapes and dimension the drawing as per standards.
- CO2: Project points, lines and solids in various positions, and convert 2D

projections to pictorial projections.



CO3: Generate sectional views of solids and construct development drawings.

CO4: Generate and interrupt pictorial views.

CO5: Use AutoCAD to create simple Engineering Drawings.

PO/ CO	PO	PO	PO	PO	PO	PO	PO	РО	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			L		М	L			М	М	L		L	М	
CO2			L		М	L			М	М	L		L	М	
CO3			L		Н	L			М	М	L		L	М	
CO4			L		Н	L		-	М	М	L		L	М	
CO5			L		Н	L			М	М	L		L	М	
18PES106			L		Н	G.M	min		М	М	L		L	М	

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate, H-High



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	ο	г	п	Э	2	υ	

COMMUNICATIVE ENGLISH (Common to All Branches)

SEMESTER II

Category : HS L T P C 2 1 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

The course is intended to

- * Make learners listen to audio files and replicate in speaking contexts
- * Make learners read widely and practice it in writing
- * Make learners develop vocabulary and strengthen grammatical understanding

UNIT-I: LISTENING (6+3 Periods) Listening Comprehension, Pronunciation, Intonation, Stress, Pause, Rhythm, Listening to Short & Long Conversations/Monologues - Note-Taking. **UNIT-II : SPEAKING** (6+3 Periods) Self Introduction, Making Oral & Formal Presentation, Communication at Work Place, Mock Interviews, Role Play Activities, Group Discussions, Debates, Delivering Welcome Address, Proposing Vote of Thanks, Introducing the Chief Guest at a function. **UNIT-III : READING** (6+3 Periods) Reading Comprehension, Speed Reading, Interpreting Visual Materials (Signs, Post Cards Pictures, Labels Etc.), Reading for Specific Information-Reading to identify Stylistic Features (Syntax, Lexis, Sentence Structures)-Cloze Test. **UNIT-IV : WRITING** (6+3 Periods) Phrase, Clause And Sentence Structures, Punctuation, Discourse Markers, Coherence, Precision in Writing, Graph & Process Description-Definition, Writing Email-Paraphrasing, Note making, Job Application With Resume, Writing Review of a Book / Movie, Creative Writing. UNIT-V : GRAMMAR AND VOCABULARY (6+3 Periods) Word Formation with Prefix and Suffix, Synonyms and Antonyms, Tenses, Parts of Speech, Common Errors in English (Subject - Verb Agreement, Noun-Pronoun Agreement, Prepositions. Articles, Conditional statements, Redundancies, Clichés etc), Voices. **Contact periods:** Lecture: 30 Periods Tutorial: 15 Periods Practical: 0 Periods **Total: 45 Periods**

TEXT BOOKS:

1. Board of Editors, Using English, Orient Black Swan, 2015.

REFERENCE BOOKS:

- 1. Practical English Usage, Michael Swan. OUP 1995.
- 2. Cambridge BEC Vantage Practice Tests, Self-study Edition, CUP, 2002
- 3. Exercises in Spoken English. Parts. I –III. EFLU, Hyderabad, OUP, 2014
- 4. Indlish. Jyothi Sanyal, Viva Books, 2006
- 5. Communicative English. J.Anbazhagan Vijay, Global Publishers, Chennai. 2018

WEB REFERENCES

- 1. www.cambridgeenglish.org/exams/business.../business-preliminary/
- 2. http://www.examenglish.com/BEC/BEC_Vantage.html
- 3. www.splendid-speaking.com/exams/bec_speaking.htmlhtml

COURSE OUTCOMES:

At the end of the course, the learners will be able to

CO1: Enhance their listening capacity through various accents and discourse

- CO2: Communicate better at various public meeting and work place environments
- CO3: Read and strengthen their interpretive and linguistic skills
- CO4: Write appropriately on technical, business and general contexts.
- CO5: Understand the usage of grammar and vocabulary

PO/CO	РО	PO	PO	РО	РО	РО	РО	РО	РО	PO1	РО	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	0	11	12	1	2	3
CO1				М	Н	L	М		Η	Н	М	Η	L	L	L
CO2				Н	Н	L	М	М	Η	Η	М	L	L	L	L
CO3				Н	Н	L	М	М		Н	М	Н	М	М	М
CO4				Н	Н	L	Μ	Μ		Н	М	L	L	L	L
CO5				L	Н	L	46	-	3	H	М	Η	L	L	L
18PHS201				Η	Η	Ľ	M	M	M	H	М	М	L	L	L

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate, H-High



18PBS202

DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES

(Common to CIVIL, MECH & PRODN Branches)

SEMESTER II

LTPC

3 1 0 4

Category: BS

(9+3 Periods)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To gain methods to solve second order differential equations with constant and variable coefficients.
- * To be familiarize with formation and solutions of first order partial differential equation.
- * To be understood with solutions of higher order partial differential equation and product solutions to standard PDEs.
- * To be known about analytic functions with properties, construction of analytic function and the knowledge of conformal transformation.
- * To obtain the knowledge of Cauchy's integral theorems, calculus of residues and complex integration around unit circle and semicircle.

UNIT-I: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER (9+3 Periods) Second order linear differential equations with constant and variable coefficients, Cauchy-Euler equation, Cauchy-Legendre equation. Method of variation of parameters, Power series solutions of Differential equations with Bessel and Legendre functions.

UNIT-II : PARTIAL DIFFERENTIAL EQUATIONS – FIRST ORDER(9+3 Periods)

Formation of partial differential equations by elimination arbitrary constants and functions. Solutions to First order partial differential equations: Standard types of first order linear and non-linear PDE, Lagrange's linear PDE.

UNIT-III: PARTIAL DIFFERENTIAL EQUATIONS – HIGHER ORDER(9+3 Periods)Solution to homogenous and non-homogenous linear partial differential equations second and higher
order by complimentary function and particular integral method. Separation of variables method:
simple problems in Cartesian coordinates, Laplacian equation in plane, cylindrical and spherical
polar coordinates, one dimensional diffusion equation.(9+3 Periods)

UNIT-IV : COMPLEX DIFFERENTIATION

Functions of a Complex variable - Analytic functions - Cauchy Riemann equations and sufficient conditions (excluding proof) - Harmonic and orthogonal properties of analytic functions - Construction

of analytic functions – Conformal mappings: w=z+a, az, 1/z, z^2 , e^z , $\cos z$, $\sin z$ and Bilinear transformations.

UNIT-V: COMPLEX INTEGRATION(9+3 Periods)Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's theorems(Statements only) and expansions - Poles and Residues - Cauchy's Residue theorem - Contourintegration: Circular and semicircle contours with no pole on real axis.Contact periods:

Lecture: 45 PeriodsTutorial: 15 PeriodsPractical: 0 PeriodsTotal: 60 Periods

TEXT BOOKS:

- 1. Veerarajan T., Engineering Mathematics (for first year), Tata McGraw-Hill, New Delhi, 2008.
- 2. Srimanta Pal and suboth.C.Bhunia, Engineering Mathematics, Oxford university publications, New Delhi, 2015.

REFERENCE BOOKS:

- 1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi, 43rd Edition, 2015.
- 2. Erwinkreyszig, Advanced Engineering Mathematics,9thEdition, John Wiley&Sons, 2006.
- 3. N.P. Bali and Manish Goyal, A TEXT BOOKS of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

- 4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
- 5. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- **CO1:** Understand the general solutions to higher order differential equations and power series solutions to second order differential equations leading to Bessel and Legendre functions.
- **CO2:** Acquire fluency in solving first order partial differential equations.
- **CO3:** Understand the techniques of solving second order partial differential equations and solutions by method of separation of variables.
- **CO4:** Understand the properties of analytic function, formation of analytic function and mappings of standard functions, Mobius transformation.
- **CO5:** Understand calculus of residues to evaluate contour integration.

COURSE	ARTICUL	ATION	MATRIX

P0/C0	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Н	L	L	-	-	-	(Trees	m	-	-	-	М	L	-	-
CO2	Н	L	L	-	- 4	Co <u>r</u> te	Οςπφά	URUS NO	3	9 -	-	М	L	-	-
CO3	Н	L	L	-	-	X	A COLOR			-	-	М	L	-	-
CO4	Н	L	L	-		1	-	þ	7	-	-	М	L	-	-
CO5	Н	L	L	-	-	-	AN AND			-	-	М	L	-	-
18PBS202	Н	L	L	-	-	/ -)		家人	-	-	-	М	L	-	-

L – Low, M – Moderate (Medium), H- High



INTRODUCTION TO ELECTROMAGNETISM AND APPLIED PHYSICS

(Common to MECH & PRODN Branches)

SEMESTER: II

Category : BS

L T P C

3 1 0 4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

To enhance the fundamental knowledge in electromagnetism and applied physics for Mechanical and Production engineering. Upon completion of this course the students will be familiar with:

- * Fundamentals of electromagnetism.
- * Properties and applications of magnetic and super conducting materials.
- * Elastic behavior of solids, thermal conduction and applications
- * Exposed to different types of Non-destructive testing methods
- * Basics of vacuum science, production and measurement

UNIT_I · FI FOTDOMA CNETISM		(0+3 Pariods)								
Develop of Divergence, Gradiant and Curl. Qualitative understanding of surface and volume integral										
Physics of Divergence, Gradient and Curi, Quantative understanding of surface and volume integral -										
Maxwell Equations (Qualitative) – Differential Form and Integral Form - Wave Equation – Derivation										
in Vacuum and Homogeneous Isotropic Dielectric Medium - E	lectromagnetic Way	ves - Refractive								
index - Phase velocity - Group velocity, Group index, Wave guide (Qualitative)										
UNIT-II : MAGNETIC MATERIALS AND SUPERCONDUCTORS (9+3 Periods)										
Introduction - Origin of magnetic moment - Bohr magneton - Dia	Para, and Ferro ma	gnetic materials								
- Domain theory of ferromagnetism - Hysteresis - Hard and Soft magnetic materials -										
Superconductivity - Types of superconductors - BCS theory of superconductivity (qualitative) -										
properties- High Tc superconductors. Applications of superconductors- SOUID Cryotron Magnetic										
levitation.										
UNIT-III : PROPERTIES OF MATTER AND THERMAL PHYSICS (9+3 Periods										
Elasticity- Hooke's law- stress-strain diagram - Factors affecting elasticity - Bending moment -										
Depression of a cantilever - Young's modulus by uniform bending - I shaped girders.										
Thermal conductivity - heat conduction in solids - Rectilinear flo	ow of heat through	along a uniform								
bar - Forbe's and Lee's disc method: theory and experiment.	C	C								
UNIT-IV : NON-DESTRUCTIVE TESTING (9+3 Periods										
X-ray Testing – Fluorescence -Phosphorescence -Fluoroscopy –Ultrasonic Testing - Pulse echo										
system –LASER Testing - Liquid Penetrant Testing – Magnetic Particle Testing										
UNIT-V : VACUUM SCIENCE (9+3 Period										
Introduction - Importance of vacuum in industries - Pumping speed and throughput - Types of pumps-										
Rotary vane type Vacuum pump(oil sealed), Diffusion Pump and Turbo Molecular Pump -										
Measurement of High Vacuum-McLeod Gauge-Pirani Gauge-Penning Gauge.										
Contact periods:										
Lecture: 45 Periods Tutorial: 15 Periods Practical: 0	Periods Total	l: 60 Periods								

TEXT BOOKS:

1. David Griffiths, "Introduction to Electrodynamics" – Unit I

2. P.K. Palanisamy – Engineering Physics–II, Scitech publications (India)pvt. Ltd , 3rd edition 2015. – Unit II& III

REFERENCE BOOKS:

- 1. Jearl Walker, "Fundamentals of Physics", Halliday & Resnick, 10th edition, 2014, WILEY- Unit-1
- 2. Baldev Raj, T. Jayakumar and M. Thavasimuthu, "Practical Non-DestructiveTesting", 3rd edition, Narosa Publishing House (2007).- Unit IV
- 3. Ganesan S. Iyandurai N-"Applied Physics", KKS Publishers, Chennai, 2007- Unit V
- 4. Krautkramer, Josef and Hebert Krautkramer, "Ultrasonic Testing of Materials", 3rdedition, New York, Springer-Verlag (1983). Unit IV
- 5. R. Halmshaw, "Industrial Radiography", Applied Science Publishers inc., Englewood, NJ (1982).

COURSE OUTCOMES:

- Upon completion of the course, the student will be able to
- **CO1:** Acquire knowledge in basics of Electromagnetism
- **CO2:** Identify, analyze the properties and applications of magnetic & super conducting materials. [Familiarity]
- **CO3:** Acquire knowledge in properties of matter and thermal physics [Application]
- CO4: Familiarization of different methods of Non-destructive testing
- **CO5:** Production & measurement of vacuum.[Familiarity]

COURSE ARTICULATION MATRIX

18PBS203 INTRODUCTION TO ELECTROMAGNETISM AND APPLIED PHYSICS

					2										
								T							
PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	н	L	L		L	- 3		入	1			L	L		L
CO2	н	М	М		A A		~					L	М	М	М
CO3	Н	М	М		M		63		EFS			L	М	L	
CO4	н	М	Н	L	М)	Pi-				L	М	L	М
CO5	Н	М	L	М	М							L	L		М
18PBS203	н	м	Н	М	м							L	М	L	М

L – Low, M – Moderate (Medium), H- High

(Common to MECH & PRODN Branches)

Category : ES											
L	Т	Р	С								
3	0	0	3								

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

Upon completion of this course the students will be Familiar with:

- * Data types and variables declaration
- * Conditional statements, Functions and the use of basic programming.
- * Iteration, Strings and List
- * Dictionaries, Tuples and File handling.
- * Object oriented programming development.

UNIT-I : INTRODUCT	ION		(9 Periods)									
Building blocks of progra	Building blocks of program – Notations, pseudo code, algorithm, flow chart, python programming											
language - program, debugging, Data and expression - types, variables and keywords, operators,												
expressions and statements, interactive mode and script mode, string operations and comments.												
UNIT-II : FUNCTIONS AND CONDITIONAL EXPRESSIONS (9 Periods)												
Function calls, type conversion, math, composition, adding new functions, Parameters, Stack												
diagram, other functions,	, importing with from, ret	turn values, increments, co	omposition, Boolean									
function, recursion, stacl	k diagram for recursive f	functions, Expressions - n	nodulus and logical									
operators, Boolean expressions, conditional execution, chain and nested conditionals.												
UNIT-III : ITERATION	N, STRINGS, LIST		(9 Periods)									
Multiple assignment, while statement, break, algorithms, For Loop, Strings - slices, searching,												
counting, methods, in operator comparison, List - traversing, operations, slices, methods, map filter												
and reduce, deleting elements, list and strings, objects and values, list arguments.												
UNIT-IV : DICTIONARIES, TUPLES, FILES (9 Periods)												
Looping and dictionaries	s, reverse lookup, dictiona	aries and lists, memos, gl	obal variables, long									
integers, Tuples – assignn	nents, return values as tuple	es, variable length and argu	ment, list and tuples,									
dictionaries	and tuples,	comparing,	sequences,									
Files - reading and writing, format operator, file names and paths, catching exceptions, data bases,												
pickling, pipes, writing modules.												
UNIT-V: OBJECT ORIENTED PROGRAMMING (9 Periods)												
Classes - user defined types, attributes, rectangles, instances as return values, objects, copying,												
Classes and Functions – time, pure functions, modifiers, prototyping versus planning, Classes and												
Methods - object oriented features, printing objects, methods, operator overloading, polymorphism,												
interface and implementation, Inheritance – class diagrams, data encapsulation.												
Contact periods:	Contact periods:											
Lasturna 15 Daniada												

TEXT BOOKS:

1. Allen Downney "Think python – How to think like a computer scientist", Grean Tea press, 2015.

REFERENCE BOOKS:

- 1. Michael Dawson "Python Programming for the Absolute Beginner", Premier Press, 2003.
- 2. Y. Daniel Liang "Introduction to Programming Using Python", Pearson, 2013.
- 3. Charles Dierbach "Introduction to Computer Science Using Python: A Computational Problem-Solving Focus", Wiley Publications, 2012.

COURSE OUTCOMES:

- Upon completion of this course the students will be able to:
- **CO1:** Use various data types.[**Understand**]
- CO2: Analyze the use of functions and conditional structures.[Analyze]
- CO3: Use control statements, strings and lists. [Understand]
- CO4: Handle Dictionaries, tuples and perform file operations. [Understand]
- CO5: Develop application using object oriented programming. [Analyze]

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	М	L		L	L	1	L	L	7		L		L	L	L
CO2	М	L		L	L		L	J.	8-4		L		L	L	L
CO3	М	М	L	М	L	//		SL.			L		L	L	L
CO4	М	М	L	М	L	a 1	М	М	- 3		L	L	L	М	L
CO5	М	Μ	L	М	L		М	М			М	L	L	М	L
18PES204	М	М	L	М	L		D LO	S.L.	B		L	L	L	L	L

COURSE ARTICULATION MATRIX

L – Low, M – Moderate (Medium), H- High
SEMESTER II

Category : BS L T P C 0 0 3 1.5

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

To improve the basic knowledge in Physics and its applications relevant to various streams of Engineering and Technology. Upon completion of this course the students will be familiar with:

* To have a practical knowledge about the concepts of physics and its applications in the emerging fields of engineering and technology

LAF	BORATORY EXPERIM	ENTS							
1.	Spectrometer - Diffraction	on Grating Norma	l Incidence Method						
2	Air Wedge –Determinati	on thickness of a	paper						
3.	Young's Modulus – Cantilever Bending Koenig's Method								
4.	a) Laser - Particle size Determinationb) Optical fiber - Determination of NA & Acceptance angle								
5.	Ammeter and Voltmeter	Calibration – Lov	w Range						
6.	Determination of Bandg	ap Energy of Sen	niconductor						
7.	Ultrasonic Interferomete	r - Velocity of so	und & Compressibility of liqu	iids.					
8.	8. Torsional pendulum –Determination of Rigidity Modulus & Moment of Inertia								
Cor	Contact periods:								
Lec	ture: 0Periods Tutor	rial: 0Periods	Practical: 45 Periods	Total: 45 Periods					

COURSE OUTCOMES:

Upon the completion of the course, the student will be able to

- CO1: Determine all physical properties of any matter,
- **CO2:** Calibrate electrical measuring instruments and thereby effectively using it for Particular application
- **CO3:** Understand principle of Laser diffraction and its application in particle size determination
- **CO4:** Understand the concept of light propagation through optical fibers and determination of its parameters
- **CO5:** Determine the Intrinsic characteristic features of electronic devices for electrical and electronic applications.
- **CO6:** Understand the ultrasonic wave propagation in liquids and the determination of compressibility of liquids for engineering applications.

COURSE ARTICULATION MATRIX

18PBS205	PHYS	ICS LA	BORA	TORY											
P0/C0	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO1	PSO2	PSO3
										0	1	2			
CO1	Н	М	L	L	М							L	L		М
CO2	Н	М	L	М	L							L	М	М	L
CO3	Н	М	L	L								L	М		
CO4	Н	М	М	L	М							L	М	М	М
CO5	Н	М	М	L	М							L	L	L	L
CO6	Н	М	М	М	М							М	L	М	М
18PBS205	Н	М	М	М	М							L	М	М	М

L-Low, M-Moderate (Medium), H-High



18PES206

SEMESTER II

Category : ES L T P C 1 0 4 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To make various basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail joint, Mortise & Tenon joint and Cross-Lap joint.
- * To make various welding joints such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint.

LIS	T OF EXPERIMENTS									
1	Introduction to use of tools and equipments in Carpentry, Welding, Foundry and Sheet metal									
2	Safety aspects in Welding, Carpentry and Foundry									
3	Half lap Joint and Dovetail Joint in Carpentry									
4	Welding of Lap joint, Butt joint and T-joint									
5	Preparation of Sand mould for cube, conical bush, pipes and V pulley									
6	Fabrication of parts like tray, frustum of cone and square box in sheet metal									
7	Electrical wiring – simple house wiring									
8	Plumbing									
9	CNC Machines demonstration and lecture on working principle.									
10	Additive manufacturing demonstration and lecture on working principle									
Co	Contact periods:									
Lec	ture: 15 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 75 Periods									
CO	COURSE OUTCOMES:									

Upon completion of the course, the student will be able to

- **CO 1:** Safely Use tools and equipment's used in Carpentry, Welding, Foundry and Sheet metal to create basic joints.
- CO 2: Prepare sand mold for various basic pattern shapes.
- CO 3: Fabricate parts like tray, frustum of cone and square box in sheet metal.
- **CO 4:** Carry out minor works/repair related to electrical wiring and plumbing.
- **CO 5:** Demonstrate the working of CNC machines and additive manufacturing.

COURSE ARTICULATION MATRIX

PO/CO	PO	PO	РО	PO	PO	РО	PO	PO	PO	РО	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н		L		L				L				М		L
CO2	Н		L		L				L				М		L
CO3	Н		L		L				L				М		L
CO4	Н		L		М				L				М		L
CO5	Н		L		Н				L				М		L
18PES206	н		L		М				L				М		L

L – Low, M – Moderate (Medium), H- High

18PES207	PYTHON PROGRAMMING LABORATORY (Common to MECH & PRODN Branches)	SEMESTER II
		Catagowy , FS

Category : ES L T P C 0 0 3 1.5

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

Upon completion of this course the students will be Familiar with:

- * Data types and variables declaration
- * Conditional statements, Functions and the use of basic programming.
- * Iteration, Strings and List.
- * Dictionaries, Tuples and File handling.
- * Object oriented programming development.

LIST	OF EXPERIMEN	NTS							
1	Expressions and o	operators							
2	Conditional states	ments							
3	Functions								
4	Looping statements								
5	Strings								
6	Lists								
7	Dictionaries								
8	Tuples								
9	Files								
10	0 Classes – overloading, polymorphism, interfacing, encapsulation								
Conta	act periods:								
Lectu	re: 0Periods	Tutorial: 0Periods	Practical: 45 Periods	Total: 45 Periods					

COURSE OUTCOMES:

- Upon completion of this course, the students will be able to
- CO1: Understand various data types.[Understand]
- CO2: Analyze the use of functions and conditional structures.[Analyze]
- CO3: Implement control statements, strings and lists. [Analyze]
- CO4: Handle Dictionaries, tuples and perform file operations. [Analyze]
- CO5: Develop application using object oriented programming. [Analyze]

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	М	L	L	L	L		L	L			L	L	L	L	М
CO2	М	L	L	L	L		L	L			L	L	L	L	М
CO3	М	М	L	М	L		L	L			L	L	М	L	М
CO4	М	М	L	М	L		М	М			L	L	М	М	М
CO5	М	М	L	М	L		М	М			М	L	М	М	М
18PES207	М	М	L	М	L		L	L			L	L	М	L	М

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

BUSINESS COMMUNICATION SKILLS

(*Common to MECH., EEE, PRODN & EIE Branches*)

SEMESTER III

PRE-REQUISITES: NIL

18PHS301

COURSE OBJECTIVES:

* To impart knowledge on effective Business Communication Skills

UNIT – I: ACQUISITION OF GOOD ENGLISH	(9 Periods)
Parts of speech, Tenses, Vocabulary, Choice of words, Synonyms, Antonyms,	Homonyms,
Homophones, Prefixes, Suffixes, One word substitutes, Idioms, Phrasal verbs,	Abbreviations,
Acronyms.	
UNIT – II : BUSINESS WRITING	(9 Periods)
Sentence structure & patterns, SV Agreement, Punctuation, Email, Letter writing	g: Application,
Interview, Appointment, Confirmation, Reference, Good will, Congratulatory, and the	nanking letters,
Report writing, Precise writing: Summarizing matters reported in dailies & jour	nals, decisions
taken in meetings & conferences.	
UNIT – III : BUSINESS CORRESPONDENCE	(9 Periods)
Enquiry: Types, Purpose, Notice inviting Tenders, Placing order, Making, Handlin	ig & Rejecting
complaints, Sales letters, Market surveys, Status reports, Advertisements, Class	sifieds, Memo
reports, Office circulars, Memorandums, and Report writing.	
UNIT – IV : BUSINESS COMMUNICATION	(9 Periods)
Verbal & Non-Verbal communication, Body language, Soft skills, Pronunciat	ion, Stress &
Intonation, Inviting people, Accepting or Declining offers, Conveying or leaving	messages over
phone, Presentation, Negotiation, Speaking at a meeting.	
UNIT – V INTERPERSONAL COMMUNICATION IN ORGANIZATIONS	(9 Periods)
Skills needed to develop effective teams, Group Communication, Profession	nal etiquettes,
Interpersonal communication, Team roles, Effective listening and speaking, Crit	tical thinking,
Technology and communication	

Contact Periods:

Lecture: 45 Periods	Tutorial: 0 Periods	Practical: 0 Periods	Total: 45 Periods

TEXT BOOKS

- 1. Bisen, Vikram & Priya. "Business Communication", New Age International Publishers, New Delhi, 2009
- 2. Thomas.L.Means. "Business Communication", South-Western Cengage Learning, USA, 2010.
- 3. Adhikari, Bhavana & Sethi, Anjanee. **"Buisness Communication"**, Tata McGraw Hill Education Private Ltd., New Delhi, 2010

REFERENCE BOOKS:

- 1. Simon Sweeney. "English for Business Communication", Cambridge University Press, Cambridge, 2007.
- 2. Hartley, Peter & Bruckmann G. Clive. "Business Communication", Routledge, New York, 2007.
- 3. Locker O. Kitty. "Business Communication" McGrill, New York, 2009

Category: HS

L T P C 3 0 0 3

COURSE OUTCOME:

Upon completion of the course, the student will be able to

CO1: Acquire English language skills.

CO2: Familiarize English language usage for business contexts.

CO3: Develop business correspondence.

CO4: Execute effective business communication.

CO5: Practice good interpersonal communication.

COURSE ARTICULATION MATRIX

CO/PO	PO 1	PO 2	PO 2	PO 4	PO 5	PO 6	PO 7	PO e	PO o	PO 10	PO	PO 12	PSO 1	PSO 2	PSO 2
	I	4	3	4	3	U	/	0	9	10	11	14	1	4	3
CO1	L									М	L	М	L		
CO2	L									М	L	М	Н		
CO3	L									М	L	М		Н	
CO4	L									М	L	М	Н		
CO5	-									М	L	М			Н
18PHS 301	L						G."	mnj	0	М	L	М	L	L	L

L-Low M-Moderate (Medium), H-High



Category : BS

L	Т	Р	С
3	1	0	4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To be familiarize with analytical solutions of boundary value problems as applications of partial differential equations
- * To gain the concepts of probability
- * To obtain the knowledge of probability distributions both discrete and continuous cases.
- * To gain the knowledge of test of hypothesis applicable to small and large samples.
- * To familiarize with control chart.

UNIT- I	BOUNDARY VALUE PROBLEMS	(9+3 Periods)						
Half range	Sine and Cosine Fourier Series -One dimensional wave equation - One di	mensional heat						
equation (Unsteady and Steady state conditions) – Two dimensional heat equation (infinite plate only)								
– Fourier series solution.								
UNIT- II	PROBABILITY AND RANDOM VARIABLES	(9+3 Periods)						
Sample spa	ces-Events - Probability Axioms-Conditional Probability - Independent E	Events – Baye's						
Theorem. F	Random Variables: Distribution Functions – Expectation - Moments - Mom	ent Generating						
Functions.								
UNIT- III	PROBABILITY DISTRIBUTIONS	(9+3 Periods)						
Binomial,	Poisson, Geometric, Uniform, Exponential, Normal, Gamma, Weibull (N	Aean, Variance						
and Simple	problems). Functions of random variables.							
UNIT- IV	TESTING OF HYPOTHESIS	(9+3 Periods)						
Large sampl	es: Tests for Mean and proportions- Small samples: Tests for Mean,	Variance and						
Attributes u	using t,F, Chi–Square distribution.							
UNIT- V	STATISTICAL QUALITY CONTROL AND CORRELATION	(9+3 Periods)						
	ANALYSIS							
Statistical basis for control charts–Control limits– Control charts for variables: \bar{X} , R Charts–Control								
chart for defective:p, np Chart – Control chart for defects:c charts. Multiple and Partial Correlation -								
Partial Reg	ression (Problems Only)							

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS:

- 1. B.S.Grewal., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
- 2. Veerarajan T.,, "Probability and Random Processes (with Queueing Theory and Queueing Networks)", McGraw Hill Education (India) Pvt Ltd., New Delhi, Fourth Edition, 2016.

REFERENCE BOOKS:

- 1. Veerarajan T., **"Transforms and Partial Differential Equations For semester III",** Tata *Mc Graw Hill Education (India) Pvt Ltd., New Delhi, 2016.*
- 2. Gupta S.C and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 2015.
- 3. Gupta S.P, "Statistical Methods", Sultan Chand & Sons, New Delhi, 2015.
- 4. Trivedi K.S, **"Probability and Statistics with Reliability, Queuing and Computer Science** *Applications"*, Prentice Hall of India, New Delhi.
- 5. Hwei Hsu, "Schaum's outline series of Theory and Problems of Probability and Random Process", Tata McGraw Hill Publishing Co., New Delhi, 2015.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Solve boundary value problems as applications of partial differential equations

CO2: Acquire fluency in solving probability oriented problems

CO3: Solve problems on discrete and continuous probability distributions

CO4: Test for significance of hypothesis connected to small and large samples

CO5: Utilize the control chart technique and find partial and multiple correlations.

COURSE ARTICULATION MATRIX

PO/PSO	PO	РО	PO	PO	PO	PO	PSO	PSO	PSO						
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Н	Н	Н	М	Η	H	М	М	М	М	Н	М	М	М
CO2	Η	Н	М	Н	М	H	M	Μ	L	Н	М	М	Η	М	L
CO3	Η	Н	Н	М	М	H	М	М	L	Μ	М	М	М	М	М
CO4	Н	Н	Н	Н	Μ	H	М	Μ	М	Н	М	М	М	М	М
CO5	Н	Н	Н	Н	Μ	Ĥ	Н	Н	H	Н	М	Н	Н	М	Μ
18PBS302	Н	Н	Н	Н	М	Η	М	М	М	Н	М	М	М	М	М

L- Low, M – Moderate (Medium), H – High

Category : ES

L	Т	Р	С
3	1	0	4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- * To understand the force systems, geometrical properties and frictions in real life applications.
- * To understand the dynamics behaviour of particles and impulse momentum principle.

UNIT – I : INTRODUCTION TO MECHANICS AND FORCE	(9+3 Periods)					
CONCEPTS	(
Principles and Concepts – Laws of Mechanics – system of forces – resultant of a t	force system –					
resolution and composition of forces - Lami's theorem - moment of a for	ce – physical					
significance of moment-Varignon's theorem - resolution of a force into force	and couple –					
forces in space – addition of concurrent forces in space – equilibrium of a particle i	n space.					
UNIT – II : FRICTION	(9+3 Periods)					
Frictional resistance - classification of friction- laws of friction - coefficient of fri	ction-angle of					
friction - angle of repose - cone of friction - free body diagram-advantages-eq	uilibrium of a					
body on a rough inclined plane - non-concurrent force system - ladder friction - :	rope friction –					
wedge friction.						
UNIT – III: GEOMETRICAL PROPERTIES OF SECTION	(9+3 Periods)					
Centroids - Determination by integration - centroid of an area - simple figure	s - composite					
sections - bodies with cut parts - moment of inertia - theorems of moment of ine	rtia – moment					
of inertia of composite sections - principal moment of inertia of plane areas - radiu	s of gyration.					
UNIT – IV : BASICS OF DYNAMICS	(9+3 Periods)					
Kinematics and kinetics - displacements, velocity and acceleration - Equations	s of motion –					
Rectilinear motion of a particle with uniform velocity, uniform acceleration, varying	g acceleration					
- motion curves - motion under gravity - relative motion - curvilinear motion	of particles -					
projectiles – angle of projection – range – time of flight and maximum height. Ne	wton's second					
law of motion – linear momentum – D'Alembert's principle, Dynamics equilib	rium — work					
energy equation of particles- law of conservation of energy - principle of work and	l energy					
UNIT – V : IMPULSE MOMENTUM AND IMPACT OF ELASTIC	(0 + 2 Dominda)					
BODIES	(9+3 Periods)					
Principle of impulse and momentum - Equations of momentum - Laws of co	onservation of					
momentum. Impact - Time of compression, restitution, collision - Co-efficient of restitution -						
types of impact - collision of elastic bodies by direct central impact and oblique impact -						
collision of small body with a massive body – Kinetic energy of a particle.						

Contact Periods:			
Lecture: 45 Periods	Tutorial: 15 Periods	Practical: 0 Periods	Total: 60 Periods

TEXT BOOKS:

- 1. S.S. Bhavikatti and K.G. Rajasekarappa "Engineering Mechanics" New Age International (P) Ltd. 1999.
- 2. S.C. Natesan "Engineering Mechanics" Umesh Publications, 5-B north market, Naisarak, Delhi, 2002.
- 3. Domkundwar V.M and Anand V. Domkundwar, "Engineering Mechanics (Statics and Dynamics)", Dhanpat Rai and Co. Ltd, 1 st Edition, 2006.

REFERENCE BOOKS:

- 1. F.B. Beer and E.R. Johnson, "Vector Mechanics for Engineers", Tata Mc.Graw Hill Pvt. Ltd, 10th Edition, 2013.
- 2. S. Timoshenko and Young, "Engineering Mechanics", Mc. Graw Hill, 4th Edition, 1995.
- 3. Irving Shames and Krishna Mohana Rao, "Engineering Mechanics", Prentice Hall of India Ltd, Delhi, 2006.
- 4. R.C. Hibbeller, "Engineering Mechanics", Prentice Hall of India Ltd, 13th Edition, 2013.
- 5. Vela Murali, "Engineering Mechanics", Oxford university Press, 1st Edition, 2010.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- CO1: Know the concept of mechanics and system of forces.
- **CO2:** Calculate the frictional properties at different bodies.
- CO3: Identify the locations of centre of gravity and moment of inertia for different sections.

CO4: Understand the basics of dynamics of particles.

CO5: Know the impulse and momentum principle and impact of elastic bodies.

PO/PSO	РО	PO	PO	РО	РО	PO	РО	РО	РО	РО	РО	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	Н	Μ	L	L)	2	L		L		L	L	L
CO2	L	Н	L		L				L		L		L		L
CO3	L	Н	L		L				L		L		L		L
CO4	М	Н	L	М	L								L		L
CO5	L	Н		М		L							L		L
18PES303	L	Н	L	М	L	L			L		L		L	L	L

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

	THERMAL SCIENCES	
18PES304	(Use of Approved Steam table and Refrigeration and Air conditioning table is permitted)	SEMESTER III

Category: ES L T P C

3 1 0 4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To understand the basic laws of Thermodynamics and Heat and mass transfer.
- * To understand the principle of operation of thermal equipment like IC engine, boiler, and refrigerator etc.

UNIT- I	THERMODYNAMICS	(9+3 Periods)							
Thermodyna steady flow entropy chan	Thermodynamic systems - zeroth law, first and second laws of thermodynamics, applications, steady flow energy equation, ideal gas processes - calculation for work done, heat transfer and entropy changes.								
UNIT- II	POWER PLANTS	(9+3 Periods)							
Rankine cycle (without reheat and regeneration), Steam power plant, Brayton cycle, gas turbine power plant, cogeneration and combined cycle power plants. Global energy requirements – role of energy managers in industries.									
UNIT- III	IC ENGINES	(9+3 Periods)							
Carnot cycle diagrams, ind IC engines, c efficiencies.	Carnot cycle, Otto, diesel cycles, Principles of operations of IC Engines, valve and port timing diagrams, indicator diagrams; diesel fuel pump and injector, need for cooling and lubrication of IC engines, coil and magneto ignition systems, mechanical, brake thermal and indicated thermal efficiencies								
UNIT- IV	REFRIGERATION AND AIR-CONDITIONING	(9+3 Periods)							
Refrigeration - vapour compression cycles - vapour absorption cycle, comparison between vapour compression and absorption systems. Properties of steam: P - V, T - S and H - S diagrams- Psychrometry, Psychrometric chart – processes.									
UNIT- V	HEAT TRANSFER	(9+3 Periods)							
Heat conduction through plane and cylinder, critical thickness of insulation, natural and forced convection. Radiation, Surface emission properties, Stefan-Boltzmann law, Kirchhoff's law.									

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS:

- 1. Yunus A Cengel "Introduction to Thermodynamics and Heat Transfer", McGraw Hill Inc., New York, 2007.
- 2. Nag.P.K, "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2008.
- 3. R.K.Rajput "Thermal Engineering", Laxmi Publications (P) Ltd, 6th edition New Delhi, 2006.

REFERENCE BOOKS:

- 1. R.K.Rajput "Heat and Mass Transfer", 5th Edition, S. Chand& Company Itd, 2012
- 2. Kothandaraman.C.P.,Domkundwar.S. andA.V.Domkundwar "A course in Thermal Engineering", Dhanpat Rai and Sons., 5th edition, 2000.
- 3. Holman.J.P "Heat and Mass Transfer", 3rd Edition, McGraw-Hill, 2007
- 4. Ganesan V "Internal Combustion Engines", Tata McGraw Hill Publishing Company, New Delhi, 2007.

COURSE OUTCOMES:

- On completion of this course, students will be able to
- CO1: describe the thermodynamic systems and various laws of thermodynamics.
- **CO2:** explain various thermodynamic cycles.
- CO3: describe about IC engines.
- CO4: describe the refrigeration and air conditioning systems.
- CO5: explain about heat transfer in a thermodynamic system.

PO/PSO	РО	PO	PO	PO	РО	PO	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	Н	М	М		L			L	Н		L	L		L
CO2	М	Μ	L	Н		Μ			L	Н		М	L		L
CO3	М	L	L	М	A	Μ	-	Sec.	L	Н		М	L		L
CO4	М	L	Н	Н		М	М	N	L	М		М	L		L
CO5	М	L	L	L	12	М	М		L	М		М	L	L	L
16PES304	М	Μ	М	М		М	L		L	М		М	L	L	L

COURSE ARTICULATION MATRIX

L – Low, M- Moderate (Medium), H – High

Category: PC

PRE-REQUISITES:

L T P C 3 0 0 3

1. 18PBS203- Introduction to Electromagnetism and Applied Physics

COURSE OBJECTIVES:

* To study the phase diagrams, various heat treatment methods, principles of foundry, welding and powder metallurgy and to acquire knowledge on testing materials, properties and application of various methods.

UNIT – I	CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS	(9 Periods)								
Constitution Isomorphou equilibrium	Constitution of alloys – Solid solutions, substitutional and interstitial –phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide equilibrium diagram.									
UNIT - II	HEAT TREATMENT AND SURFACE TREATMENT	(9 Periods)								
Definition – Full annealing, process annealing, stress relief, recrystallisation - spheroidizing – normalising, hardening and tempering of steels – austempering, martempering - Isothermal transformation diagrams – cooling curves superimposed on I.T diagram- CCR - hardenability, Jominy end quench test - Case hardening, carburising, nitriding, cyaniding, carbonitriding–Flame and Induction hardening.										
UNIT - III	FERROUS AND NON FERROUS METALS	(9 Periods)								
Plain carbon steels – alloy steels - Effect of alloying elements (Mn, Si, Cr, Mo, V, Ni, Ti& W) on properties of steel - stainless and tool steels – Gray, White, Malleable, Spheroidal graphite - alloy cast irons – heat resistant steels and die steels. Copper, Aluminium, Nickel, Magnesium, Titanium, Lead, Tin - Important alloys - their composition, properties and applications - Material Specification and standards.										
UNIT - IV	FOUNDRY AND POWDER METALLURGY	(9 Periods)								
Solidification of pure metals and alloys – melting – super heating – fluxing – micro and macro segregation – hot tears – heat transfer and structural change - Production of powders, mixing, blending, compacting, sintering and hot pressing – secondary operations- application of powder metallurgy – advantages and limitations.										
UNIT - V	WELDING METALLURGY AND TESTING OF MATERIALS	(9 Periods)								
Weldability – heat distribution during welding and thermal effects on parent metals – HAZ – factors affecting HAZ - hardening, cracking, distortion and residual stresses – stress relief treatment of welds – Mechanical tests - tension, compression, impact, hardness, Non Destructive Testing basic principles and testing method for Radiographic testing, Ultrasonic testing, Magnetic Particle inspection and Liquid penetrant inspection test - Eddy current testing.										

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

TEXT BOOKS:

- 1. Higgins R.A "Engineering Metallurgy", Viva books(p) ltd.,6th edition, 1998.
- 2. Dieter, G.E "Mechanical metallurgy, SI metric edition", McGraw-Hill, ISBN 0-07-100406-8, 1988.
- 3. Sydney H.Avner **"Introduction to Physical Metallurgy"**, Tata McGraw Hill Book Company, 1994.

REFERENCE BOOKS:

- 1. William D Callsber "Material Science and Engineering", Wiley India pvt Ltd 2007.
- 2. Lakhtin Yu. **"Engineering Physical Metallurgy and Heat Treatment",** Mir Publisher, 1985.
- 3. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials", Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.
- 4. GUY.A.G "Elements of Physical Metallurgy", Oxford & IBH Pub.Co, 1990.
- 5. O.P.Khanna "Material Science And Metallurgy", Dhanpat Rai Publication ,2011.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Predict the alloy components and its composition variation with respect to temperature changes.

CO2: Select suitable materials and heat treatment methods for various industrial applications.

CO3: Understand the ferrous and nonferrous materials and their application

CO4: Apply the knowledge of foundry and powder metallurgy to solve various industrial production processes.

CO5: Gain knowledge about materials testing methods and welding techniques to meet industrial requirements.

PO/PSO	PO	PO	PO	PO	PO	РО	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
СО	1	2	5	-	2	CO.	5	5 630	C	D	11	12	1	2	5
CO1	L				М			L				L	М		
CO2	М		Η		Η								Η	М	
CO3	Η	М			Μ								М	Η	L
CO4	L	М			Μ								L	М	
CO5	L					Μ	Η				L				L
18PPC305	М	L	L		М	L	L	L			L	L	М	М	L

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

Category : PC

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming, sheet metal and manufacture of plastic components.

UNIT- I	METAL CASTING PROCESSES	(9 Periods)					
Sand Cast	ing : Sand Mould – Type of patterns – Pattern Materials – Pattern	allowances –					
Moulding sand Properties and testing - Cores - Types and applications - Moulding machines-							
Types and	applications; Melting furnaces : Blast and Cupola Furnaces; Princip	ole of special					
casting processes : Shell – investment – Ceramic mould – Pressure die casting – Centrifugal							
Casting – C	CO2 process – Stir casting; Defects in Sand casting.						
UNIT- II	JOINING PROCESSES	(9 Periods)					
Operating	principle, basic equipment, merits and applications of Fusion welding pr	rocesses: Gas					
welding –	Types – Flame characteristics; Manual metal arc welding – Gas Tungster	n arc welding					
– Gas met	al arc welding - Submerged arc welding - Electro slag welding; Opera	ting principle					
and applic	ations of Resistance welding - Plasma arc welding - Thermit weldir	ng – Electron					
beam weld	ding - Friction welding and Friction Stir Welding; Brazing and sole	dering; Weld					
defects: typ	pes, causes and cure.						
UNIT- III	METAL FORMING PROCESSES	(9 Periods)					
Hot working	ng and cold working of metals – Forging processes – Open, impression ar	nd closed die					
forging – f	forging operations. Rolling of metals- Types of Rolling - Flat strip rol	ling – shape					
rolling ope	rations - Defects in rolled parts. Principle of rod and wire drawing - Tub	be drawing –					
Principles	of Extrusion – Types – Hot and Cold extrusion.	1					
UNIT- IV	SHEET METAL PROCESSES	(9 Periods)					
Sheet met	al characteristics – shearing, bending and drawing operations – Str	etch forming					
operations	- Formability of sheet metal - Test methods -special forming process	sses-Working					
principle	and applications – Hydro forming – Rubber pad forming – Met	al spinning-					
Introductio	on of Explosive forming, magnetic pulse forming, peen forming, Super pl	astic forming					
- Micro fo	rming.						
UNIT- V	MANUFACTURE OF PLASTIC COMPONENTS	(9 Periods)					
Types and	characteristics of plastics - Moulding of thermoplastics - working p	rinciples and					
typical ap	plications - injection moulding - Plunger and screw machines -	Compression					
moulding,	Transfer Moulding – Typical industrial applications – introduction to blow	w moulding –					
Rotational	moulding – Film blowing – Extrusion – Thermoforming –	Bonding of					
Thermopla	stics.						

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

TEXT BOOKS:

- HajraChouldhary S. K. and HajraChouldhary A. K. "Elements of Workshop Technology - Volume I", Media promoters and Publishers Private Limited, Mumbai, 2008.
- 2. Kalpakjian. S "Manufacturing Engineering and Technology", Pearson Education India Edition, 2018

REFERENCE BOOKS:

- 1. Sharma, P.C., "A TEXT BOOKS of production Technology", S.Chand and Co. Ltd., 2004.
- 2. P.N. Rao "Manufacturing Technology Foundry, Forming and Welding", TMH-2003; 2ndEdition, 2003.
- 3. Roy. A. Lindberg "Processes and Materials of Manufacture", PHI / Pearson Education, 2006

COURSE OUTCOMES:

On completion of this course, students will be able to

- CO1: Describe the fundamentals and different types of metal casting process.
- CO2: Explain the different types and processes of metal joining process.
- CO3: Explain the concepts of metal forming processes.
- CO4: Describe various sheet metal forming processes.

CO5: Explain the different processes used in making plastic parts.

PO/PSO	PO	PO	РО	РО	РО	PO	РО	PO	РО	PO	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М		L		1	E S		L	L	Ľ	L	М	Η		
CO2	М		L			L	24	L	Ľ	L	L	М	Н		
CO3	М		L			L		L	L	L	L	М	Н		
CO4	М		L			L		L	L	L	L	М	Н		
CO5	М		L			L		L	L	L	L	М	Н		
18PPC306	М		L			L		L	L	L	L	М	Н		

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COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H - High

18PMC3Z7

CONSTITUTION OF INDIA (Common to all Branches)

SEMESTER: III

PRE-REQUISITES: NIL

Category:MC

L T P C 3 0 0 0

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- * To know about Indian constitution
- * To know about central and state government functionalities in India
- * To know about Indian society

UNIT – I: INTRODUCTION	(9 Periods)							
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian								
Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy –								
Fundamental Duties – Citizenship – Role of the Election Commission.								
UNIT – II : STRUCTURE AND FUNCTION OF CENTRAL AND STATE	(0 Dominda)							
GOVERNMENT	(91 erious)							
Union Government - Structures of the Union Government and Functions - Pre	sident - Vice							
President- Prime Minister - Cabinet - Parliament - Supreme Court of India - Jud	dicial Review.							
State Government - Structure and Functions - Governor - Chief Minister	– Cabinet –							
State Legislature - Judicial System in States - High Courts and other Subordinate Courts	urts.							
UNIT – III : CONSTITUTION FUNCTIONS OF INDIA AND INDIAN	(0 Dominda)							
SOCIETY	(9 Periods)							
Indian Federal System - Central - State Relations - President's Rule - Constitutional	Amendments							
- Constitutional Functionaries - Assessment of working of the Parliamentary System	in India.							
Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion	, Language in							
India; Constitutional Remedies for citizens - Political Parties and Pressure Gro	ups; Right of							
Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sect	tions.							
UNIT – IV : POLICIES AND ACTS - GENERAL	(9 Periods)							
Insurance and Bonding - Laws Governing Sale, Purchase and use of Urban and	Rural Land –							
Land Revenue Codes - Tax Laws - Income Tax, Sales Tax, Excise and Custom d	uties and their							
Influence on Construction Cost – Legal Requirements for Planning – Property I	Law– Agency							
Law – Local Government Laws for Approval.								
UNIT – V: POLICIES AND ACTS ON INFRASTRUCTURE	(0 Dariada)							
DEVELOPMENT	(9 Periods)							
A Historical Review of the Government Policies on Infrastructure - Current Public	lic Policies on							
Transportations - Power and telecom Sector - Plans for Infrastructure Developm	ment – Legal							
framework for Regulating Private Participation in Roads and Highways - Ports and	d Airport and							
Telecom.								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

TEXT BOOKS:

- 1. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 2018
- 2. R.C.Agarwal, "Indian Political System", S.Chand and Company, New Delhi, 2004.
- 3. Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi,2007
- 4. K.L.Sharma, "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi, 2006.

REFERENCE BOOKS:

- 1. M.Laxmikanth, "Indian Polity", Mcgraw Hill Education (India) Private limited, 2016
- 2. Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi,2018

COURSE OUTCOMES:

On completion of the course, the students will able to

- **CO1:** Understand and abide the rules of the Indian constitution.
- **CO2:** Understand the functions of Central government.
- **CO3:** Understand the function of state government.
- **CO4:** Understand the various constitutional functions.
- **CO5:** Understand the different culture among the people of India.

PO/PSO	PO	PO	РО	РО	PO	PO	PO	PO	PO	PO	РО	PO	PSO	PSO	PSO
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						Μ	Μ					Μ			L
CO2				- 1		L		AP.	28075	¢.		М		L	
CO3						L		Rel	2	D		М			
CO4				0		L		18	1	7		L		L	
CO5						L	L	\leq				L		L	L
18PMC 3Z7						F	L	队				М		L	L

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate (Medium), H-High



METALLURGY LABORATORY AND THERMAL SCIENCE LABORATORY

Category: PC

L T P C

0 0 3 1.5

18PPC308

(A) METALLURGY LABORATORY

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To impart the skill of micro structural examination, defect examination and heat treatment of ferrous and nonferrous materials.

LIST OF EXERCISES
1. Study of Metallurgical microscope

- 2. Preparation of Specimen for micro-examination
- 3. Study of Iron carbon Equilibrium diagram
- 4. Study of Microstructure of materials

-Steel (low carbon steel, high carbon steel, HSS, Spheroidised steel)

-Cast iron (grey, white, SG)

-Non Ferrous (brass, Gun metal, aluminium, silicon alloy)

5. Study of Heat Treatment processes (Annealing, Normalizing, Hardening and Tempering)

6. Study of non-destructive tests

-Liquid penetrant test

-Ultrasonic inspection

-Magnetic particle inspection

-Radiography

7. Determination of Hardenability by Jominy end quench test.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 22.5 Periods Total:

Total: 22.5 Periods

COURSE OUTCOME

Upon completion of the course, the student will be able to

- CO1: Prepare specimen for microscopic examination
- CO2: Identify the microstructures of ferrous and nonferrous engineering components.
- **CO3:** Realize the effect of heat treatment on the properties of materials.
- CO4: Select suitable non-destructive tests for finding flaws in a material.
- CO5: Determine Hardenability by Jominy end quench test.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	М	Η	L	L		L			L		L		М		М
CO 2	М	Η	L	L		L			L		L		М		М
CO 3	М	L		L		L	L		L		L		М		М
CO4	Н	Μ	L	L		L			L		L		М		М
CO5	Н	Μ	L	L		L			L		L		М		М
18PPC308 (A)	Μ	Μ	L	L		L	L		L		L		М		М

L- Low, M – Moderate (Medium), H - High



18PPC308 (B) THERMAL SCIENCE LABORATORY

COURSE OBJECTIVES:

* To impart the skill of conducting tests on I.C engines, compressors and blowers for finding the performance and other related characteristic parameters.

LIST OF EXERCISES

- 1. Valve timing and port timing diagrams of single cylinder diesel engines.
- 2. Performance test on 4 stroke Diesel Engine using various loading devices.
- 3. Retardation test to find Frictional Power of a Diesel Engine.
- 4. Economical speed test on Diesel Engine.
- 5. Performance test on Constant speed blower.
- 6. Performance test on Variable speed blower.
- 7. Performance test on Reciprocating Air compressor.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods

Practical: 22.5 Periods

Total: 22.5 Periods

COURSE OUTCOME

Upon completion of the course, the student will be able to

- CO1: Find the opening / closing timings of valves or ports in engines.
- **CO2**: Conduct performance tests on diesel engines with different types of loading devices to access the performance.

CO3: Find Frictional Power and Economical Speed of a Diesel Engine.

CO4: Conduct performance tests on blowers to access the performance.

CO5: Conduct performance tests on reciprocating compressor to access the performance.

PO/PSO	PO	РО	PO	PSO	PSO	PSO									
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	М	Μ	L	L		М	Μ		L		L				М
CO 2	Н	Μ	L	L		Η	Н		L		М				Μ
CO 3	Н	Μ	L	L		Н	Н		L		М				М
CO4	Н	Μ	L	L		Н	Н		L		М				Μ
CO5	Н	Μ	L	L		Н	Н		L		М				Μ
18PPC308 (B)	М	Μ	L	L		М	Μ		L		L				Μ

COURSE ARTICULATION MATRIX:

L- Low, M – Moderate (Medium), H - High

52

18PPC309

Category: PC

PRE-R	EQUISITES:	
1.	18PPC406 - Machine Tools and Processes	

COURSE OBJECTIVES:

- * To practice various machining operations in lathe.
- * To practice operations in radial drilling, shaper, grinder, milling machine and gear cutting with gear hobbing, gear shaping, milling.

LIST OF EXERCISES

- 1. Study of construction details of different types of lathes and tools
- 2. Study of various accessories used in lathe.
- 3. Study of different types of tools used in lathe and the measuring instruments
- 4. Exercises on models using conventional Lathes:
 - * Facing, plain turning, step turning and parting
 - * Groove cutting, knurling and chamfering.
 - * Form turning and Taper turning
 - * Thread cutting (Internal and external -Vee and square)
- 5. V-Groove cutting in shaping machine.
- 6. Drilling, tapping and surface grinding using surface grinder and Radial drilling machine.
- 7. Spur gear milling.
- 8. Helical gear milling.
- 9. Gear shaping.
- 10. Gear hobbing.
- 11. Making hexagonal hole using slotting machine.
- 12. Letter cutting in vertical milling machine.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods

Total: 45 Periods

COURSE OUTCOME

Upon completion of the course, the student will be able to

- **CO1:** Explain the constructional details of different types of lathe.
- **CO2:** Perform various lathe machining operations.
- CO3: Set up machines like shaper, grinding and milling machine for various applications.
- **CO4:** Prepare gears using forming and generating methods of gear manufacturing.
- **CO5:** Operate machines tools for various assembly and fabrication tasks and expose to time management.



COURSE ARTICULATION MATRIX

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н					L	L	L	Н	Н	М	L	Μ		М
CO2	Н	Н	Н				М	L	Н	Н	М	L	М		М
CO3	Н	Н	Н				М	L	Н	Н	М	L	М		М
CO4	Н	Н	М		Н		М	L	Н	Н	М	L	М		М
CO5	Н	Н	М		Μ		Μ	L	Н	Н	М	L	Μ		Μ
18PPC309	Н	Н	М		М	L	L	L	Н	Н	М	L	M		М

L- Low, M – Moderate (Medium), H - High



TOTAL QUALITY MANAGEMENT CONCEPTS

Category: HS L T P C 3 0 0 3

PRE-REQUISITES: NIL

18PHS401

COURSE OBJECTIVES:

* To impart knowledge to develop a product with the required quality at a reasonable price and to satisfy the requirements under various quality standards

UNIT-I INTRODUCTION	(9 Periods)								
Definition of quality, dimensions of quality, quality planning, quality costs con	cepts - basic								
concepts of total quality management, principles of TQM, leadership concepts - quality council,									
quality statements, strategic planning- steps in strategic planning- Deming philosopl	ny, barriers to								
TQM implementation.									
UNIT- II TQM PRINCIPLES	(9 Periods)								
Customer satisfaction - customer perception of quality - customer retention	on, employee								
involvement - motivation, empowerment, performance appraisal, continu	ous process								
improvement - Juran trilogy, PDSA cycle, 5S concept, kaizen, supplier partnersh	nip - supplier								
rating – performance measures- Malcom Balridge National Quality Award.									
UNIT- III TOOLS AND TECHNIQUES	(9 Periods)								
Benchmarking - benchmarking process - quality function deployment (QFD) - hous	se of quality -								
Taguchi quality loss function - total productive maintenance (TPM) - pillars of T	PM - Failure								
Mode Effective Analysis (FMEA) - Failure rate- types of FMEA - stages of FMEA.									
UNIT- IV OLD AND NEW TQM CONCEPTS	(9 Periods)								
Seven old and new tools of quality - process capability. Six sigma - history -objecti	ves- concepts								
- implementation - methodologies - DMAIC - DMADV - case studies.									
UNIT- V QUALITY SYSTEMS	(9 Periods)								
Need for ISO 9000 and other quality system - ISO 9001:2015 quality system	– elements -								
implementation of quality system - documentation - quality auditing - QS 9000,	ISO 14000 -								
concept, requirements and benefits- integrating ISO 14000 with ISO 9000 - OSHSA	S 18001 – TS								
16949.									
10747.									

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Dale H.Besterfield "Total Quality Management", Pearson Education, 2008.
- 2. SubburajRamasamy "Total Quality Management", Tata McGraw Hill, 2008.

REFERENCE BOOKS:

- 1. James R.Evans & William M.Lidsay "The Management and Control of Quality", Thomson Learning, 2002.
- 2. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
- 3. Zeiri "Total Quality Management for Engineers", Wood Head Publishers, 1991.
- 4. John.LHradesky "Total Quality Management Hand book", McGraw-Hill, 1995

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Apply the principle of strategic planning, Deming philosophy and leadership concepts in industries.
- **CO2:** Apply the principle of TQM in industries.
- **CO3:** Select appropriate quality tools to meet industrial requirements.
- **CO4:** Apply the six sigma concepts in industries.
- CO5: Implement appropriate quality standards for industries.

COURSE ARTICULATION MATRIX															
PO/PSO	PO	PO	PO	PO	РО	РО	РО	РО	РО	РО	PO	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	Н			М	Pr.	X		∏ <i>F</i>		L	L	М	L	М
CO2	L	Н			М			E	L	1	L	L	М	L	М
CO3	L	Н			М	5	// 074	L	L		L	L	М	L	М
CO4	L	Н			Μ	1	E.	L	L		L	L	М	L	М
CO5	L	Н			М		L	L	L		L	L	М	L	М
18PHS401	L	Н			М	24	L	L	L		L	L	L	L	М

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H - High

56

Category: BS

LTPC 3 0 0 3

PRE-REOUISITES:

- 1. 18PBS202- Differential Equations and Complex Variables
- 2. 18PBS203- Introduction to Electromagnetism and Applied Physics

COURSE OBJECTIVES:

To improve the basic knowledge in Physics and its applications relevant to Mechanical & Production Engineering and Technology. Upon completion of this course the students will be familiar with:

- * Types of motions, oscillations and production of waves
- * Wave optics phenomenon, Huygens' principle, Interference of light
- * Basic principles in lasers, characteristics, types of lasers and its applications
- * Fiber optic principles and its applications.
- * Origin of quantum physics, Schrödinger's equation and its applications.

WAVES AND OSCILLATIONS UNIT- I (9 Periods) Introduction - Vibrational or Oscillatory Motion - Simple Harmonic Motion - Differential Equation of Simple Harmonic Motion and its Solution – Total Energy of a Harmonic Oscillator – Mass-String System - Horizontal Oscillation - Vertical Oscillations - Damped Harmonic Oscillator - Theory of Forced Vibrations - Resonance

UNIT-II WAVE OPTICS

Huygens' Principle-superposition of waves and interference of light - Air wedge - Theory -Applications - Testing of flat surfaces - Antireflection Coatings - Thickness of a thin sheet of paper -Michelson interferometer-Theory-Applications-Determination of wavelength of monochromatic light.

LASER OPTICS UNIT-III

Einstein's theory of matter radiation interaction and A and B coefficients-amplification of light by population inversion - different types of lasers - gas laser - CO2 - solid state laser - Neodymium Nd -YAG laser-dye laser-properties of laser beams - monochromaticity - coherence-directionality and brightness-Applications of lasers in cutting, welding, drilling and materials processing.

UNIT-IV **FIBER OPTICS**

Introduction - Basic Principles involved in fiber optics- Total internal reflection - Structure of optical fiber - Propagation of light through optical fiber - Derivation for Numerical Aperture and acceptance angle - fractional index change - Classification of optical fiber based on materials, refractive index profile and Modes - Fiber optical communication links - Fiber optic sensors -Temperature and displacement.

UNIT- V MATTER WAVES AND APPLICATIONS Dual nature of matter and radiation - Properties of matter waves-de-Broglie wavelength in terms of voltage, energy, and temperature - Physical significance of a wave function- Schrödinger's Time independent and Time dependent wave equations - Particle in a one dimensional potential well -Applications – Scanning Electron Microscope – Transmission Electron Microscope.

Contact Periods:

Lecture: 45 Periods **Tutorial: 0 Periods** Practical: 0 Periods **Total: 45 Periods**

(9 Periods)

(9 Periods)

(9 Periods)

(9 Periods)

TEXT BOOKS:

- 1. Hitendra K Malik and A K Singh **"Engineering Physics",** McGraw Hill, New Delhi, 2015.
- 2. Arumugam M "Engineering Physics", Anuradha Publishers, 2010.
- 3. P.K.Palanisamy **"Engineering physics-II",** Scitech publications (India) pvt. Ltd 2015 3 rd edition

REFERENCE BOOKS:

- 1. E.Hecht, "Optics", McGraw Hill Education, 2012.
- 2. D.J.Griffiths, "Quantum mechanics", Pearson Education, 2014.
- 3. H.J.Pain, "The physics of vibrations and waves", Wiley, 2006.
- 4. O.Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- CO1: Study the oscillations and motions for the production of waves.[Familiarity & Assessment]
- CO2: Study the waves and optics phenomena- applications [Familiarity & Assessment]
- CO3: Analyze the construction and working of different types of lasers and its applications [Familiarity & Applications]
- **CO4:** Understand the propagation of light waves through optical fibers, analyse the different types of fibers and its applications[**Familiarity & Application**]
- **CO5:** Analyze the dual nature of matter using de-Broglie matter waves, Schrodinger's time independent and dependent wave equations and itsapplication to quantum mechanical problems.[Familiarity & Application]

PO/PSO	РО	РО	РО	PO	РО	РО	РО	РО	PO	РО	РО	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н	М			М	Η	М						Η		
CO2	Н	М	М				L					Μ			
CO3		Н	М	М	L									Н	
CO4	М	Н		М	М										Η
CO5		М	М		L	М						Μ			
18PBS402	Н	М	М	М	L	М	L					Μ	Η	Н	Н

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

BASIC ELECTRONICS ENGINEERING (Common to MECH & PRODN Branches)

Category : ES

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* This course enables the students to understand semiconductor devices like diodes and transistors characteristics and applications. The students also have an exposure to digital fundamentals and 8085 microprocessor.

UNIT- I	SEMICONDUCTOR DEVICES AND APPLICATIONS	(9 Periods)						
Introduction	n to PN junction diode and VI characteristics – Half wave and F	ull wave rectifiers						
- Capacitor filters - Zener diode and its characteristics - BJT introduction - Operation and Characteristics - BJT as a single store CE amplifier - Erecuency response and Pandwidth								
Positive Fe	Characteristics – BJ I as a single stage CE amplifier – Frequency response and Bandwidth –							
Oscillator	edback – Darkhausen's enterna for ösemation – Ke Thase shift	and wenn bridge						
UNIT- II	OP-AMP AND ITS APPLICATIONS	(9 Periods)						
		() I (11003)						
Introduction	n to Op-amp – Op-amp input modes and parameters – Op-a	mp in open loop						
configuration	on – Op-amp with negative feedback – Study of practical o	p-amp IC 741 –						
Inverting a	nd Non-inverting amplifier applications: Summing and Differ	rence amplifier –						
Unity gain	Unity gain buffer – Comparator – Integrator and Differentiator.							
UNIT- III	DIGITAL ELECTRONICS FUNDAMENTALS	(9 Periods)						
Difference	between analog and digital signals – Boolean algebra – Basic and	d Universal Gates						
– Symbols,	Truth Tables, Logic expressions, Logic simplification using K-n	nap – Logic ICs –						
Half and Fu	Il adder/subtractor - Multiplexers and Demultiplexers - Flipflop	s-RS,JK,T,D .						
UNIT- IV	8085 MICROPROCESSOR ARCHITECTURE	(9 Periods)						
Block diag	ram of microcomputer - Architecture of 8085 - Pin configu	uration – Timing						
Diagram -	Instruction formats - Instruction set - Addressing modes -	Simple assembly						
language programs.								
UNIT- V	INTERFACING AND APPLICATIONS	(9 Periods)						
Interfacing of Input and output devices using 8255 - Applications of microprocessor -								
Temperature control – Stepper motor control – Traffic light control.								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Robert L.Boylestad "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education, 2009.
- 2. Ramesh S. Goankar "Microprocessor Architecture and Programming and Applications 8085", 6th Edition, Penram International Publishing (India) 2013

REFERENCE BOOKS:

- 1. S.Salivahanan, N.Sureshkumar and A.Vallavaraj "Electronic Devices and Circuits", 3rd Edition", Tata McGraw Hill, 2012.
- 2. Krishna Kant, "Microprocessor and Microcontroller Architecture, Programming and System Design using 8085,8086, 8051 and 8096", PHI, 2011.
- 3. Charles H.Roth, Jr, "Fundamentals of Logic Design", 6th Edition, Cengage Learning, 2010.

COURSE OUTCOMES

- Upon completion of the course, the student will be able to
- CO1: Exposure to semiconductor devices and its applications
- CO2: Knowledge on op-amp and its applications
- CO3: Ability to design basic digital logic circuits
- CO4: Understanding of 8085 architectures and programming
- CO5: Knowledge on interfacing and applications of 8085

PO/PSO	PO	РО	РО	PO	РО	РО	РО	РО	РО	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L				0			×	1			L	L		
CO2	М						SIL					L	М		
CO3	М	М	М		/	L		入	1			L	М	L	L
CO4	М	L				8	X			16		Μ	М		
CO5	М	М			М	R				80		Μ	М	L	М
18PES403	Μ	Μ	Μ		M	μĻ	200	E S	15000	1		L	М	L	L

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

Category: PC

PRE-REQUISITES:

L T P C 3 0 0 3

1. 18PES303 – Engineering mechanics

COURSE OBJECTIVES:

* To understand the basic principles in fluid mechanics and behavior study of fluid particles

under rest and moving conditions.

* To understand the moment principle in fluid mechanics and its application in flow through pumps and turbines.

UNIT- I	FLUID PROPERTIES	(9 Periods)					
Units and I	Dimensions - Fluid properties - Density, Specific gravity, Viscosi	ty, Surface					
tension, Cap	tension, Capillarity, Compressibility and Bulk modulus – Pascal's Law – pressure measurements						
- manometer	rs - Fluid statics - Total pressure and centre of pressure on submerged sur	faces					
UNIT-II	FLUID KINEMATICS AND DYNAMICS	(9 Periods)					
Types of flui	id flow and flow lines - control volume - continuity equation in one-dir	nension and					
three dimen	sion - velocity potential and stream function - Energy equation -	Euler and					
Bernoulli's e	equations – Applications of energy equations- Flow meters - Laminar an	d Turbulent					
flow through	flow through pipes – Hagen poisullie equation – Darcy Weisbach formula – Applications.						
UNIT- III	DIMENSIONAL ANALYSIS	(9 Periods)					
Need for di	mensional analysis - Dimensional Homogeneity - Rayleigh's and H	Buckingham					
methods of	dimensional analysis -Problems. Model study and Similitude - scale	effects and					
distorted mo	del.						
UNIT- IV	HYDRAULIC TURBINES	(9 Periods)					
Classification	n - construction, working principles and design of Pelton wheel, Francis	and Kaplan					
Turbines - he	ead, losses, work done and efficiency - specific speed - operating char	racteristics -					
Governing of	f Turbines – Problems.						
UNIT- V	PUMPS	(9 Periods)					
Classification	n of pumps - Centrifugal pump - working principle - discharge, wor	k done and					
efficiencies - Gear oil and Multistage pumps - Reciprocating pumps - work done and efficiencies							
- negative sli	p - air vessels - indicator diagram and its variation – Problems.						

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Rajput.R.K. "A TEXT BOOKS of Fluid Mechanics and Machinery", S.Chand and Company, NewDelhi, 2010.
- 2. Ramamrutham.S and Narayanan.R. "Fluid Hydraulics and Fluid Machines", Dhanpat Rai Publishing House (P) Ltd, New Delhi, 2010.
- 3. Modi.P.N. and Seth.S.M. "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard book house, Delhi, 2015.

REFERENCE BOOKS:

- 1. Streeter, Victor L .and Wylie, E.Benjamin, "Fluid Mechanics", McGraw Hill Ltd., 2017.
- 2. Natarajan.M.K., **"Fluid Machines",** AnuradhaAgencies, VidayalKaruppur, Kumbakonaam, 1998.
- 3. Kumar.K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi, 2008.

COURSE OUTCOMES:

- On completion of this course, the students will be able to
- **CO1:** Identify the importance of fluids properties and fluid principles at rest.
- CO2: Know the physical behaviour of fluids system and equations under moving conditions.
- **CO3:**To apply the concept of dimensional analysis for model study.
- **CO4:** To conduct the performance test on different types of turbines.

CO5: To conduct the performance study and selection of pumps for different applications

COURSE ARTICULATION MATRIX

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	М	Η	L	L	М				Ma						М
CO 2	Η	М	L	М	L		1	P	h	(L		М
CO 3	L	L	М	Η	L			The	1				L		М
CO 4	L	М	М	Η	L	2			-	L			М		Η
CO 5	L	М	М	Н	L	S DM	1)			L			Н		Μ
18PPC404	М	М	М	Η	L	ľ	2 /		X	L			L		Μ

L- Low, M – Moderate (Medium), H

Category: PC

LTPC

3 0 0 3

PRE-REQUISITES:

1. 18PES303 - Engineering mechanics

COURSE OBJECTIVES:

- * To understand the basic concepts of stress, strain, shear force, bending moment and deflection for different types of loading conditions.
- * To understand the deflection of beams, theory of columns and applications of torsion

UNIT- I	STRESS AND STRAIN	(9 Periods)							
Stress and stra	in at a point-Tension, compression, shear stresses - Hooke's law - Com	pound bars –							
lateral strain	- Poisson's ratio -Volumetric strain - Bulk modulus - Relationship a	mong elastic							
constants – st	constants - stress strain diagrams for mild steel, cast iron-Ultimate stress - Yield stress-Factor of								
safety - Thern	safety - Thermal stresses - Thin cylinders - Strain energy due to axial force - Resilience- Stress due								
to gradual load	to gradual load, suddenly applied load and impact load								
UNIT- II	SHEAR FORCE AND BENDING MOMENT	(9 Periods)							
Beams – Type	s of Beams - Types of loads, supports - Shear force - Bending moment -	- shear forces							
and bending	moment diagrams for cantilever, simply supported and over hanging	beams with							
concentrated	, uniformly distributed and uniformly varying load-Relationship bet	ween rate of							
loading, shear	force, bending moment- Point of contra flexure.								
UNIT- III	THEORY OF BENDING AND COMPLEX STRESSES	(9 Periods)							
Theory of ber	Theory of bending-Bending equation-Section Modulus-Stress distribution at a cross section due to								
bending mom	ent and shear force for cantilever, simply supported beams with point	, UDL loads							
(Rectangular,	circular, I & T sections only) -combined direct and bending stresses, Ker	nel of section							
(Rectangular,	Circular Sections only). 2D State of stress - 2D Normal and shear str	resses on any							
plane-Principa	al stresses and Principal planes-Principal Strains and direction-Mohr's cir	cle of stress.							
UNIT- IV	DEFLECTION OF BEAMS AND THEORY OF LONG	(9 Periods)							
	COLUMNS								
Determination	is of deflection curve – Relation between slope, deflection and radius of	curvature –							
Slope and def	lection of beam at any section by Macaulay's method - Concept of Con	njugate beam							
method (Theo	ry only)- Euler's theory of long Columns- Expression of crippling loa	d for various							
end condition	s-Effective length-Slenderness ratio-limitations of Euler equation - Ran	kine formula							
for columns.									
UNIT- V	THEORY OF TORSION	(9 Periods)							
Torsion of sha	fts - Torsion equation - Polar modulus- Stresses in Solid and Hollow circ	cular shafts -							
Torsional rigio	lity - Power transmitted by the shaft – Importance of angle of Twist -	Strain energy							
due to Torsio	due to Torsion - Modulus of rupture - Torsional resilience - Combined bending and Torsion-								
Stresses in he	lical springs - Deflection of helical spring-Leaf springs.								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Sadhu Singh "Strength of Materials", Khana Publishers, New Delhi, 2014.
- 2. Rajput.R. K "Strength of Materials", S. Chand & Company Ltd., New Delhi 2018.
- 3. James M.Gere "Mechanics of Materials", Thomson India, Brooks/cole, 2012.

REFERENCE BOOKS:

- 1. Dr.B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain "Mechanics of Materials", Lakshmi Publications Pvt Ltd, New Delhi, 2002.
- 2. Kazimi, "Solid Mechanics", Tata McGraw Hill, New Delhi, 2001.
- 3. Robert L.Mott "Applied Strength of Materials", PHI Learning Pvt. Ltd, New Delhi, 2009.
- 4. Jindal U C, "Textbook on Strength of Materials", Asian Books Pvt. Ltd., 2007.
- 5. Ramamrutham S and Narayan R "Strength of Materials", Dhanpat Rai and Sons, New Delhi, 2000.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Find the stress, strain and modulus for different materials.
- CO2: Understand the knowledge of shear force and bending moment diagrams of beams.
- CO3: Calculate the complex stresses in beams with different loading conditions.
- **CO4:** Find the deflection behaviour of beams and slender columns.
- **CO5:** Apply the concepts of torsion in shafts and springs.

PO/PSO	PO	РО	РО	РО	РО	РО	РО	РО	РО	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	L	Η		М	AG .	L	E	5	1:00	Ŋ			L	L	L
CO 2	L	М	Η	L	М	P		¢G	3)	L			L		L
CO 3		Η	L	Η	М					L			L		L
CO 4	М	Η	L	М	L								L		L
CO 5	L	Η		М		L							L		L
18PPC405	L	Η	L	М	М	L				L			L	L	L

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

Category: PC

L T P C 3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To study different machine tools and machining operations.

UNIT- I	FUNDAMENTALS OF METAL CUTTING	(9 Periods)					
Concepts of	orthogonal and oblique cutting - Mechanics of chip formation - Ty	pes of chips					
produced in cutting - Cutting forces and power-Temperature in cutting- Machinability-Tool life -							
Wear and failure-surface finish and integrity- Cutting Tool Materials-cutting fluids.							
UNIT- II	MACHINE TOOLS AND PROCESSES FOR PRODUCING ROUND SHAPES	(9 Periods)					
Engine Lath	e – functions; work holding devices in lathe – functions – Chuck, Centre,	Dogs, Steady					
Rest and Fo	llower Rest; Mechanism of lathe - Apron, Feed, Tumbler Gear; variou	us operations					
performed in	h Lathe – facing, turning, chamfering and knurling – relative positions of t	iool and job –					
Taper turnin	g methods. Drilling machines - specifications, types - feed mechanism,	operations –					
drill bit nom	enclature.						
UNIT. III	MACHINE TOOLS AND PROCESSES FOR PRODUCING	(9 Periods)					
	VARIOUS SHAPES	() Terrous)					
Milling – sp	pecifications - types - cutter nomenclature - types of cutters - milling	g processes –					
indexing – g	ear forming in milling – gear generation - gear shaping and gear hobbing.	. Broaching –					
specification	s, types, tool nomenclature, broaching operations. Shaper machine - blo	ck diagram –					
functions - Q	Quick return mechanism.						
UNIT- IV	ABRASIVE MACHINING AND FINISHING OPERATIONS	(9 Periods)					
Abrasives -	bonded abrasives - Grinding process- wheel, gear grinding operations an	d machines -					
grinding flu	ids - Design Consideration for Grinding - Finishing operations: Lapp	oing, Honing,					
Burnishing-	economics of grinding and finishing operation.						
UNIT- V	MACHINE TOOL STRUCTURE AND AUTOMATION	(9 Periods)					
Machine to	ols structures -erecting and testing of machine tools- Vibration and	1 chatters in					
machining-	machining- Automation: Capstan and Turret lathe - single spindle and multi spindle automats -						
Swiss type	Swiss type and automatic screw machines-Feeding Mechanisms-Transfer mechanism-Tracer						
controller M	controller Mechanism.						
Contact Peri	ods:						
Lecture: 45 I	Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Peri	iods					

TEXT BOOKS:

- 1. Hajra Choudhry S.K. and Bose S.K., "Workshop Technology Vol II", Media Promoters and Publishers Pvt. Ltd., Bombay, 12th edition, 2007.
- 2. Sharma P.C., "A TEXT BOOKS of Production Technology", S.Chand and Company Ltd., New Delhi, 10th Revised edition, 2010.

REFERENCE BOOKS:

- 1. Khanna, O.P and Lal, M "A TEXT BOOKS of Production Technology", Vol.II, DhanpatRai Publications (P) ltd., 1st Edition, 2009.
- 2. SeropeKalpakjian and Steven R.Schmid, "Manufacturing Engineering and Technology", Addison Wesley Longman (Singapore) Pte Ltd, Delhi, 2009.
- 3. Jain R.K. and Gupta S.C "Khanna Publisher", New Delhi, 17th edition, 2004.

COURSE OUTCOMES:

- On completion of this course, students will be able to
- CO1: describe about various machining processes and cutting tools.
- CO2: explain the processes involved in production of round shaped components.
- CO3: explain the processes involved in production of prismatic and contour shapes.
- **CO4:** discuss about various finishing operations.
- CO5: explain the machine tool structure and mechanisms of automation.

PO/PSO	PO	РО	PO	РО	PO	PO	PSO	PSO	PSO						
СО	1	2	3	4	5	6	79	8	9	10	11	12	1	2	3
CO1	Н	L		L	5	L	L	ľ	he	L	L	М	М	L	
CO2	Н		L		L	М	L	H	M		L	L	Η		М
CO3	Н		L		L	М	E	L	М		L	L	Η		М
CO4	Н		L		L	Μ	L	L	М		L	L	Н		М
CO5	М	Μ	Н	М	H	M	M	L	L	М	L	М	Н	М	Н
18PPC406	Н	L	L	L	14	М	L	L	L	Ľ	L	L	Н	L	М

COURSE ARTICULATION MATRIX

L – Low, M- Moderate (Medium), H - High

18PMC4Z7

ENVIRONMENTAL SCIENCES AND ENGINEERING

SEMESTER: IV

(Common to all Branches)

Category : MC

L	Т	Р	С
3	0	0	0

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* The course is aimed at creating awareness among students and also to inseminate the critical ideas of preserving environment.

UNIT I: ENVIRONMENTAL RESOURCES	(9 Periods)					
Natural resources-Forest – benefits, over exploitation, deforestation & consequences – Water- unique features, hydrological cycle & over exploitation – Food -effect of modern agriculture, fertilizers, pesticides, eutrophication & biomagnifications- Energy resources - renewable & non-renewable resources - wind, solar and tidal-harnessing methods.						
UNIT II: ECO SYSTEM AND BIODIVERSITY	(9 Periods)					
Ecology - ecosystem, physical and chemical components of ecosystem, biological components of ecosystem, forest ecosystem, desert ecosystem and pond ecosystem, Energy flow in ecosystem, nitrogen cycle and carbon dioxide cycle, food pyramid, Ecological succession, Biodiversity - types, values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity - in situ - ex situ conservation						
UNIT III: ENVIRONMENTAL POLLUTION						
Air pollution, classification of air pollutants – sources, effects and control of gaseous pollutants SO_2 , NO_2 , H_2S , CO , CO_2 and particulates, control methods - cyclone separator and electrostatic precipitator, water pollution - classification of water pollutants, organic and inorganic pollutants, sources, effects and control of water pollutants, soil pollution - sources, effects and control noise pollution - decibel scale - sources - effects and control						
UNIT IV: ENVIRONMENTAL THREATS	(9 Periods)					
Acid rain, greenhouse effect, global warming and ozone depletion, disaster manage drought, earthquake and tsunami, Threats to biodiversity-destruction of h fragmentation- hunting, over exploitation and man-wildlife conflicts, The IU categories, status of threatened species.	ment - flood, abitat, habit ICN red list					
UNIT V: SOCIAL ISSUES AND ENVIRONMENT	(9 Periods)					
Sustainable development- sustainable technologies, need for energy and water conservation, rain water harvesting, water shed management, waste land reclamation, Pollution control Act, Wild life protection act, Forest conservation act, population growth- exponential and logistic growth, variation in population among nations, population policy, women and child welfare programs, role of information technology in human and health, HIV/AIDS - effects and preventive measures.						

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods
TEXT BOOKS:

- 1. Sharma J.P., "Environmental Studies", 3rd Edition, University Science Press, New Delhi 2009.
- 2. Anubha Kaushik and C.P.Kaushik, **"Environmental Science and Engineering"**, 3rd Edition, New age International Publishers, New Delhi, 2008.

REFERENCE BOOKS:

- 1. R.K.Trivedi, "Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards", Vol.1&II, Environ Media, 2006.
- 2. G.TylerMiller, JR, "Environmental Science", Tenth Edition, Thomson BROOKS / COLE Publishing, 2004.
- *3. Gilbert M.Masters,* **"Introduction to Environmental Engineering and Science",** 2nd Edition, *Pearson Education,* 2004.

COURSE OUTCOMES:

Upon the completion of the course, Students will be able to

- **CO1:** To know about the various environmental resources, the effective utility and problems accompanied in over exploitation.
- **CO2:** To acquire knowledge about the interaction of biosphere with environment and conservation methods of bio diversity.
- **CO3:** To be aware of the sources of various types of pollution, their ill effects and preventive methods.
- **CO4:** To understand the environmental threats, Acid rain, Green house effect and Ozone depletion and natural disasters.
- **CO5:** To create an idea about sustainable development and social issues.

СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	М	L	Η	L	Μ	М	Μ	Μ	Μ	М	L	L	L	L	М
CO2	М	L	L	L	L	L	L	L	L	L	L	L	М	L	L
CO3	L	L	Η	L	L	L	М	М	L	М	L	L	L	L	L
CO4	L	L	Η	L	L	L	L	L	L	L	L	L	L	L	L
CO5	М	L	Η	L	L	L	Η	Η	L	М	L	L	М	L	М
18PMC4Z7	Μ	L	Η	L	L	L	М	М	L	М	L	L	L	L	L

COURSE ARTICULATION MATRIX:

L	Т	Р	С
0	0	3	1.5

PRE-REQUISITES:

1. 18PES303 – Engineering Mechanics

COURSE OBJECTIVES:

- * To understand the basics of different testing methods for different materials.
- * To study the behaviour of fluid system in pumpsand turbines.

18PPC408 (A) STRENGTH OF MATERIALS LABORATORY

LIST OF EXERCISES

- 1. Tension Test on steel rods using Universal Testing Machine.
- 2. Bending Test on rolled steel Joist Beam.
- 3. Double shear test on mild steel rod.
- 4. Torsion Test on Mild steel rod
- 5. Tension and Compression Test on Springs
- 6. Deflection test on simply supported aluminium beam
- 7. Deflection Test on Cantilever Beam
- 8. Hardness tests on metals like Mild Steel, Brass, Copper and Aluminium
- 9. Bend Test on Steel rod
- 10. Compression Test
- 11. Impact test-izod and charpy

18PPC408 (B) FLUID MACHINERY LABORATORY

LIST OF EXERCISES

- 1. Determination of Darcy's friction factor
- 2. Calibration of Flow Meters
- 3. Flow through Mouth Piece
- 4. Performance study on Centrifugal pump
- 5. Performance study on reciprocating pump
- 6. Performance study on Submersible Pump
- 7. Performance study on Gear oil Pump
- 8. Load test on Pelton Wheel Turbine
- 9. Load test on Kaplan Turbine

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Apply knowledge of compression, tension, shear and torsion testing procedures on materials.
- **CO2:** Know the deflection and bending behaviour of different types of beams.
- **CO3:** Find the hardness of different metals.
- **CO4:** Find the flow properties of fluids at different places.
- **CO5:** Conduct performance tests on pumps and turbines and draw the performance curves.

PO/PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	Н	Μ	L	L					М				L		L
CO 2	М	Η	L	М	L				L				L		L
CO 3	L	Η		М	Va	L'		103	L	3			L		L
CO 4	М	Η	L	L	M	No.	190 B	R.		Ì			L		
CO 5	L	Μ	М	Η	K	1			E.	$^{\rm L}$			L		
18PPC408	Μ	Η	L	Μ	L	L		Å	L	L			L		L

COURSE ARTICULATION MATRIX



18PPC409

SEMESTER: IV

Category: PC

L T P C 0 0 3 1.5

PRE-REQUISITES:

18PES106 - Engineering Graphics

COURSE OBJECTIVES:

- To provide hands on training on assembly drawing and impart knowledge on various types of machine parts & joints.
- * To create knowledge about important features of assembled parts used in major engineering applications.

UNIT- I	CONVENTIONS, ABBREVIATIONS AND SYMBOLS	(4 Periods)								
Interrupted views- Partial views of symmetrical objects- Conventional representation of intersection curves- Square ends and openings, adjacent parts- Common machine elements.										
UNIT- II	NIT- II FITS AND TOLERANCES (6 Periods)									
Description systems- So Geometrica	Description of tolerances and grades- Types of fits and their description- Shaft and hole basis systems- Selection of fits from standard tables- Fits for different applications- Examples-Geometrical tolerances- Surface finish conventions.									
UNIT- III	PREPARATION OF ASSEMBLY DRAWINGS AND COMPONENT DRAWINGS	(35 Periods)								
Cotter joint, Knuckle joint, Flange coupling, Universal coupling, Foot step bearing, Plummer block, Connecting rod ends, Cross heads, Screw jack, Lathe tailstock, Stop valves, Non-return valve.										
Contact Peri	ods:									

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Gopalakrishna K.R "Machine Drawing in First Angle Projection", Subhas Stores, Bangalore, 2007,
- 2. Bhatt.N.D "Machine Drawing", Charotar Publishing House Pvt. Ltd., 49th edition, 2013.

REFERENCE BOOKS:

- 1. Gill.P.S., **"TEXT BOOKS of Machine Drawing",** S.K.Kataria and Sons, Publishers and Distributors, Delhi, 2013.
- 2. PSG College of Technology "PSG College of Technology", KalikathirAchchagam, 2012.
- 3. Narayana K.L., Kannaiah.P., VenkataReddy.K., "Machine Drawing", New Age International Publishers, 2009.

COURSE OUTCOMES:

- On completion of this course, students will be able to
- **CO1:** Describe the conventions in assembly drawing
- **CO2:** Describe the Fits and Tolerances
- **CO3:** Describe the Geometric Dimensioning & Tolerancing
- CO4: Incorporate the parts for to assemble
- **CO5:** Construct an assembly drawing of various machine unit

COURSE ARTICULATION MATRIX

PO/PSO	PO	PO	PO	PO	PO	РО	РО	РО	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М				М			М	L	М		М	М		
CO2	М				Н			М	М	М		М	М		
CO3	М				Н		1	m Der	М	М		М	М		
CO4					М	b		Re	\mathbf{L}^{\prime}	M		М	М		
CO5	Н				Н	М		М	М	M			М		
18PPC409	М				Н	М		М	М	М		М	М		



Category: HS

L	Т	Р	С
3	1	0	4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To provide an in-depth understanding of definition, scope, objectives, phases, models & limitations of operations research.
- * To familiarize various tools of optimization, decision making and simulation, as applicable in particular scenarios in industry for better management of various resources.

UNIT- I	LINEAR MODELS	(9+3 Periods)							
The phases	of operations research study- formation of Linear programming m	odel - Graphical							
Simplex met	hod.	- Duanty - Duar							
UNIT- II	TRANSPORTATION, ASSIGNMENT AND SEQUENCING PROBLEMS	(9+3 Periods)							
Transportati	on Models – Formulation – Basic feasible solution by North West	Corner method -							
Least Cost Method - Vogel's Approximation Method- Optimality test - MODI method - Degeneracy. Assignment problem - formulation – Hungarian method – unbalanced assignment problem. Sequencing problem: processing 'n' jobs through two machines and three machines, processing two jobs through 'n' machines									
UNIT- III	NETWORK MODELS	(9+3 Periods)							
Shortest rou PERT netwo	te - Minimal spanning tree - Maximum flow models - Project networks - Critical path scheduling – Cost analysis and Crashing the networks	work - CPM and ork.							
UNIT- IV	QUEUEING THEORY AND SIMULATION	(9+3 Periods)							
Queueing models - Queueing systems and structures - Notation - parameter - Single Server and multi server models-Poisson input-exponential service –constant rate service- infinite population. Simulation- random number generation- application of simulation for queuing and maintenance.									
UNIT- V	DECISION MODELS	(9+3 Periods)							
Game theory - Two person zero sum games - Graphical solution- Algebraic solution.									
Replacemen	t models - Replacement of items that deteriorate with time –	value of money							
individual and group replacement policy									
individual and group replacement policy.									

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS:

- 1. P.K. Gupta and D.S. Hira "Problems in Operations Research (Principles and Solutions)", S.Chand and Co. Ltd., 2013.
- 2. Panneerselvam, R "Operations Research", 2nd Edition, Prentice Hall of India, New Delhi, 2006.

REFERENCE BOOKS:

- 1. Taha H.A "Operations research", 8th Edition, Prentice Hall of India, New Delhi, 2006.
- 2. Sharma S.D, "OperationsResearch", Kedarnath Ram Nath and Co.Meerut, 2009.
- 3. Don. T. Phillips, Ravindren A and James Solberg "Opeartions research", John Wiley and sons, 1987.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Identify and formulate operational research models from the verbal description of a real system.
- **CO2:** Apply operations research techniques like L.P.P, Scheduling, Sequencing, Transportation problems to Industrial optimization problems.
- **CO3:** Use network scheduling techniques like PERT, CPM for solving project management problems.
- **CO4:** Analyze various models and apply suitable analytical method or simulation technique to solve queuing problems.
- **CO5:** Apply suitable decision making tools for Replacement and Game theory problems for achieving optimization.

PO/PSO	PO	PO	PO	PO	РО	РО	РО	РО	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	М				N	2	1							М
CO2	М	Н	М	L						U					М
CO3	М	Н	L		Y	E C	22	304	ST ST	h	Η				М
CO4	М	Н	М	L											М
CO5	М	Н	М	L											М
18PHS501	М	Η	М	L							Η				М

COURSE ARTICULATION MATRIX

PRE-REQUISITES: NIL

L	Т	Р	С
3	0	0	3

COURSE OBJECTIVES:

* To study various production planning and control activities in industries

UNIT- I INTRO	DUCTION	(9 Periods)						
Objectives and ben	efits of planning and control-Functions of production con	trol-Types of						
production-job- bate	h and continuous-Product development and design-Market	ting aspect -						
Functional aspects-O	perational aspect-Durability and dependability aspect-aesthetic	aspect. Profit						
consideration-Standar	rdization, Simplification and specialization-Value analysis.							
UNIT-II COST	ESTIMATION	(9 Periods)						
Importance, Types, I	Purpose, Components, Procedure, Classification of costs, Cost	elements,Cost						
ladder, Overhead exp	penses, Break-even analysis - Concept, make or buy decision,	, assumptions,						
merits and demerits	of break even analysis. Applications - Linear, multi produ	ct break-even						
analysis.								
UNIT-III WORK	K STUDY	(9 Periods)						
Productivity - concep	Productivity - concepts - Method study, basic procedure, Selection criteria, Recording techniques -							
Motion study, princip	oles, Micro motion and memo motion study - Work measuremen	t - Time study						
- Steps in making tim	e study, Computation of standard time - Other work measurement	nt techniques						
UNIT- IV OPER	ATIONS PLANNING AND SCHEDULING	(9 Periods)						
Components of opera	tions planning and scheduling systems – Aggregate planning – I	MPS – MRP –						
Capacity Planning, P	rocess – Routing, Techniques – Scheduling, Principles, Types	and Strategies						
Methodology - Dispa	tching-Progress reporting and expediting-Lead time, Technique	es for aligning						
completion times and	due dates							
UNIT- V MATE	RIALS PLANNING AND CONTROL	(9 Periods)						
Materials Planning and control, scope, Techniques – Purchasing, Functions, Methods, Procedure,								
parameters, Supplier selection – Make or Buy Decision – Store and storekeeping, Codification,								
Functions, Organising	g, Methods, Accounts of stores, valuation methods, storage, prote	ection and						
Interrelationship.								

Contact Periods:

Lecture: 45Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Samson Eilon **"Elements of production planning and control",** Universal book traders, 2014.
- 2. Stephen N. Chapman "The fundamentals of production planning and control", Pearson education, 2009.
- 3. Anil Kumar, Suresh "Production and Operations Management", New Age international, 2018.

REFERENCE BOOKS:

1. Mart and Telsang, "Industrial Engineering and Production Management", S. Chand and Company, First edition, 2011.

COURSE OUTCOMES

On completion of this course, students will be able to

- **CO1:** Describe the various aspects of product development
- CO2: Explain about the method, motion studies and work measurement
- CO3: Explain about various techniques of operations planning and scheduling
- CO4: Describe various aspects of materials planning and control
- **CO5:** Explain about the theory of constraints and significance of purchasing and distribution.

PO/PSO	PO	PO	PO	PO	PSO	PSO	PSO								
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	L	L	1	61	35	2	36	19and	L	Μ	L			М
CO2	М	М		М	L	60		R		L	Η	L			М
CO3	L	М	L	L	L	1		1	-		М	L			М
CO4	М	L	L	L	L	1	1	小		М	Η	L			М
CO5	М	М	М	L	L				2	L	М	L			М
18PPC502	М	М	L	L	L	B		入		L	Η	L			М

COURSE ARTICULATION MATRIX



L	Т	Р	C
3	0	0	3

PRE-REQUISITES:

- 1. 18PES303 Engineering mechanics
- 2. 18PPC405 Mechanics of Materials

COURSE OBJECTIVES:

- * To familiarize the basic concepts of mechanisms and machinery.
- * To make the students to know the importance of balancing and the effect of friction and vibration in different machine parts.
- * To make the students to learn about various gear train configurations and kinematic analysis

Angen BILLING STORATS

of cam-follower motion.

UNIT- I	MECHANISMS	(9 Periods)										
Machine str Slider crank analysis and simple mech	Machine structure - Kinematic link, pair and chain-Constrained motion- Degrees of freedom- Slider crank and crank rocker mechanisms - inversions, applications - Introduction to Kinematic analysis and synthesis of simple mechanisms - Determination of velocity and acceleration of simple mechanisms.											
UNIT- II	FRICTION	(9 Periods)										
Types of fric and V) and I for maximum	Types of friction - Friction in pivot, collar and thrust bearings - Plate and disc clutches - Belt (flat and V) and Rope drives - Ratio of tensions - Effect of centrifugal and initial Tension - Condition for maximum power transmission.											
UNIT- III	GEARING AND CAMS	(9 Periods)										
Gear – Typ interference and reverted Types of car	bes and profile – nomenclature of spur and helical gears – laws – requirement of minimum number of teeth in gears – gear trains – simple gear trains – determination of speed and torque in epicyclic gear trains ns and followers – Cam design for different follower motions.	of gearing – le, compound iins – Cam –										
UNIT- IV	BALANCING	(9 Periods)										
Static and d secondary ba	Static and dynamic balancing - Single and several masses in different planes - Primary and secondary balancing of reciprocation masses – Balancing of single and multi cylinder engines.											
UNIT- V	VIBRATION	(9 Periods)										
Free, forced supports - v multi rotor s	and damped vibration of single degree of freedom systems - force T ibration isolation - vibration absorption - torsional vibration of shaft ystems-Critical speed of shafts.	ransmitted to – Single and										

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Rattan, S.S. "Theory of Machines", Mc Graw-Hill Education (I) Private Ltd., New Delhi, 2015.
- 2. Bansal Dr.R.K. and BrarDr.J.S. "Theory of Machines", Laxmi Publications (P) Ltd., New Delhi, 2016.

REFERENCE BOOKS:

- 1. Uicker, J.J., Pennock G.R and Shigley, J.E "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press, 2009.
- 2. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
- 3. Robert L. Norton "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
- 4. Rao, J.S. and Dukkipati R.V. "Mechanism and Machine Theory", Second Edition, Willey Eastern Ltd., 1992.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain the basics concepts of various mechanisms and to do velocity and acceleration analysis of simple mechanisms.
- CO2: Describe the effect of friction on power transmission.
- **CO3:** Discuss the basic principles of gears and cams.
- **CO4:** Perform static and dynamic balancing of high speed rotary and reciprocating machines.

CO5: Analyze free and forced vibrations of machines, engines and structures.

PO/PSO	РО	PO	РО	PO	РО	PSO	PSO	PSO							
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	Η											М		
CO2	М	Η											М		
CO3	М	Η										L	М		
CO4	М	Η										L	М		
CO5	М	Η										L	М		
18PPC503	М	Н										L	М		

L- Low, M - Moderate (Medium), H - High

PRE-REQUISITES: NIL

L	Т	Р	С
3	0	0	3

COURSE OBJECTIVES:

* To impart knowledge on different kind of traditional and latest computer aided measuring instruments with appropriate parameters of measuring components.

UNIT- I	GENERAL CONCEPTS OF MEASUREMENT	(9 Periods)
Definition – fits and tole Principles of gauges.	standards of measurement – accuracy and precision – errors in measuremerances – interchangeability and selective assembly – calibration of f light interference – measurements and calibration – Taylor's principles	nent –limits, instruments. 3 - design of
UNIT- II	LINEAR AND ANGULAR MEASUREMENTS	(9 Periods)
Linear meas bore gauges level, sine ba	uring instruments: Vernier instruments, micrometers, height gauge, dia , slip gauges, comparators. Angle measuring instruments: bevel protr ar, autocollimator, angle dekkor and clinometers – interferometry.	l indicators, actors, sprit
UNIT- III	FORM MEASUREMENT	(9 Periods)
Screw threa methods - er tooth termin thickness co - Stylus pre Flatness and	d terminology- Measurement of effective diameter by two wire and rors in threads-Measurement of pitch, profile errors and total composite nology-Methods of measurements of runout, pitch, profile, lead, back mposite method of inspection - Parkinson gear tester, Measurement of su obe instruments - profilometer-Tomlinson and Talysurf instrument-S Roundness measurement.	three wire errors, Gear klash, tooth urface finish Straightness,
UNIT- IV	LASER METROLOGY	(9 Periods)
Laser in eng laser – laser optical meth	ineering metrology – methods of laser metrology – precision instrumer interferometer – applications of laser in industry – linear and angular me ods for fast non contact online measurement – scanning laser beam.	its based on asurement –
UNIT- V	COMPUTER AIDED INSPECTION	(9 Periods)
Automated process mon – automatic CMM using	inspection - online and offline inspection, sensor technology for ma itoring and inspection - flexible inspection systems – non contact inspect gauging and size control system – co ordinate measuring machine – electro optical sensors for dimensional metrology – non contact sensors	anufacturing ion methods non contact s for surface

finish measurements – machine vision systems and its applications.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Gupta. I.C "A TEXT BOOKS of Engineering Metrology", Dhanpat Rai and Sons, Delhi, 2012.
- 2. Groover M.P "Automation, Production systems and Computer Integrated Manufacturing", Prentice Hall India Ltd.,

REFERENCE BOOKS:

- 1. Jain.R.K., "Engineering Metrology", Khanna Publishers, Delhi, 2015.
- 2. Gayler G.N., and Shotbolt C.R "Metrology for Engineers", ELBS Edn.
- 3. ASTE "Hand book of industrial metrology", CRC Press.
- 4. Marvin J.Weber, "Hand book of LASERS", CRC Press.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** understand the general concepts of linear and angular measurements.
- **CO2:** describe various geometric and form measurements.
- CO3: explain about recent measuring machines and advances in metrology.
- CO4: describe various measurement concepts involved in laser metrology.

CO5: explain the basic concepts of computer aided inspection

PO/PSO	PO	PO	PO	РО	РО	РО	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η			L		E			X	1999		М	L		М
CO2	М	L		М	19	36	12		DEUD	Ì		L	L		М
CO3	М			Н		3		×G	D			М	L		М
CO4	М		L	М								М	L		М
CO5	М		L	Н								М	L		М
18PPC504	Η	L	L									М	L		М

COURSE ARTICULATION MATRIX

18PPC507

Category: PC L T P C 0 0 3 1.5

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To familiarize the basic concepts of measurements, various linear, angular and form measuring equipment, and their principles of operation.

LIST OF EXERCISES

- 1. Study and use of Measuring Instruments.
- 2. Calibration of Dial gauge using Dial Calibration Tester.
- 3. Measurement of external taper angle using sine bar and slip gauges.
- 4. Measurement of internal and external dovetail angle using rollers.
- 5. Measurement of internal angle using spheres.
- 6. Measurement of external angle using rollers and slip gauges.
- 7. Measurement of spur gear tooth thickness using gear tooth verniercaliper.
- 8. Measurement of internal diameter and depth of the cylinder using spheres.
- 9. Measurement of effective diameter and pitch of screw thread using three wire method and pitch gauge.
- 10. Optical profile projector Measurement of gear tooth parameters and screw thread parameters.
- 11. Tool maker's microscope Measurement of cutting tool geometry and screw threads parameters.
- 12. Straightness measurement using Autocollimator.
- 13. Study of Co-ordinate Measuring Machine.
- 14. Study of surfcorder for surface roughness measurement.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain the general concepts of measurements.
- CO2: Apply and Identify correct symbols, abbreviations and units for all measurements.
- CO3: Perform some linear, angular and form measurements, and record observations.
- **CO4:** Calibrate the measuring instruments.
- **CO5:** Explain about various methods of traditional and modern measurements that are used in the industry to measure product dimensions.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	L							М	L			L		М
CO2	L				L	L			М	L			L		М
CO3	L	Η							М	L			L		М
CO4	L	Η							М	L			L		М
CO5	L	Η			М				М	L			L	М	М
18PPC507	L	Η			L	L			М	L			L	L	М



PRE-REQUISITES: NIL

Category: EEC

L	Т	Р	С
0	0	4	2

COURSE OBJECTIVES:

- * To provide an opportunity to the student to get an industrial exposure and training in the field of one or more relevant courses of a specific programme or inter disciplinary engineering streams.
- * To provide an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

The students may undergo Industrial training / Internship at Research organization / Reputed firms satisfying prescribed qualifications set by the department (after due approval from the HOD) for a period of not less than two week during summer vacation. In this case, the training has to be undergone continuously from one organization only. At the end of Industrial training / Internship, the student shall submit a detailed report on the training under gone and a certificate from the organization concerned. If the student does not have the offer for Industrial training / Internship, the student may instead do a project on a topic of interest related to area of study.

The progress of the Industrial training / Internship / Project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The Industrial training / Internship / project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 60 Periods Total: 60 Periods

COURSE OUTCOMES

On completion of this course, students will be able to

- **CO1:** Practice acquired knowledge within the chosen area of technology for project development.
- **CO2:** Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
- CO3: Reproduce, improve and refine technical aspects for engineering projects.
- CO4: Follow and value health, safety and ethical practices during project.
- CO5: Work as an individual or in a team in development of technical projects.
- CO6: Communicate and report effectively project related activities and findings.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	М		М		L			L		L	М	Μ	L	
CO2	Μ	Η	Н	Μ	Η	Μ	L		Η	L	Η	Μ	Η	Η	Н
CO3	Η	Η	Η	Μ	Η	Μ	L		Η	L	Η	Η	Η	Η	Н
CO4						Μ	L	Η	L		Η	L			
CO5									Η	L	Η	Η	Η	Η	Н
CO6									М	Η	Μ	М			
18PEE508	Н	Н	Н	Μ	Η	Μ	L	Η	Η	Η	Η	Η	Η	Н	Н



L	Т	Р	С
3	1	0	4

(9+3 Periods)

PRE-REQUISITES:

1.18PES303 - Engineering Mechanics

2.18PPC405 - Mechanics of Materials

3.18PPC503 - Mechanics of Machines

COURSE OBJECTIVES:

- * To familiarize the various steps involved in the Design Process.
- * To make the students to learn the designing procedure for shafts, energy storing elements and flexible elements like Belt, Pulley and chain etc.
- * To train the students to design the different type of bearings and gears using standard procedure.

UNIT- I	PRINCIPLES OF DESIGN	(9+3 Periods)									
Fundamentals of Machine Design - Phases of Design, Design Consideration - Standards and Codes - Selection of Materials - Design against Static and Dynamic Load - Modes of Failure, Factor of Safety, Principal Stresses, Theories of Failure - Stress Concentration, Stress Concentration Factors, Variable Stress, Fatigue Failure, Endurance Limit, Design for Finite and Infinite Life, Soderberg and Goodman Criteria.											
UNIT- II	SHAFTS AND BEARING	(9+3 Periods)									
Design of sol and rolling co	id and hollow shafts based on strength, rigidity and critical speed. S ontact bearings.	liding contact									
UNIT- III	JOINTS, COUPLINGS AND SPRINGS	(9+3 Periods)									
Design of we and leaf sprin	lded joints, Bolted joints (brackets) - Design of flange couplings - Desi gs.	gn of helical									
UNIT- IV	FLEXIBLE ELEMENTS	(9+3 Periods)									
Calastian of f	Let and W halfs and multices. Dalland halfs										

Selection of flat and V belts and pulleys. Roller chains.

UNIT- V GEARS AND GEAR BOXES

Design of spur and helical gears based on strength and wear considerations. Design of gear box: geometric progression - standard step ratio - ray diagram, kinematic layout - design of sliding mesh and constant mesh gear box.

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

TEXT BOOKS:

- 1. Bhandari V "Design of Machine Elements", Tata McGraw-Hill Book Co,3rd Edition, 2010.
- 2. Sharma, P.C., Aggarwal, D.K "A TEXT BOOKS of Machine Design", Kataria and sons., 2012.

REFERENCE BOOKS:

- 1. Shigley, J.E., and Mischke, C.R "Mechanical Engg. Design", McGraw-Hill Book Co., 8th edition, 2008.
- 2. Dobrovolsky, V., "Machine Elements", A TEXT BOOKS, MIR Publishers.
- 3. Spotts, M.F "Design of Machine Elements (6th ed.)", Prentice Hall of India Pvt.Ltd.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Estimate safety factors of simple structures exposed to static and repeated loads.
- **CO2:** Design the shafts and bearings.
- **CO3:** Design the welded joints, bolted joints, couplings and springs.
- **CO4:** Design the drives chain drives and belt drives.

CO5: Design the spur gears, helical gears and gear boxes

PO/PSO	PO	PO	PO	РО	РО	РО	PSO	PSO	PSO						
СО	1	2	3	4	5	6	7 	8	9	10	11	12	1	2	3
CO1	Μ	Η	L				奥			2		L	М	М	Η
CO2	М	Н	L		1			30	- 7	7		L	Н	М	Н
CO3	М	Н	L				SW					L	Η	М	Η
CO4	Μ	Η	L			Ŕ						L	Н	М	Η
CO5	М	Н	L		A	83	1		1			L	Η	М	Η
18PPC601	М	Н	L						\sim	396		L	Н	М	Н

COURSE ARTICULATION MATRIX

18PPC602

SEMESTER: VI

Category: PC L T P C 3 0 0 3

PRE-REQUISITES:

18PPC406 - Machine Tools and Processes

COURSE OBJECTIVES:

- * To provide knowledge on various automated manufacturing activities.
- * To familiarize the application of computer Technology in the manufacturing activities.
- * To enable the students to understand the smooth transition from conventional manufacturing to automated production and computer integrated manufacturing.

UNIT- I	FUNDAMENTALS OF AUTOMATION AND CIM	(9 Periods)							
Concept of a	utomation - Basic Elements of an Automated system - Advanced	automation							
functions – L	evels of Automation - Ten Strategies for Automation, Concept of a	utomation in							
industry - clas	ssification, mechanization and automation. Evolution of CIM - CIM H	ardware and							
Software – Da	ata base Requirement of CIM - Concurrent engineering - Principles -	- Design and							
development.	Production economics.								
UNIT- II	AUTOMATION IN MANUFACTURING	(9 Periods)							
Automation in	n machine tools - Mechanical feeding and tool changing - machine	tool control							
transfer automaton, automated flow lines - Methods of work part transport transfer - Line									
efficiency. Simulation in assembly line - Analysis of Automated flow lines - General terminology									
and analysis of transfer lines - without and with buffer storage, partial automation,									
Implementatio	on of automated flow lines. Buffer stock - Mechanical buffer sto	rage control							
function.									
UNIT- III	AUTOMATED MATERIAL HANDLING AND STORAGE	(9 Periods)							
	SYSTEMS								
Storage syste	m performance, Storage location strategies, Conventional storage r	nethods and							
equipment. A	utomated storage systems-Automated Storage/Retrieval systems, Carc	ousel storage							
systems. Eng	ineering analysis of storage systems. Industrial Robot applicati	ons-Material							
handling, Proc	cessing operations, Assembly and Inspection.								
UNIT- IV	GROUP TECHNOLOGY AND FMS	(9 Periods)							
Group Techno	ology - Part families - Part Classification and Coding - Production flow	w Analysis –							
Cellular man	ufacturing - Cell design - Application considerations in Group	Technology.							
Concepts of I	FMS – Comparison with Conventional Manufacturing – Economic Ju	stification –							
Components of	of FMS – Types of Flexibility – FMS Applications and Benefits.								
UNIT- V	CONTROL SYSTEMS	(9 Periods)							
Process indus	tries and Discrete manufacturing industries - levels of automation, v	variables and							
parameters –	Continuous control systems - Steady state optimization, Adaptiv	ve control -							
Computer pro	cess control - control requirements, capabilities and forms of comp	outer process							
control - Computer process monitoring, Direct Digital Control, Distributed Control systems -									
Hardware con	nponents for automation and process control - Discrete process con	trol – Logic							
control, Seque	ncing - Programmable Logic controllers.								

Contact Periods:

Lecture: 45 Periods

Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

TEXT BOOKS:

- 1. Mikell P Groover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson education (Singapore) Pvt. Ltd., New Delhi, 4th edition 2008.
- 2. Radhakrishnan P and Subramaniyan S "CAD/CAM/CIM", New Age International (P) Ltd., 3rd edition, 2008.

REFERENCE BOOKS:

- 1. James A Rehg and Henry W Kraebber "Computer Integrated Manufacturing", 3rd edition Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2005.
- 2. Chris McMahon, and Jimmie Browne, "CAD/CAM Principles, Practice and manufacturing Management", Addison Wesley Longman Ltd, England, 2nd edition, 1998.
- 3. Kant Vajpayee .S, "Principles of Computer Integrated Manufacturing", Prentice Hall of India Limited, 3rd edition 2010.
- 4. Paul G Rankey. "Computer Integrated Manufacturing", Prentice Hall, 2004

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain the fundamentals of automation and CIM.
- **CO2:** Describe the automation in manufacturing.
- **CO3:** Describe the material handling and storage systems.
- CO4: Explain the concept of group technology and flexible manufacturing system.
- **CO5:** Describe the fundamentals of Control systems.

PO/PSO	РО	PO	PO	PO	PO	РО	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6		8	9	10	11	12	1	2	3
CO1	М	М	М	L	Μ	Ľ		¢G	L			L	Н	М	М
CO2	L	М	М	М	Н	L			L		М	L	Н	Н	L
CO3	L	М	М	М	М	L			L		М	L	Н	М	L
CO4	L	М	М	М	М	М			М		М	L	Н	М	L
CO5	L	М	L	Μ	Μ	L			М	М	L		Н	М	L
18PPC602	L	М	М	Μ	Μ	L			L	L	М	L	Н	М	L

COURSE ARTICULATION MATRIX

L – Low, M- Moderate (Medium), H – High

L T P C 3 0 0 3

PRE-REQUISITES:

- 1. 18PPC404 Fluid Mechanics and Machinery
- 2. 18PPC406 Machine Tools and Processes

COURSE OBJECTIVES:

* To make the students to design the hydraulic and pneumatic circuits for different applications.

UNIT- I	BASIC PRINCIPLES	(9 Periods)								
Hydraulic F Selection, F Characteris	Principles; Hydraulic Fluids; Hydraulic pumps – Classification, Charact Pumping Circuits; Hydraulic actuators – Classification, Cylinder Mount tics; Hydraulic valves – Pressure, Flow, Direction Controls, Application	teristics, Pump ing, Selection, ns, Symbols								
UNIT- II	HYDRAULIC CIRCUITS	(9 Periods)								
Hydraulic circuits – Reciprocating, Quick Return, Sequencing, Synchronizing, Regenerative circuit, Double pump hydraulic system; Application circuits – Press, Milling Machine, Planner, Fork Lift, etc.										
UNIT- III	POWER GADGETS IN HYDRAULICS	(9 Periods)								
Accumulate Mechanical Hydraulic p	ors – Classification, Circuits; Pressure Intensifier and Circuit; Sa hydraulic servo system; Selection of components. Installation and M ower pack; Troubleshooting of fluid power circuits.	afety Circuits; Iaintenance of								
UNIT- IV	PNEUMATIC SYSTEMS	(9 Periods)								
Pneumatic Electrical c	Fundamentals; Control Elements; Logic Circuits; Position sensing, Pre ontrols:Various switches; Electro Pneumatic and Electro Hydraulic Circ	essure sensing; cuits.								
UNIT- V	DESIGN AND SELECTION OF PNEUMATIC CIRCUITS	(9 Periods)								
Design of Pneumatic circuits – Classic, Cascade, Step counter, Combination methods; PLC and Microprocessors – Uses; Selection criteria for Pneumatic components; Installation and Maintenance of Pneumatic power pack; Fault finding; Case studies.										

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Anthony Esposito, **"Fluid Power with Applications"**, Pearson Education India, 7th edition, 2013.
- 2. Andrew Parr, "Hydraulics and Pneumatics: A Technician's and Engineer's Guide", Butterworth – Heinemann 3rd edition, 2011.

REFERENCE BOOKS:

- 1. DudleyA Pease and John J Pippenger "Basic Fluid Power", Prentice Hall PTR, 2nd edition 1987.
- 2. John J Pippenger and Tyler G Hicks "Industrial Hydraulics", McGraw Hill,2nd edition, 1970.
- 3. J. Michael, Pinches and HohnG.Ashby "Power Hydraulics", Prentice Hall, 1989.

COURSE OUTCOMES:

- On completion of this course, students will be able to
- **CO1:** Describe the principle of fluid power
- CO2: Describe the components of hydraulics
- **CO3:** Design the hydraulic circuits for automation
- **CO4:** Describe the components of pneumatics
- **CO5:** Design the pneumatic circuits for automation

PO/PSO	PO	PO	PO	РО	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ				3		760 B	R	$\langle 2 \rangle$)			М		
CO2	Μ			6	X	14				2			М		
CO3	М	Н					1						М		
CO4	Μ					1			2				М		
CO5	М	Н			1	8000							М		
18PPC603	М	Н		3	Ja	X		and		<u>1</u>			М		

COURSE ARTICULATION MATRIX

L T P C 0 0 3 1.5

PRE-REQUISITES:

- 1. 18PES106- Engineering Graphics
- 2. 18PPC409-Production Drawing

COURSE OBJECTIVES:

* To design the solid models by creating parts and assemble them with the aid of computers.

LIST OF EXERCISES

Exercises on modelling of mechanical components using packages like AutoCAD / Mechanical Desktop/Inventor/IDEAS/ Pro Engineer/CATIA/Unigraphicsetc...

- 1. Simple two dimensional geometry creations and modification using drafting module.
- 2. Detailing and documentation of a typical production drawing
- 3. Attributes and data extraction from a drawing
- 4. Creation of simple solid models using CSG and B-rep Approach
- 5. Surface Modeling
- 6. External database connection

7. Generation of working drawings of components and preparation of assembly models of Tail stock, Crane hook, Flanged coupling ,Screw jack, Clapper box, Universal coupling, Machine vice Drill jig assembly by using the following techniques...

- 8. Generation of surfaces of revolution
- 9. Generation of surfaces of extrusion
- 10. Generation of surfaces by skinning operation
- 11. Generation of solid models using constructive solid geometry, method shading and rendering.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Explain the basics of graphics generation, 2-Dimensional and 3-Dimensionalconcepts involved in Computer Aided Design.

CO2: Use the commands to create, edit and dimension the 2D model in detail.

CO3: Use the commands to create, edit and dimension the 3D surface model.

CO4: Use the commands to create, edit and dimension the 3D solid model.

CO5: Do the assembly of various solid models and create 3D assembly model.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н	Μ	М	М	М							L	L	L	
CO2	Μ	Μ	L	L	L								L	L	
CO3	Μ	Μ	L	L	L								L	L	
CO4	Μ	Μ	Μ	L	L								L	L	
CO5	Η	Μ	Μ	L	L								L	L	
18PPC607	Μ	Μ	Μ	L	L							L	L	L	

Category: EEC

PRE-REQUISITES: NIL

L	Т	Р	С
0	0	3	1.5

COURSE OBJECTIVES:

- * To train the students to simulate the simple applications in hydraulic and pneumatic kits.
- * To train the students to control the speed of electrical drives.

1. Design and simulation of systems using single acting actuator and Pneumatic elements.

2. Design and simulation of system using double acting actuator, Pneumatic elements and Electro Pneumatic elements.

3. Design and simulation of system using double acting actuator and PLC.

4. Design and simulation of hydraulic system – sequencing circuit, air-oil intensifier circuit, meter-in and meter-out circuit.

5. Design and simulation of hydraulic system with PLC – sequencing circuit, meter-in and meterout circuit, high-low circuit, on delay timer control circuit.

6. Speed control of AC motor.

7. Speed control of DC motor.

8. PID controller with temperature control system.

9. Servo controller using servo motor.

10. Stepper motor interfacing with 8051 micro-controller.

11.Computerized data logging system.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: design and develop the simple industrial application pneumatic circuits.

CO2: design and develop the simple industrial application hydraulic circuits.

CO3: explain PID controller with temperature control system.

CO4: control the speed of electrical drives.

CO5: activate the stepper motor interfacing with 8051 micro-controller.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	Η	Μ	Μ		Μ			L	L		L	Н	М	L
CO2	М	Η	Μ	Μ		L			L	L		L	Н	М	L
CO3	L	Μ	Н	Μ		L			L	L		L	Η	М	L
CO4	L	Μ	L	Μ		L			L	L		L	Н	М	L
CO5	L	Μ	Μ	Μ		L			L	L		L	Η	М	L
18PEE608	L	Μ	Μ	Μ		L			L	L		L	Н	Μ	L

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To educate students with fundamental and advanced knowledge in the field of Additive Manufacturing technology and the associated Aerospace, Architecture, Art, Medical and Industrial applications.

UNIT- I	INTRODUCTION	(9 Periods)									
Need - Deve	elopment of AM systems - AM process chain - Impact of AM	on Product									
Development	- Virtual Prototyping- Rapid Tooling - RP to AM - Classification of A	M processes									
– Benefits – A	Applications. Software for AM- Case studies.										
UNIT- II	REVERSE ENGINEERING AND CAD MODELING	(9 Periods)									
Basic concept- Digitization techniques - Model reconstruction - Data Processing for Rapid											
Prototyping: CAD model preparation, Data requirements - Geometric modeling techniques:											
Wireframe, s	urface and solid modeling - data formats - Data interfacing, Part or	entation and									
support gener	support generation, Support structure design, Model Slicing, Tool path generation.										
UNIT- III	LIQUID BASED AND SOLID BASED ADDITIVE	(9 Periods)									
	MANUFACTURING SYSTEMS										
Stereo lithog	raphy Apparatus (SLA): Principle, pre-build process, part-building ar	nd post-build									
processes, ph	oto polymerization of SL resins, part quality and process planning, reco	pating issues,									
materials, ad	vantages, limitations and applications. Solid Ground Curing (SG	C): working									
principle, pro	cess, strengths, weaknesses and applications. Fused deposition Mode	ling (FDM):									
Principle, de	tails of processes, process variables, types, products, materials and	application.									
Laminated O	bject Manufacturing (LOM): Working Principles, details of process	es, products,									
materials, adv	vantages, limitations and applications.										
UNIT- IV	POWDER BASED ADDITIVE MANUFACTURING SYSTEMS	(9 Periods)									
Selective Las	er Sintering (SLS): Principle, process, indirect and direct SLS- powd	er structures,									
materials, pos	st processing, surface deviation and accuracy, Applications. Laser En	gineered Net									
Shaping (LEI	NS): Processes, materials, products, advantages, limitations and application	ations – case									
Studies, Selec	ctive Laser Melting and Electron Beam Melting										
UNIT- V	OTHER ADDITIVE MANUFACTURING SYSTEMS	(9 Periods)									
Three dimens	sional Printing (3DP): Principle, basic process, Physics of 3DP, types	of printing,									
process capab	bilities, material system. Solid based, Liquid based and powder based 3	BDP systems,									
Demerits, Ap	oplications and case studies. Shape Deposition Manufacturing (SDM	M), Ballastic									
Particle Manu	facturing (BPM), Bio Additive Manufacturing.										

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Chua Chee Kai and Leong Kah Fai, **"Rapid Prototyping: Principles and Applications in** *Manufacturing", John Wiley AND Sons, 1997.*
- 2. Paul F. Jacobs "Stereo-lithography and other RP & M Technologies", from Rapid Prototyping to Rapid Tooling, SME/ASME, 1996

REFERENCE BOOKS:

- 1. Gibson, I., Rosen, D.W. and Stucker, B "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
- 2. Chua, C.K., Leong K.F. and Lim C.S. "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010.
- 3. Gebhardt, A., "Rapid prototyping", Hanser Gardener Publications, 2003.
- 4. Liou, L.W. and Liou, F.W "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2011.
- 5. Hilton, P.D. and Jacobs, P.F "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC press, 2005

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Appreciate the importance of computers and modern tools in manufacturing to reduce cost and matching the societal needs.
- **CO2:** Create and analyze 2D and 3D models using CAD modeling software and integrating with manufacturing systems.
- **CO3:** Understand the variety of Additive Manufacturing (AM) technologies apply to their potential to support design and manufacturing, case studies relevant to mass customized manufacturing.
- CO4: Apply knowledge on latest techniques of manufacturing in their field of career
- CO5: To monitor and control shop floor with the aid of computers

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01			L				Μ						L	L	
CO2			Μ											М	L
CO3			L										М	L	
CO4			Μ		Η	Μ	L						М	Н	L
CO5		М				L					М		L	Н	
18PPC701		Μ	Μ		Μ	L	L				L		М	М	L

COURSE ARTICULATION MATRIX

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Category: PC

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PRE-REQUISITES:

- 1. 18PPC305 Engineering Metallurgy
- 2. 18PPC306 Manufacturing Technology
- 3. 18PPC406 Machine Tools and Processes

COURSE OBJECTIVES:

To familiarize the students in functional requirements, need based materials and suitable * manufacturing processes to produce the automobile components.

UNIT – I CYLINDER BLOCK (9 Periods) Structure and functions - types - materials - sand casting of cast iron cylinder block- modification and machining - sand, gravity and low pressure casting methods of aluminium cylinder blocks cylinder liners. Cylinder head - material - construction - heat treatment. Oil pan - function and materials. Gaskets - functions - materials and types. UNIT – II **ENGINE PARTS** (9 Periods) Piston parts - Functions - materials - casting of piston by gravity casting and squeeze casting modification and heat treatment - machining. Piston rings - Types - materials - functions -piston ring manufacturing. Piston pin types - materials. Forgings of crankshaft, connecting rod and gudge on pins. UNIT –III VALVES AND ACCESSORIES Valve - types - Mechanisms - Materials - production methods - production of push rod, rocker arm and tappets. Camshaft- function and materials - chilled cast iron casting process - finishing operations - production of assembled camshaft - production of propeller shaft. UNIT - IV **CLUTCH, GEARBOX AND BRAKES** (9 Periods) Clutch system, friction lining materials, requirements and manufacturing. Casting of gear box casing, precision forging of gears, gear hobbing, shaping, powder metallurgy, orbital forming of gears, heat treatment and finishing. Braking system - Types- manufacturing methods. UNIT - V **BODY PANELS, SUSPENSION AND MISCELLANEOUS** (9 Periods) Principles of hydroforming - press forming - welding of body panels - resistance welding. Forging of front and rear axles, casting of rear axle casing- leaf spring materials and manufacturing Manufacturing details - Construction details of wheel mounting -tyres and tube manufacturing

Mechatronics in automobile - Use of plastics in automobile components -Application of sensors and

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods

actuators - Automotive quality management system - ISO / TS 16949.

Practical: 0 Periods

Total: 45 Periods

(9 Periods)

TEXT BOOKS:

- 1. Kirpal Singh "Automobile Engineering, Vol I and II", Standard Publishers., 12th edition, 2011.
- 2. William H.Crouse and Anglin "Automotive Mechanics", McGraw Hill Book Co., 10th edition, 2008.
- 3. Helt P.M. "High speed combustion engines", Oxford and IBM Publishers Co. 1990.

REFERENCE BOOKS:

- 1. Newton and Steels "The motor vehicle", 12th edition, 1998.
- 2. Narang G.B.S, "Automobile Engineering", Khanna Publishers, 1991.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Describe the major casting methods of cast iron and aluminium cylinder block.
- CO2: Describe the manufacturing methods of engine parts.
- CO3: Select the suitable material with respect to the functional requirement.
- **CO4:** Explain the fuel and transmission system.
- CO5: Explain the brakes, suspension and engine management systems.

PO/PSO	PO	PO	PO	PO	РО	РО	PO	РО	РО	PO	PO	P0	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н	Н	Н	Н	М	H	Н	and the second s		M	М	Н	Н	Н	L
CO2	Η	Н	Η	Η	М	Η	Н	E.	1	M	М	Η	Н	Η	L
CO3	Η	Н	Η	Η	Μ	H	\mathbf{H}_{0}		B	М	М	Η	Η	Η	L
CO4	Η	Н	Η	Η	М	Η	Η			М	М	Η	Η	Η	L
CO5	Н	Н	Η	Η	М	Η	Н			Μ	Μ	Η	Н	Η	L
18PPC702	Η	Н	Η	Η	М	Η	Η			М	М	Η	Н	Η	L

COURSE ARTICULATION MATRIX

18PPC703

PRE-REOUISITES:

1.18PPC306- Manufacturing Technology

COURSE OBJECTIVES:

- * To introduce the fundamental concepts of various types of jigs, fixtures and dies
- To design a simple jig/ fixture / die for a given component *

UNIT- I	LOCATING AND CLAMPING PRINCIPLES	(9 Periods)							
Tool desig supporting locating fro principles accessories	n objectives - tool design in manufacturing - planning the design - p and locating elements- referencing, basic rules of locating - planes of om a flat surface - locating from internal and external diameter - extern of clamping and work holding – types - non mechanical clamping - materials used in jigs and fixtures	principles of movement - nal profile - g- clamping							
UNIT- II	DESIGN OF JIGS	(9 Periods)							
Component plate, post, design and	ts of jigs - Drill bushes – different types of jigs – plate, latch, channel turnover, pot jigs - Automatic drill jigs - Rack and pinion operated, air op development of jigs for simple components.	, box, angle berated jigs -							
UNIT- III	DESIGN OF FIXTURES	(9 Periods)							
General pr shaping fix development	inciples of milling boring, lathe and broaching fixtures - Grinding, p stures, assembly, Inspection and welding fixtures- modular fixtures - nt of fixtures for simple component.	lanning and design and							
UNIT- IV	PRESS ELEMENTS AND CUTTING DIE DESIGN	(9 Periods)							
Press work operations Calculation progressive	Press working terminology – types - Punch and die elements - Types of Sheet metal shearing operations - Blanking and Piercing - Mechanism of Shearing – Centre of Pressure, Die clearance, Calculation of force requirements, methods of reducing cutting force - Design of simple progressive dies for blanking and piercing								
UNIT- V	DESIGN OF BENDING, FORMING, DRAWING AND MISCELLANEOUS DIES	(9 Periods)							
Bending, fo consideration forming and	orming and drawing dies – types - design and development of above d ons in forging -extrusion –recent trends in tool design – computer aids for alysis – basic introduction	ies - design sheet metal							

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods **Total: 45 Periods**

TEXT BOOKS:

1. K. Venkataraman "Design of Jigs, Fixtures and Presstools", John Wiley & Sons, 2015.

REFERENCE BOOKS:

- 1. BDonaldson, B.H. Lecain, Goold V.V "Tool Design", TMH Edition, 2012.
- 2. P.H.Joshi "Jigs and Fixtures", Mcgraw Hill Education, 2010.

- **Category: PC**
- Т С L Р 3 0 3 0

. COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain the fundamentals of work holding devices, locators and clamps.
- CO2: Discuss about various types of jigs and design simple jigs.
- CO3: Discuss about various types of fixtures and design simple fixtures
- **CO4:** Discuss about the various elements of die and design simple dies for sheet metal shearing operation.
- **CO5:** Discuss about various sheet metal forming operations and recent trends.

	PO	PO	PO	PO	PO	PSO	PSO	PSO							
PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
СО															
CO1	L	М	Μ	Μ						L	М	L	М	L	М
CO2	М	Н	М	L						L	М	L	М		М
CO3	М	М	L	L				5		L	М	L	М		М
CO4	М	М	М	L	C.	5	1	00	19,015	L	L	L	L		М
CO5	М	Н	Н	Μ	S.	63		(F)	3	L	L	L	М		Н
18PPC703	М	Η	Μ	L	<	1		5	-	L	М	L	М	L	М

COURSE ARTICULATION MATRIX



L T P C 0 0 3 1.5

PRE-REQUISITES:

1. 18PPC405- Mechanics of Materials

COURSE OBJECTIVES:

* To gain practical experience in handling 3D modeling and analysis software.

Finite Element Modeling and Analysis
1. Exercises on Modeling and Meshing on 1D, 2D and 3D models.
2. Exercises on Solution and Post processing of 1D, 2D and 3D models.
3. Structural analysis of a fixed beam
4. Structural analysis of a cantilever beam
5. Structural analysis of a link element
6. Structural analysis of aluminium bracket
7. Modeling using axisymmetry
8. Plane stress analysis
9. Modeling of a spindle base
10. Modal analysis of cantilever beam
11. Modeling of allen key
12.Heat distribution in rectangular slab
13. Thermal analysis of 2D heat sink
14. Exercise on coupled field analysis
CAM software
* Designing of connecting rod using CAM software
Exercise on 2D part development and NC contour tool path generation
CASTING simulation software
* Study of casting simulation

Contact Periods:

Lecture: 0 Periods

Tutorial: 0 Periods

Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain the basics used to create and manipulate geometric models in computer using ANSYS.
- CO2: Create 1D, 2D and 3D models using ANSYS and Master CAM.
- **CO3:** Do structural and thermal analysis of various models.
- **CO4:** Describe about the failure criteria and vonmises stress for various models.
- **CO5:** Explain the importance of casting simulation in foundry industries.

PO/PSO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO						
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	М	М	М	М								L	М	
CO2	М	М	Η	М	Μ	0	press	n					L	М	
CO3	М	М	Η	М	М			NUS S	NPRI/IS	2			L	М	
CO4	М	М	Η	М	М	92			W.				L	М	1
CO5	Η	Η	Η	М	Μ			J.o	- 7	7			L	М	
18PPC707	М	М	Η	М	М		STU						L	М	

COURSE ARTICULATION MATRIX



Category: EEC

PRE-REQUISITES:	L	Т	Р	С
1. 18PEE508 Skill Development on Industrial Practices/Technical Projects	0	0	8	4

COURSE OBJECTIVES:

* To provide an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated continuously by a Committee constituted by the Head of the Department.

The progress of fabrication project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The fabricated model is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods

Practical: 120 Periods

Total: 120 Periods

COURSE OUTCOMES

On completion of this course, students will be able to

- **CO1:** Practice acquired knowledge within the chosen area of technology for project development.
- **CO2:** Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
- CO3: Reproduce, improve and refine technical aspects for engineering projects.
- CO4: Follow and value health, safety and ethical practices during project.
- CO5: Work as an individual or in a team in development of technical projects.
- CO6: Communicate and report effectively project related activities and findings.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	М		М		L			L		L	М	М	L	
CO2	М	Η	Η	М	Η	М	L		Η	L	Η	М	Н	Н	Н
CO3	Η	Η	Η	М	Η	Μ	L		Η	L	Η	Η	Н	Н	Н
CO4						М	L	Η	L		Н	L			
CO5									Η	L	Η	Η	Н	Н	Н
CO6									М	Η	М	М			
18PEE708	М	Η	Η	М	Η	М	L	Η	Η	Η	Η	Η	Н	Н	Н



Category:	EEC
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PRE-REQUISITES:

L T P C

1. 18PEE508 Skill Development on Industrial Practices/Technical Projects 0 0 16 8

COURSE OBJECTIVES:

- * To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- * To train the students in preparing project reports and to face reviews and viva voce examination.

A project topic must be selected by the students in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and fabrication of a device for a specific application, a research project with a focus on an application needed by the industry/society, a computer project, a management project or a design project.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

Contact Periods:Lecture: 0 PeriodsTutorial: 0 PeriodsPractical: 240 PeriodsTotal: 240 Periods

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: identify problem specification or need for development.

CO2: analyse and develop conceptual design and methodology of solution for the problem.

 $\textbf{CO3:} \ \text{devise solution and build physical model /test if required, as per industry / research / }$

societal need, with due consideration of environmental aspects.

CO4: follow and value health, safety and ethical practices during project.

CO5: contribute as an individual or in a team in development of technical projects.

CO6: express technical ideas, strategies and methodologies in written form.

CO7: develop effective communication skills for presentation of project related activities.
COURSE ARTICULATION MATRIX

PO/PSO	PO	РО	PO	PSO	PSO	PSO									
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	М		М		L			L		L	Μ	М	L	
CO2	М	Η	Η	Η	Η	Μ	L		Η	L	Η	М	Н	Н	Н
CO3	Н	Η	Η	Η	Η	Μ	Η		Η	L	Η	Η	Н	Н	Н
CO4						Η	L	Η	L		Η	L			
CO5									Η	L	Η	Н	Н	Н	Н
CO6									Μ	Н	Μ	М			
CO7									Μ	Н	L	М			
18PEE803	Н	Η	Η	Η	Η	Η	Η	Η	Η	Н	Η	Н	Н	Н	Η



Category: PE

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PRE-REQUISITES:

- 1.18PES103-Basics of Electrical Engineering
- 2. 18PES403- Basic Electronics Engineering

COURSE OBJECTIVES:

* Introducing the key elements of mechatronics system and understanding the concepts of integration and design of mechatronics system.

UNIT- I	MECHATRONICS SYSTEMS	(9 Periods)									
Introduction	to Mechatronics- Basics of actuating systems. Mechanical, pneumatic,	hydraulics,									
electrical syst	ems- control systems- measurements systems- Mechatronics approach.										
UNIT- II	SENSORS AND TRANSDUCERS	(9 Periods)									
Introduction - performance terminology- displacement, position and proximity- velocity and motion- fluid pressure-temperature sensors- light sensors- selection of sensors- signal processing.											
UNIT- III 8085 MICROPROCESSOR (9 Periods)											
Introduction- using 8085 in converters- aj	Introduction- architecture- pin configuration- instruction set- programming of microprocessors using 8085 instructions-interfacing input and output devices- interfacing D/A converters and A/D converters- applications- temperature controls-stepper motor control- traffic light controller.										
UNIT- IV	PROGRAMMABLE LOGIC CONTROLLERS	(9 Periods)									
Introduction internal relay	- basic structure - input/output processing – programming – Mnemoni s And counters - data handling - analog input/output - selection of a PLC.	cs - timers,									
UNIT- V	DESIGN OF MECHATRONIC SYSTEMS	(9 Periods)									
Stages in designing Mechatronics systems - Traditional and Mechatronics design - Possible design											
- solutions - case studies of Mechatronics systems - pick and place robots - automatic car park											
systems - eng	ine management systems.										

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. W.Bolton "Mechatronics", Pearson education., Second Edition, 2007.
- 2. Ramesh S. Gaonkar "Microprocessor Architecture Programming and Applications", Wiley Eastern, 1991.

- 1. Michel B. Histand and David G. Alciatore, "Introduction to Mechatronics and measurement systems", McGraw Hill International Editions.
- 2. HMT Ltd, "Mechatronics", Tata McGraw Hill publishing Co. Ltd.
- 3. D.A.Bradley, D. Dawson, N.C. Buru and A.J. Loader "Mechatronics", Chapman and Hall.
- 4. K. Ram,. "Fundamantals of Microprocessors and Microcomputers", Dhampat rai publications.
- 5. Dan Necsulescu "Mechatronics", Pearson Education Asia. (Indian reprint).

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Build the basic block diagram of mechatronics system (sensing, measuring controlsand actuation, hardware and software).

CO2: Describe the mechatronic system approach.

CO3: Explain the concepts of transducers, sensors, microprocessor and programmable logic controllers in mechatronics systems.

CO4: Identify critical problems/ design issues and suggest feasible solutions in mechatronics systems.

CO5: Design mechatronic components and systems.

PO/PSO	PO	РО	PO	РО	РО	РО	РО	РО	РО	PO	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н	Н	М	М	М	L	2. 24		X	BY		L	L	Μ	
CO2	Μ	М	М	М	М	L	3E)	5	acue alla			L	L	М	
CO3	М	М	М	М	М	L))			L	L	М	
CO4	Μ	М	Н	Н	М	L						L	L	М	
CO5	Н	Н	Н	Н	М	L						L	L	М	
18PPE\$01	Н	Н	Н	Н	М	L						L	L	М	

COURSE ARTICULATION MATRIX

Category: PE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES:

1. 18PPC405 – Mechanics of Materials

COURSE OBJECTIVES:

* To familiarize the students in principles involved in discretization, finite element approach and can solve the simple engineering problems.

		-
UNIT- I	INTRODUCTION TO FINITE ELEMENT METHOD (FEM)	(9 Periods)
Historical	background; Basic concept of FEM; Discrete and continuous models; 1	Boundary and
Initial valu	e problems; Discretization - Convergence requirements.	•
	a Caral	
	FORMULATION OF ELEMENT CHARACTERISTIC	
UNIT- II	MATRICES	(9 Periods)
One dimen	nsional governing equations - Structural and heat transfer problems; Variat	ional method;
Weighted	residual methods; Principle of minimization of potential energy.	
_		
UNIT-III	ONE DIMENSIONAL PROBLEMS	(9 Periods)
Shape fund	ctions: Problems in axial loaded members, trusses, beams, heat transfer through	igh composite
walls and	fins: Gauss elimination and Cholesky method of solving equations.	0 1
LINIT_IV	TWO DIMENSIONAL PROBLEMS	(9 Periods)
		() I thous)
Linear tria	ingular and rectangular elements – Shape functions: Pascal's triangle - Con	ncept of plane
stress and	plane strain. Solution of simple problems in structural and heat transfer mod	els.
UNIT- V	HIGHER ORDER ELEMENTS	(9 Periods)
Applicatio	ns of higher order elements; Lagrangian and serendipity elements; Isoparam	etric elements
- Jacobian	transformation.	

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. J.N.Reddy "Introduction to Finite Element Method", McGraw Hill, Intl, 3rd edition, 2006.
- Larry J. Segerlind "Applied Finite Element Analysis", John Wiley and Sons., 2nd edition, 1985.
- 3. SingiresuS.Rao "The Finite Element Method in Engineering", Butterworth Heinemann., 5thedition, 2011.

- 1. Tirupathi R. Chandrupatala and Ashok D. Belegundu "Introduction to Finite Elements in Engineering", Pearson Education, 4th edition, 2011.
- 2. David V. Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill, 3rd edition, 2005.
- 3. ChandrakantS.Desai, "Elementary Finite Element Method", Prentice Hall Inc., 1979.
- 4. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002.
- 5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.

COURSE OUTCOMES:

- On completion of this course, students will be able to
- CO1: Describe the fundamentals of finite element technique
- CO2: Formulate the structural and heat transfer problems
- **CO3:** Solve the simple structural and heat transfer problems
- **CO4:** Describe the shape function and element characteristics
- **CO5:** Describe the higher order elements

	a Charman Barra														
COURSE A	COURSE ARTICULATION MATRIX														
PO/PSO	РО	РО	РО	РО	PO	РО	РО	РО	РО	PO	РО	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	М	Η	М				М		1	6		М		М	
CO 2	М	М	L	М		Ä	L	()		М		L		М	
CO 3	М		М	М		ŝ	Μ	*	1	М		L		Н	
CO 4	М	М		М		M	2	4		Н		М		Н	
CO 5	М	М	L		JE J		15	(See		L		L		М	
18PPE\$02	М	М	L	М	0	Chille and	М	OCAR		Μ		L		М	

18PPE\$03

Category: PE L T P C 3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To understand the working principles of various non-traditional machining processes, applications, advantages and limitations.

UNIT- I	MECHANICAL ENERGYMETAL REMOVAL PROCESSES	(9 Periods)										
Need of mod	lern machining processes - classification and selection of technology.	Mechanical										
processes -	Abrasive jet machining (AJM), water jet machining (WJM), Abrasi	ve water jet										
machining (A	machining (AWJM), Ultrasonic machining (USM) - working principles, equipment, effect of											
process parameters, applications, advantages and limitations.												
UNIT H	ELECTROCHEMICAL AND CHEMICAL METAL REMOVAL	(0 Dominda)										
0111-11	PROCESSES											
Electrochemical machining (ECM), electrochemical grinding (ECG), electrochemical deburring												
and honing – chemical machining (CHM) – working principles, equipment, effect of process												
parameters, applications, advantages and limitations.												
UNIT- III THERMAL METAL REMOVAL PROCESSES (9 Periods)												
Electric disch	narge machining (EDM), wire cut electric discharge machining (WEDM)), Plasma arc										
machining (F	PAM), Electron beam machining (EBM), Laser beam machining (LBM	1), Ion beam										
machining (I	BM) - working principles, equipment, effect of process parameters,	applications,										
advantages an	nd limitations.											
UNIT- IV	FORMING PROCESSES AND FOUNDRY TECHNIQUES	(9 Periods)										
Explosive for	ming, Electro – hydraulic forming, electro – magnetic forming. Dynapak	machine -										
high pressure	moulding, squeeze casting, vacuum castings.											
UNIT- V	RAPID PROTOTYPING	(9 Periods)										
Introduction - advantages - limitations - principle. Rapid prototyping systems - stereo-												
lithography(SLA), selective laser sintering(SLS), fused deposition modeling(FDM), laminated												
object manufacturing (LOM), solid ground curing (SGC), three dimensional printing. Application												
of reverse eng	gineering in rapid prototyping.											

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. P.C.Pandey "Modern machining processes", Tata McGraw Hill publishing company Ltd. 2008.
- 2. P.C.Sharma, "A TEXT BOOKS of Production Technology", S.Chand & Company Ltd. 2009.

- 1. Bhattacharya, "New Technology", Institution of Engineers, 1997
- 2. Gary.F.Benedict "Nontraditional machining Processes", Marcell Dekker Inc, 2001
- 3. HMT "Production Technology", Tata McGraw Hill Publishers, 2001.
- 4. V.K.Jain "Advanced Machining Process", Allied Publishers PVT Ltd 2007

COURSE OUTCOMES:

On completion of this course, students will be able to

- CO1: describe the mechanical energy based newer production processes.
- CO2: describe the electrochemical energy based newer production processes.
- CO3: describe the thermal energy based newer production processes.
- **CO4:** explain the explosive forming and high pressure casting processes.
- CO5: describe various Rapid Prototyping techniques

PO/PSO	PO	PO	PO	PO	РО	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01	Μ	Н		М	М			木	Μ	L	L	L	Н		L
CO2	Μ	Н		М	М			2.	Μ	L	L	М	Н		L
CO3	Μ	Н		М	L	2			M	L	L	М	Н		L
CO4	Μ	Н		М	L	X			M	L	L	М	Н		L
CO5	L	Н		М	L			N	L	L	L	М	Н		L
18PPE\$03	Μ	Н		Μ	F.	004		19.19	М	L	L	М	Н		L

MB CON

COURSE ARTICULATION MATRIX

L – Low, M- Moderate (Medium), H – High

Category: PE

L T P C 3 0 0 3

PRE-REQUISITES:

18PPC406 - Machine Tools and Processes

COURSE OBJECTIVES:

* To enable the students to understand CNC machines constructional features, working and programming.

UNIT- I	INTRODUCTION TO CNC MACHINE TOOLS	(9 Periods)										
Evolution of concept, typ Machines – centre, EDM	Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, types of control systems, CNC controllers, characteristics, interpolators, types of CNC Machines – turning centre, machining centre, grinding machine, Vertical turret lathe, turn – mill centre, EDM.											
UNIT- II	STRUCTURE OF CNC MACHINE TOOL	(9 Periods)										
CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings.												
UNIT- III	DRIVES AND CONTROLS	(9 Periods)										
Spindle dri motors. Op gratings, me	Spindle drives, feed drives – stepper motor, servo principle, DC and AC servomotors, Linear motors. Open loop and closed loop control, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosysn, laser interferometer.											
UNIT- IV	CNC PROGRAMMING	(9 Periods)										
Coordinate radius and parametric centre for F	system, structure of a part program, G & M Codes, tool length compens tool nose radius compensation, do loops, subroutines, canned cycles, m programming, machining cycles, programming for machining centre anuc controller - Generation of CNC codes from CAM packages.	ation, cutter irror image, and turning										
UNIT- V	TOOLING AND WORK HOLDING DEVICES	(9 Periods)										
Cutting tool materials for CNC machine tools – Carbides, Ceramics, CBN, PCD – inserts classification - qualified, semi qualified and preset tooling, tooling for Machining and Turning centre, ATC, APC, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.												

Contact Periods:

Lecture: 45 Periods

Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

TEXT BOOKS:

- 1. HMT Limited "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005
- 2. Mike Mattson "CNC Programming Principles and Applications", Delmar Cengage learning, 2010

REFERENCE BOOKS:

- 1. Evans K., Polywka J. and Stanley Gabrel., "Programming of CNC Machines", Third Edition Industrial Press Inc, New York, 2007
- 2. Madison J. "CNC Machining Hand Book", Industrial Press Inc., 1996.
- 3. Smid P "CNC Programming Hand book", Industrial Press Inc., 2007
- 4. Third Edition Radhakrishnan P "Computer Numerical Control Machines", New Central Book Agency, 2002
- 5. Rao P.N. "CAD/CAM Principles and Applications", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Describe the evolution and principle of CNC machine tools and types of control systems.
- CO2: Apply knowledge in current terminology to describe the CNC machines and its types.
- **CO3:** Describe constructional features of CNC machine tools, drives and positional transducers used in CNC machine tools.
- **CO4:** Generate CNC programs for popular CNC controllers.
- **CO5:** Describe tooling and work holding devices for CNC machine tools.

PO/PSO	PO	PO	PO	РО	PO	PO	PO	PO	PO	РО	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7.	8	9	10	11	12	1	2	3
CO1	L				Н								L		
CO2	L				Н								L		
CO3	L				М								М		
CO4	L				Н							М		Н	
CO5	L				М								М		
18PPE\$04	L				Η							М	М	М	

COURSE ARTICULATION MATRIX

18PPE\$05

POWER PLANT ENGINEERING

(Common to MECH & PRODN)

1. 18PPC304 -Thermal Sciences

COURSE OBJECTIVES:

PRE-REOUISITES:

- To learn the economics of power generation.
- To understand the working of power plants components.

ECONOMICS OF POWER GENERATION UNIT- I (9 Periods)

Load and load duration curves. Electricity billing - costing of electrical energy - Tariff structures. Economics of power plant - Fixed and variable cost. Payback period. Net Present Value, Internal Rate of Return. Emission calculation and carbon credit.

UNIT- II HYDRO POWER PLANTS Energy scenario – Global and National. Essential elements and classification of hydro power plants. Typical Layout and associated components. Selection of turbines. Pumped storage plants.

UNIT- III | THERMAL AND GAS TURBINE POWER PLANTS

Cycle analysis - Layout of modern coal based power plant. Super Critical Boilers - FBC Boilers. Subsystems - Water and Steam, Fuel and ash handling, Air and Gas, Draught system. Diesel and Gas Turbine power plants- Layout and Functioning. Environmental impact and Control.

UNIT- IV NUCLEAR POWER PLANTS

Layout and subsystems. Fuels and Nuclear reactions. Boiling Water Reactor, Pressurized Water Reactor, Fast Breeder Reactor, Gas Cooled and Liquid Metal Cooled Reactors - working and Comparison. Safety measures. Environmental aspects.

UNIT- V	RENEWABLE ENERGY POWER PLANTS	(9 Periods)
Solar power	plants – Photovoltaic and Thermal. Wind power plants – Vertical and	Horizontal
axes Wind T	urbines. Biomass power plants – Gasification and combustion. Tidal a	nd Ocean
Thermal Ene	rgy plants. Geothermal plants. Fuel cell – Types. Hybrid power plants	

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods **Total: 45 Periods**

TEXT BOOKS:

- 1. M.G.R. Nagpal "Power Plant Engineering", Khanna publishers, 2012
- 2. S.C. Arora and S. Domkundwar "A Course in Power Plant Engineering", Dhanpat Rai and sons, 2014.

REFERENCE BOOKS:

- 1. P.K.Nag, "Power Plant Engineering", Tata McGraw Hill, 2014
- 2. Paul Breeze "Power Generation Technologies", Elsevier Ltd., 2014.
- 3. M.M.El.Wakil "Power Plant Technology", Tata McGraw Hill, 2010

Category: PE LTPC

3 0 0 3

(9 Periods)

(9 Periods)

(9 Periods)

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Arrive at cost of power generation, electricity billing and rate of return on power plant investments.
- **CO2:** Understand the working of Hydro-electric power plants.
- CO3: Analyze the working of Conventional power plants such as Thermal and Gas Turbines.
- **CO4**: Understand the working of nuclear power plants and its functional components.
- **CO5:** Understand the different types of renewable energy systems and its functional components.

PO/PSO	PO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	Μ	L	Н	М	Н	L	М	L	L	L	М	Н	М		М
CO 2	L	М	Н	L	М	L	Н	М	М	L	Н	L	L		М
CO 3	Μ	М	Н	М	Μ	Н	М	L	L	Н	М	М	М		L
CO 4	Η	М	L	М	Н	Μ	L nóà u	Μ	L	Н	Н	М	М		М
CO 5	Μ	L	L	Н	Μ	М	Lo	H	H	Μ	Н	Н	М		М
18PPE\$05	Μ	М	М	М	Μ	М	М	Μ	M	М	Н	М	Μ		М

COURSE ARTICULATION MATRIX



ROBUST DESIGN

Category: PE

L T P C 3 0 0 3

PRE-REQUISITES:

1. 18PES303 - Engineering Mechanics

COURSE OBJECTIVES:

* To impart knowledge to design experiments to a problem situation using traditional experimental designs as well as Taguchi Methods.

UNIT- I	EXPERIMENTAL DESIGN FUNDAMENTALS	(9 Periods)							
Importance	of experiments, experimental strategies, basic principles of design,	terminology,							
ANOVA, st	eps in experimentation, sample size, normal probability plot and line	ar regression							
models.									
UNIT- II	SINGLE FACTOR EXPERIMENTS	(9 Periods)							
Completely	randomized design, Randomized block design, Latin square design	- Statistical							
analysis, est	imation of model parameters, model adequacy checking, pair wise comp	arison tests							
UNIT- III	MULTIFACTOR EXPERIMENTS	(9 Periods)							
Two and thr	ee factor full factorial experiments, Randomized block factorial design,	Experiments							
with randor	n factors, rules for expected mean squares, approximate F - tests.	2K factorial							
Experiments									
UNIT- IV	SPECIAL EXPERIMENTAL DESIGNS	(9 Periods)							
Blocking an	d confounding in 2k designs. Two level Fractional factorial design, ne	sted designs,							
Split plot de	sign, Response Surface Methods								
UNIT- V	TAGUCHI METHODS	(9 Periods)							
Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control									
and noise factors, S/N ratios, parameter design, Multi-level experiments, Multi - response									
optimization	1								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. A. Mitra "Fundamentals of Quality Control and Improvement", Pearson Publication, 1998
- 2. Phillip J.Rose "Taguchi techniques for quality engineering", McGraw Hill, 1996

- 1. Montgomery, D.C., "Designand Analysis of experiments", John Wiley and Sons, Eighth edition, 2012
- 2. Krishnaiah, K. and Shahabudeen, P. "Applied Design of Experiments and Taguchi Methods", PHI learning private Ltd., 2012.
- 3. NicoloBelavendram "Quality by Design; Taguchi techniques for industrial experimentation", Prentice Hall, 1995.
- 4. J. Krottmaier "Optimizing Engineering Design", McGraw Hill Ltd, 1993
- 5. MadhavShridharPhadke, "Quality Engineering Using Robust Design", Prentice Hall, 1985

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Select appropriate tools for robust design.

CO2: Identify and implement single factor experiments

CO3: Identify and implement multi factor experiments

CO4: Apply the concepts of .special experiment designs

CO5: Apply the concepts of Taguchi experiment design for practical problems.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PO	PO	PO	PO	PO	PO	РО	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	L	М	Н		L	100			L	/	L		L	L	L
CO 2	L	М	Н		L	0		10	L		L		L	L	L
CO 3	L	М	Н		L				L		L		L	L	L
CO 4	L	М	Н		L				L		L		L	L	L
CO 5	L	М	Н		L				L		L		L	L	L
18PPE\$06	L	М	Н		L				L		L		L	L	L

PRE-REQUISITES:

STATISTICAL QUALITY CONTROL AND RELIABILITY ENGINEERING

Category: PE

LTPC

3 0 0 3

1. 18PPC502- Production Planning and Control

COURSE OBJECTIVES:

* To introduce the concept of SQC, understand process control, acceptance sampling procedure and to learn the concept of reliability.

UNIT- I	INTRODUCTION AND PROCESS CONTROL FOR	(9 Periods)							
	VARIABLES								
Introduction,	definition of quality, basic concept of quality, definition of SQC,	benefits and							
limitation of	SQC, Quality assurance, Quality cost-Variation in process- factor	ors – process							
capability - process capability studies and simple problems - Theory of control chart- uses of									
control chart	– Control chart for variables – X chart, R chart and σ chart.								
UNIT- II	PROCESS CONTROL FOR ATTRIBUTES	(9 Periods)							
Control chart	for attributes - control chart for proportion or fraction defectives - p	chart and np							
chart – contr	ol chart for defects - C and U charts, State of control and process of	out of control							
identification	in charts.								
UNIT- III ACCEPTANCE SAMPLING (9 Periods)									
Lot by lot sa	ampling - types - probability of acceptance in single, double, multi-	ple sampling							
techniques -	O.C. curves - producer's Risk and consumer's Risk. AQL, LTPD, AO	QL concepts-							
standard samp	pling plans for AQL and LTPD- uses of standard sampling plans.								
UNIT- IV	LIFE TESTING - RELIABILITY	(9 Periods)							
Life testing –	Objective - failure data analysis, Mean failure rate, mean time to failu	re, mean time							
between failu	re, hazard rate, system reliability, series, parallel and mixed configura	tion – simple							
problems. M	aintainability and availability - simple problems. Acceptance sampl	ing based on							
reliability test	t – O.C Curves.								
UNIT- V	QUALITY AND RELIABILITY	(9 Periods)							
Reliability in	nprovements - techniques- use of Pareto analysis - design for	reliability –							
redundancy u	redundancy unit and standby redundancy - Optimization in reliability - Product design - Product								
analysis – Pro	oduct development – Product life cycles.								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. Grant, Eugene.L "Statistical Quality Control", McGraw-Hill, 7th edition, 2008.
- 2. L.S.Srinath "Reliability Engineering", Affiliated East west press, 1991.

- 1. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai and Sons, 2001.
- 2. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997
- 3. Besterfield D.H "Quality Control", Prentice Hall, 1993.
- 4. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998
- 5. Connor, P.D.T.O "Practical Reliability Engineering", John Wiley, 1993.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: describe the basic concepts involved in manufacturing process control for variables.

CO2: describe various process control charts for attributes.

CO3: explain the concepts of acceptance sampling.

CO4: explain the life testing techniques, failure data analysis and mean failure rate.

CO5: describe Pareto analysis and product design, development and life cycle concepts.

PO/PSO	Р	Р	Р	Р	Р	P	-Pm	Р	Р	Р	Р	Р	PS	PS	PS
СО	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01	М	М	L	L				5	7				М		М
CO2	М	М	L	L			STI2	$ \wedge $					М		М
CO3	М	L	L	L	1				1				М		М
CO4	М	L	М	М		8							М		М
CO5	М	М	М	Μ	J.	Mr.	6	and the second					М		М
18PPE\$07	М	М	М	M	1007			R	50				М		М

COURSE ARTICULATION MATRIX

ADVANCED WELDING TECHNOLOGY

Category: PE

L T P C

3 0 0 3

- **PRE-REQUISITES:** 1. 18PPC305 – Engineering Metallurgy
 - 2. 18PPC306 Manufacturing Technology

COURSE OBJECTIVES:

* To impart knowledge of basic concepts, principle, procedure, applications and advances in welding processes.

UNIT- I	SOLID STATE WELDING PROCESSES	(9 Periods)									
Review of the	e various pressure welding processes and their applications. Friction	on, explosive,									
diffusion, and	d Ultrasonic welding - principles of operation, process chara	cteristics and									
application.	application.										
UNIT- II	HIGH ENERGY BEAM WELDING	(9 Periods)									
Electron Bear	m welding and Laser Welding: Principles of operation, Heat g	eneration and									
regulation - E	quipment details in typical setup - advantages, disadvantages and appl	ications.									
UNIT- III	ELECTRO SLAG WELDING	(9 Periods)									
Heat generation	Heat generation, principles of operations, wire and consumables, guide techniques, selection of										
current, volta	ge and other process variables, nature of fluxes and their selection	n. Electro-gas									
welding Princ	iple of operation and applications, Narrow gap welding.										
UNIT- IV	PLASMA ARC WELDING	(9 Periods)									
Special featur	es of plasma arc- transferred and non transferred arc, key hole and pu	uddle mode of									
operation, mic	cro, low and high current plasma arc welding and their applications. I	Plasma cutting									
and surfacing	and their applications.										
UNIT- VSPECIALWELDING PROCESSES(9 Periods)											
Adhesive bonding and Welding of plastics, Cold pressure welding, High frequency Welding,											
Stud welding,	Stud welding, Under Water welding, Welding automation.										

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. Parmer R.S "Welding Engineering and Technology", Khanna Publishers, New Delhi, 2ndedition, 2010
- 2. Parmer R.S. "Welding Processes and Technology", Khanna Publishers, New Delhi, 3rd edition, 2003
- 3. Little R.L "Welding and welding Technology", Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.

- 1. Schwartz M.M "Metals Joining Manual", McGraw Hill Books, 1979.
- 2. Tylecote R.F. "The Solid Phase Welding of Metals", New York, St. Martin's Press, 1968.
- 3. Nadkarni S.V "Modern Arc Welding Technology", Oxford IBH Publishers, 2nd edition, 2005
- 4. Christopher Davis "Laser Welding- Practical Guide", Jaico Publishing House, 1994.
- 5. Davis A.C., "The Science and Practice of Welding", Cambridge University Press, Cambridge, 10th edition 1993.

COURSE OUTCOMES:

- On completion of this course, students will be able to
- **CO1:** Describe the solid state welding processes
- **CO2:** Describe the high energy beam welding processes
- CO3: Describe the Elctro-slag and Elctro-gas welding processes
- CO4: Describe the plasma arc welding processes
- **CO5:** Describe the special welding techniques for plastics and underwater welding processes

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ				M		H		L	10		Μ	Μ		
CO2	Н		Н		L		Μ		L	Μ	L		Μ		Μ
CO3	Μ	L	Μ		Μ	1	Μ				Μ	Μ	L		
CO4	Μ				L	8	Μ		L	M					
CO5	Μ	L	Μ		L	1	L	1		G.		L			Μ
18PPE \$08	М	L	М		Ł	1015	М	all a	L	М	L	М	М		М

COURSE ARTICULATION MATRIX

PRE-REQUISITES:

- 1. 18PPC305 Engineering Metallurgy
- 2. 18PPC306 Manufacturing Technology
- 3. 18PPC406 Machine Tools and Processes
- 4. 18PPC504 Metrology and Computer Aided Inspection

COURSE OBJECTIVES:

* To train the students to design the product and to develop the feasible processing technique for specific need.

UNIT- I	PRODUCT ENGINEERING	(9 Periods)								
Nature and so	cope of product engineering; creative and organizing for product innov	ation criteria								
for product su	access in life cycle of a product; maintainability engineering.									
UNIT- II	MODELING AND SIMULATION	(9 Periods)								
Modeling and	simulation; the role of models in product design mathematical modeli	ng similitude								
relations; Weighted property index.										
UNIT- III	MATERIAL SELECTION	(9 Periods)								
Material select	ction; Problems of material selection; Performance characteristics of n	naterials; the								
materials sele	ction process; economics of materials; Cost versus performance relatio	ns; Weighted								
property inde	x									
UNIT- IV	DESIGN CONSIDERATIONS	(9 Periods)								
Functional an	d production design; form design; influence of basis design - mecha	nical loading								
and material	on form design - form design of gray castings, malleable iron casting	gs, aluminum								
castings, pres	sure die castings, plastic mounding, welded fabrications, forging and	manufacture								
by machining	methods.									
UNIT- V	AESTHETIC AND ERGONOMIC CONSIDERATIONS	(9 Periods)								
Influence of	space, size, weight, etc. on form design; aesthetic and ergonomic co	onsiderations;								
geometric dir	geometric dimensioning and tolerance of product; functional production and inspection datum;									
tolerance anal	ysis.									

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. George E.DieterandLinda C. Schmidt "Engineering design", McGraw HillEducation, 5thedition, 2012
- 2. Robert Matousek "Engineering Design", Blacke and Sons Ltd, 1972

Ca	ateg	ory	: PE
L	Т	Р	С
3	0	0	3

- 1. Jones J "Design Methods", Wiley, 2ndedition, 1992
- 2. Buhl H.R, "Creative Engineering design", Iowa state university press, 1960.
- 3. Benjamin W.Niebel and Alan B.Draper "Product Design and process Engineering", McGraw HillInc., US, 1st edition, 1974.
- 4. Harry peck "Designingfor Manufacturing", Sir Issac Pitman and Sons Ltd, 1973.
- 5. Gladman C.A "Manual for Geometric Analysis of Engineering Designs", Australian Trade publications Ltd, 1966.
- 6. Oliver R. Wade, "Tolerance Control in Design and Manufacturing", Industrial Press, New York publications, 1967.

COURSE OUTCOMES:

On completion of this course, students will be able to

- CO1: Describe the product innovation
- CO2: Describe the analytical evaluation of the products
- **CO3:** Select the appropriate material for the product
- CO4: Develop the appropriate processing technique for the product
- **CO5**: Incorporate the aesthetic and ergonomic values

PO/PSO	PO	РО	PO	PO	РО	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01	Μ	М	Н		//	H	L		Н	L		М	Н		
CO2	Μ	Н	М			М	M		М				М		
CO3	L	Μ	М	М	A.	М	М		М			М	М		
CO4	Μ		L	M	000	Н	La la	201	H				М		
CO5		L	L		10	P	Μ	C.	М				L		
18PPE\$09	Μ	Μ	М	М		М	М		М	L		М	М		

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

18PPE\$10

Category: PE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To acquire knowledge of the general design principles of Manufacturing.
- * To familiarize various assembly methods and processes and design for assembly guidelines.

UNIT- I	DESIGN PRINCIPLE	(9 Periods)									
Economics selections – Tolerance C working pla	of process selection – general design principles of manufacturability – p strength and mechanical factors – Geometric tolerances – Design for s Charting Techniques. General aspects of the designers work - design factor n – basic design.	roper material erviceability – rs – systematic									
UNIT- II	FORM DESIGN	(9 Periods)									
Factors affe ferrous allo Gas and Are	Factors affecting casting design - Grey iron castings, steel castings, malleable iron castings – Non ferrous alloys: Aluminium castings – Pressure die castings – factors affecting weldment design – Gas and Arc welding.										
UNIT- III	UNIT- III FORMED METAL COMPONENTS AND NON-METALLIC (9 Periods)										
Metal extru thermo setti	sion – cold headed pats – fine blanking – Tube and section bends – powde ng plastic parts – reinforced - plastic/composite parts.	r metal parts –									
UNIT- IV	MACHINED COMPONENTS DESIGN	(9 Periods)									
Design for Turned part produced by	Design for machinability – design for economy – design for clampability – design for accessibility. Turned parts – drilled parts – milled parts, planned, shaped and slotted parts – Ground parts – parts produced by EDM.										
UNIT- VTECHNOLOGY REQUIREMENT AND ASSEMBLY(9 Periods)											
Product design requirements for group technology concepts and CNC machining – part family concept – mechanical assemblies – general recommendations - design rules for rivets, screw fasteners, gaskets and seals. Press and snap fits.											

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. James G.Bralla "Hand book of product design for manufacture", Mc Graw Hill Book Co., Second edition, 1999.
- 2. Robert Matousek "Engineering Design A systematic approach", Blackie and Son Ltd, London
- 3. Geoffrey Boothroyd, PeterDewhurst, Winston A. Knight "Product design for manufacture and assembly", Taylor and Francis group, 2011.

- 1. Harry Peck, "Design for manufacture", Pitman publications, 1983.
- 2. Trucks H.E., "Design for Economic Production, Society of Manufacturing engineers", Michigan 2nd Edition1987
- 3. Karl T.Ulrich and Steven D Eppinger "**Product Design and Development**", Tata McGraw Hill, 3rd edition, 2008
- 4. Oliver R.Wade, "Tolerance Control in design and Manufacturing", Industrial Press Inc., New York Publications, 1967.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain the basic design principles and use of tolerances in manufacturing.
- **CO2:** Describe the concepts of form design for various metals and alloys involving in casting process.
- CO3: Describe the design concepts of formed metals and plastic components.
- CO4: Explain the concepts of various machined parts design for manufacturing.
- **CO5:** Explain the assembly concepts for manufacturing and its technology requirements.

PO/PSO	PO	РО	PO	PO	РО	РО	РО	РО	РО	РО	РО	PO	PSO	PSO	PSO
CO	1	2	3	4	5	6	.7 1/	8	9	10	11	12	1	2	3
C01	Η	М	Μ	L	1	2			1				L		
CO2	Μ	L	М	L	A	X				3			L		
CO3	М	L	Μ	L						285			L		
CO4	М	L	Μ	L	de la	100	526		11.000	1			L		
CO5	Μ	L	Μ	L		3		%G	Ð				L		
18PPE \$10	Μ	L	М	L									L		

COURSE ARTICULATION MATRIX

18PPE\$11

Category: PE

PRE-REQUISITES: NIL

L T P C 3 0 0 3

COURSE OBJECTIVES:

* To develop the capacity of making value judgments in real life situations and to overcome the crisis of values encountered in professional life.

UNIT - I	HUMAN VALUES AND INTRODUCTION TO ETHICS	(9 Periods)
Morals, Valu	es and Ethics - Integrity - Work Ethic - Respect for Others - Livin	g Peacefully –
caring – Shar	ing – Honesty – Courage – Valuing Time – Co-operation – Commitm	ent – Empathy
 Self-Confid 	lence - Character - Spirituality - Senses of 'Engineering Ethics' - va	ariety of moral
issues - types	of inquiry.	
UNIT - II	ETHICAL THEORIES AND PROFESSIONALISM	(9 Periods)
Moral dilemn	nas - moral autonomy - Kohlberg's theory - consensus and controvers	sy – Models of
Professional	Roles - theories about right action - Self-interest - customs and reli	gion - uses of
ethical theorie	es.	
UNIT - III	ENGINEERING AS SOCIAL EXPERIMENTATION	(9 Periods)
Engineering a	as experimentation - engineers as responsible experimenters - code	s of ethics - a
balanced outle	ook on law - the challenger case study.	
	9	
UNIT - IV	SAFETY, RESPONSIBILITY AND RIGHTS	(9 Periods)
Safety and ris	k - assessment of safety and risk - risk benefit analysis and reducing ri	sk - three mile
island and che	ernobyl case studies.	
Collegiality a	nd loyalty - respect for authority - collective bargaining - confidentia	lity - conflicts
of interest -	occupational crime - professional rights - employee rights - Intelle	ctual Property
Rights (IPR)	- discrimination.	
UNII - V	GLOBAL ISSUES	(9 Periods)
Multinational	corporations - Environmental ethics - computer ethics - weapons	development -
engineers as	managers-consulting engineers-engineers as expert witnesses and a	dvisors -moral
leadership-sai	mple code of Ethics like ASME, SAE India, Institution of Engineers	(India), Indian
Institute of N	naterials management, institution of electronics and telecommunica	tion engineers
(IEIE),India.		

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. Mike Martin and Roland Schinzinger "Ethics in Engineering", McGraw-Hill, New York, 3rd edition, reprint 2007
- 2. Govindarajan M, Natarajan S, Senthil Kumar V. S **"Engineering Ethics",** Prentice Hall of India, New Delhi, 2004
- 3. Tripathi A N "Human values", New Age international Pvt. Ltd., New Delhi, 2002

- 1. Charles D. Fleddermann "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004
- 2. Charles E Harris, Michael S. Protchard and Michael J Rabins "Engineering Ethics Concepts and Cases", Wadsworth Thompson Learning, United States, 2000.
- 3. John R Boatright "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
- 4. Edmund G Seebauer and Robert L Barry **"Fundamentals of Ethics for Scientists and Engineers"**, Oxford University Press, Oxford, 2001.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: recognize the basic concepts of Human values and ethics.

CO2: express the ethical theories.

CO3: identify the concept of professionalism

CO4: identify and implement the safety aspects in social experimentation

CO5: understand the impact of technical development in environmental and societal context.

PO/PSO	PO	PO	РО	PO	РО	РО	РО	PO	PO	РО	РО	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	L	Н			Н	H	Н	Н			М	Н		
CO2	L	L	Н			Ηð	H	Н	Н			М	Н		
CO3	L	L	Н			H	Н	Н	H	Н	Н	М	Н		
CO4	L	L	Н			Η	H	Н	Η	Н		М	Н	Н	
CO5	L	L	Н			H	H	H	H	Н		М	Н	Н	
18PPE \$11	L	L	Н			Н	Н	Н	Н			М	Н		

COURSE ARTICULATION MATRIX

Category: PE

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PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To understand basic layout and the usage of material handling equipments for industries and gain knowledge on industrial buildings and utilities.

UNIT- I	INTRODUCTION	(9 Periods)					
Factors to be	e considered for plant layout - physical facilities - equipments requ	ired for plant					
operation. Ca	pacity, serviceability and flexibility and analysis in selection of equ	ipments space					
requirements,	man power requirements						
UNIT- II	PLANT LAYOUT	(9 Periods)					
Plant layout -	need for layout, factors influencing product, process, fixed and comb	ination layout					
- tools and	techniques for developing layout, process chart, flow diagram, st	ring diagram,					
template and	scale models machine data. Layout planning procedure. Visualiza	tion of layout					
revision and i	mproving existing layout, balancing of fabricating and assembly lines	•					
UNIT- III	MATERIAL HANDLING	(9 Periods)					
Principles, in	portance and scope of material handling. Planning, operation and cos	ting principles					
types of mate	rial handling systems, factors influencing their choice.						
UNIT- IV	UTILITIES	(9 Periods)					
Industrial bui	ldings and utilities - centralized electrical pneumatic water line syste	ems. Types of					
building, ligh	ting heating, ventilation and air-conditioning utilities. Planning and n	naintenance of					
waste handlin	ng statutory requirements. Packing and storage of materials - layout	for packaging					
-packaging m	achinery - wrapping and packing of materials, cushion materials						
UNIT- V	ANALYSIS OF MATERIAL HANDLING	(9 Periods)					
Analysis of material handling - factors involved, motion analysis, flow analysis, safety analysis,							
and equipment	nt cost analysis, analysis of operation and material handling surveys.						

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. James, M. Apple "Plant Layout and Material Handling", Kreiger Publishing Company, 1991
- 2. Rudenko. N "Materials handling equipment", Mir Publishers, 1969

- 1. James, M. Moore "Plant Layout and Design", Macmillan Company, NY, 1963
- 2. Muther, R."Practical Plant Layout", McGraw Hill Book Company, NY, 1955
- 3. Colin Hardie "Material Handling in Machine Shops", Machinery Publication Co. Ltd., London, 1970
- 4. Alexandrov, M "Materials Handling Equipments", MIR Publishers, 1981.
- 5. Boltzharol, A. "Materials Handling Handbook", The Ronald Press Company, 1958

COURSE OUTCOMES:

- On completion of this course, students will be able to
- **CO1:** Design plant layout for any type of industries.
- CO2: Perform effective selection and utilization of buildings and utilities.
- **CO3:** Select and utilize suitable material handling equipment.
- CO4: Plan appropriate HVAC system for industrial buildings.
- **CO5:** Analyze the usage of material handling equipments.

PO/PSO	PO	PO	PO	PO	PO	PO	РО	РО	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	L	Μ		L	L	291	$\mathbf{F}_{\mathbf{r}}$	Ĺ	2.5	L		L	L	L
CO2	Μ	L	Μ		1	L	1	L	- L	2	L		L	М	L
CO3	Μ	L	Μ		110	L		L	L		L		L	L	L
CO4	Η	L	Μ		1	L	SW.	L	L		L		L	L	L
CO5	Μ	L	Μ		М	La		L	L		L		L	L	L
18PPE\$12	Μ	L	М		L	L	1	L	L		L		L	L	L

COURSE ARTICULATION MATRIX



Category: PE L T P C

3 0 0 3

1. 18PPC306 - Manufacturing Technology

COURSE OBJECTIVES:

PRE-REQUISITES:

- * To understand principle behind various NDT techniques.
- * To study about NDT equipments and accessories.
- * To learn working procedures of various NDT techniques.

UNIT- I	INTRODUCTION	(9 Periods)
NDT Versus detection of limitations, V Dynamic insp	Mechanical testing, Overview of the Non-Destructive Testing Met manufacturing defects as well as material characterization. Relative Visual methods: Optical aids, In-situ metallography, Optical holography pection.	hods for the e merits and hic methods,
UNIT- II	LIQUID PENETRANT & MAGNETIC INSPECTION	(9 Periods)
Penetrant sys developers - Advantages, liquids. Magr	stems: Principles – Process - Liquid penetrant materials – Emulsifie - sensitivity - Advantages, Limitations and Applications. Magnet Limitations - Methods of generating fields: magnetic particles and netography - field sensitive probes: applications. Measurement of metal p	rs - cleaners tic methods: l suspending properties.
UNIT- III	RADIOGRAPHIC METHODS	(9 Periods)
Principles of rays Recordin Radiation saf	radiography - sources of radiation - Ionising radiation – sources - X- ng of radiation-Radiographic sensitivity - Fluoroscopic methods - specia ety. Advantages, Limitations and Applications.	rays, gamma al techniques.
UNIT- IV	ULTRASONIC TESTING OF MATERIALS	(9 Periods)
Ultrasonic tes waves - gen materials test	sting: Principle - Advantages, Disadvantages, Applications - Generation eral characteristics of ultrasonic waves: methods and instruments for ing: special techniques.	of Ultrasonic or ultrasonic
UNIT- V	ELECTRICAL AND SPECIAL METHODS	(9 Periods)
Electrical me Acoustic Emi	thods: Eddy current methods: potential - drop methods, applications - Ot ssion methods. Acoustic methods: Leak detection: Thermal inspection	her methods:

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.
- 2. Ravi Prakash "Non-Destructive Testing Techniques", New Age International Publishers, 2010

- 1. ASM Metals Handbook "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
- 2. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005
- 3. Charles, J. Hellier, "Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Classify various non-destructive testing and choose the right method of testing for detection of defects on various materials.
- CO2: Check different metals and alloys by visual inspection method.
- **CO3:** Explain and perform non-destructive tests like: Liquid penetrant test, Magnetic particle test, Ultrasonic test, X-ray and Gamma ray radiography, Leak Test, Eddy current test.
- CO4: Describe the safety procedures of operating the NDT equipments and follow them.

CO5: Detect the flow and other defects using NDT procedure for industrial component.

PO/PSO	PO	PO	PO	PO	PO	PSO	PSO	PSO							
СО	1	2	3	4	5	6		8	9	10	11	12	1	2	3
C01		М			A	X							L		М
CO2		М				1		N		200					М
CO3		М	М	Η	M	10	3	115	110			М			
CO4					2	М		10							Н
CO5			М			L									М
18PPE\$13		М	М	Η	М	М						М	L		М

COURSE ARTICULATION MATRIX

SUPPLY CHAIN MANAGEMENT

Category: PE L T P C 3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To develop the students in the dynamics of inter-organizational collaboration and coordination towards building supply chains.

UNIT- I	INTRODUCTION TO SUPPLY CHAIN MANAGEMENT	(9 Periods)
Meaning and	l definition of supply chain management, Difficulties of managing supp	bly chains, the
development	chain, global optimization, Key issues in of supply chain management.	
UNIT- II	INVENTORY MANAGEMENT AND RISK POOLING	(9 Periods)
Introduction	, single stage Inventory control, The economic lot size model, effect	ct of demand
uncertainty.	Risk pooling, centralized and decentralized system, managing inventory	in the supply
chain, foreca	sting.	
UNIT- III	VALUE OF INFORMATION	(9 Periods)
Introduction	, Bullwhip effect-Quantifying the bullwhip effect-impact of centralize	d information
on the bull	whip effect-supply chain with centralized demand information and	decentralized
demand info	ormation=managerial insights in the value of centralized information.	Methods for
coping with	the bullwhip effect. Supply chain integration - push, pull and push	1-pull system.
Demand driv	ven strategies.	
UNIT- IV	GLOBALISATION OF SCM	(9 Periods)
Introduction	-Global market forces, Technological forces, global cost forces,	political and
economic f	orces. Managing global risks-speculative strategies, hedge strate	gies, flexible
strategies- re	equirements for global strategy implementation. Issues in international	supply chain
management	- International versus regional products, region-specific products,	, true global
products. Su	pplies integration into to new product development- spectrum of suppli	er integration,
keys to ef	fective supplier integration, bookshelf of technologies and sup	pliers. Mass
customizatio	n-Meaning, making mass customization work, mass customization and	supply chain
management		
UNIT- V	INFORMATION TECHNOLOGY FOR SCM	(9 Periods)
Goals of sup	ply chain IT, IT standards, It infrastructure, IT for supply chain excellen	ce.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. Simchi-Levi David, Kaminsky Philip, Simchi-Levi Edith and Ravi Shankar. "Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies", Third Edition, Tata McGraw Hill Education Private Limited, New Delhi, Tenth reprint, 2012.
- 2. Chopra S and Meindl P "Supply Chain Management: Strategy, Planning and Operation", Second Edition, Prentice Hall India Private Limited, 2005.

- 1. Robert Jacobs F, William Berry and Clay Whybark D "Manufacturing Planning and Control for Supply Chain Management", Tata McGraw Hill, New Delhi, 2011.
- 2. Christopher "Logistics and Supply Chain Management", Pearson Education Asia, New Delhi
- 3. Taylor and Brunt, "Manufacturing Operations and Supply Chain Management (The Lean Approach)", Business Press Thomson Learning, NY

COURSE OUTCOMES:

- On completion of this course, students will be able to
- **CO1:** Describe the objectives of supply chain management.
- CO2: Describe the inventory management and risk pooling.
- **CO3:** Describe about value of information.
- **CO4:** Describe about globalization of SCM.
- **CO5:** Describe about information technology for SCM.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PO	PO	PO	РО	РО	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ					Μ			2			L		L	
CO2	Η	L			L	Μ		汄	L				М	М	
CO3					A	Ŵ			L	М		М			М
CO4	Η	L				L		L		198			L		
CO5		Η			L	100	52	5-1	0Lu	Į		М		М	
18PPE\$14	Μ	Μ			L	М		L	L	L		М	L	М	L

18PPE\$15

PRODUCTION MANAGEMENT

Category: PE L T P C 3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To introduce various management methods in production industries.

UNIT- I	BASICS OF MANAGEMENT	(9 Periods)
Evolution of	f management - General principles of management - management	t functions –
organization	-types - comparison - functions of personnel management - recruitment	nt – training –
leadership -	motivation - communication - conflict - Industrial relations - trade union	1.
UNIT- II	OPERATIONS MANAGEMENT	(9 Periods)
Plant Locati	on - Layout - Materials Handling - Method study - Time study - I	Ergonomics –
Aggregate P	lanning – Value Analysis.	
	192 SuperCel	
UNIT- III	MATERIALS MANAGEMENT	(9 Periods)
Materials m	anagement - Purchasing - Objectives - parameters - procedure. Suppli	er selection –
Stores mana	agement - codification - Waste management - Reasons for waste	generation -
identification	n and control of waste – scrap disposal.	
UNIT- IV	INVENTORY MANAGEMENT	(9 Periods)
Purpose of i	nventory - Cost related to inventory - Basic EOQ model - variations in	EOQ model –
Finite Produ	ction, quantity discounts - ABC Analysis - MRP - Introduction to MRP	II and ERP.
	Children and a state	
UNIT- V	MARKETING MANAGEMENT	(9 Periods)
Functions of	f marketing – Sales promotion methods – advertising – product packagin	g – marketing
variables – c	listribution channels – organization – market research – market research te	echniques.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. R. Panneerselvam "Production and Operations Management", Prentice Hall of India, 2012.

REFERENCE BOOKS:

- 1. Koontz and Weihrich "Essentials of Management", McGraw Hill 2015
- 2. Philips Kotler "Marketing management", Pearson, 2015
- 3. Martand T. Telesang "Production Management", S. Chand& Co., 2007

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Illustrate the functions of management and personnel management.
- **CO2:** Explain various ways of managing operations in engineering industries.
- **CO3:** Identify the methods for managing materials in engineering industries.
- **CO4:** Describe the importance of inventory and the ways of managing inventory.
- **CO5:** Explain the various processes involved in marketing.

PO/PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L								М	М	Η	М			
CO2	Μ	М		М	L					L	Н	L	L		Н
CO3	L	М	L	L	L	G	num .	ng.	1	L	М	L			L
CO4	М	L	L	L	L	Lan Las	<i>π</i> ¢α θ	1000	3	L	Н	L			М
CO5		L			Z	N. N.			X	Н	М	L			
18PPE\$15	L	М	L	L	L			T.	L	L	Н	L	L		М

COURSE ARTICULATION MATRIX



18PPE\$16

PRE-REQUISITES:

- 1. 18PPC306 Manufacturing Technology
- 2. 18PPC406 Machine Tools and Processes

COURSE OBJECTIVES:

* To craft the students to acquire knowledge in lean manufacturing tools, understand various phases involved and methodology in implementing lean in manufacturing scenario.

LEAN MANUFACTURING

(Common to MECH & PRODN)

UNIT- I	FOUNDATION AND CONCEPTS OF LEAN	(9 Periods)
Historical ev	olution of lean manufacturing - Objectives of lean manufacturing - Key	principles
and implicat	ions of lean manufacturing - Traditional verses lean manufacturing Fo	ord System –
Growing Dy	sfunction — Ten steps to lean production - Necessity of Lean Production	n – Systems
and lean thin	king - Construction of Lean Production - Lean images and Lean Activit	ies
UNIT- II	LEAN TOOLS AND METHODOLOGY	(9 Periods)
Primary tool	s – Implementing 5S, Workplace organization – Stability - Just-In-Time	e – Takt time
- One piece f	Now – Pull, Cellular systems, , Six Sigma. SMED: Single minute exchar	ige of dies –
theory and p	ractice of the SMED system - TPM, Pillars of TPM, Conditions for TPM	1 success,
TPM implen	nentation process - Overall Equipment Effectiveness - computation of O	EE.
UNIT- III	VALUE STREAM MAPPING	(9 Periods)
Process Map	ping and Value Stream Mapping - Current state map – Future state map	- VSM
symbols – M	lapping tips - Need for process maps - types and its construction - steps i	in preparing
VSM - Com	parison of CSVAM and FSVSA – Simulation scenario case studies	
UNIT- IV	INTEGRATED QUALITY	(9 Periods)
Developmen	t and necessity - Poke Yoke - mistake proofing - quality improvement -	- Leveling
and Visual n	nanagement. Common errors – Inspection system and Zone control – Us	sing Poke
Yokes – Jide	oka implementation -Process capability study – Lean six sigma.	
UNIT- V	LEAN INVOLVEMENT AND CULTURE	(9 Periods)
Necessity of	involvement - Waste of Humanity - Activities supporting involvement	– Kaizen
Circle Activi	ty – Practical Kaizen Training – Key factors in Practical Kaizen Trainin	g – Lean
Culture – Sta	andardization – Standards and abnormality control – 'Five Why' analysi	s.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. Dennis P "Lean Production Simplified: A Plain Language Guide to the World's Most Powerful Production System", Productivity Press, New York, 2009.
- 2. Liker, J and Meier, D "The Toyota Way", Field book, McGraw-Hill, 2010
- 3. N.Gopalakrishnan, "Simplifed Lean Manufacture", PHI, 2010

- Category: PE
- LTPC
- 3 0 0 3

- 1. Devadasan S R, Mohan Sivakumar V, Murugesh R and Shalij P R, "Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities", Prentice Hall of India Learning Limited, New Delhi, 2012.
- 2. Gopalakrishnan N, "Simplified Lean Manufacture: Elements, Rules, Tools and Implementation", Prentice Hall of India Learning Private Limited, India, 2010.
- 3. Bill Carreira, **"Lean Manufacturing that Works: Powerful Tools for Dramatically** *Reducing Wastes and Maximizing Profits",* Prentice Hall of India Learning Private Limited, India, 2009
- 4. Don Tapping, Tom Luyster and Tom Shuker "Value Stream Management: Eight Steps to Planning, Mapping and Sustaining Lean Improvements", Productivity Press, New York, USA, 2007

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Describe about the origin and foundation of lean production.
- CO2: Describe about stability and standards in lean system.
- CO3: Describe about Just In Time (JIT) and its application in lean.
- CO4: Describe about Jidoka and Poke Yoke.
- **CO5:** Describe about lean involvement and culture.

PO/PSO	PO	РО	PO	PO	PO	PO	РО	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	70	8	9	10	11	12	1	2	3
CO 1	L		М		L	H	Μ			3	L	L		L	
CO 2	М	L		М	L	M	L		Ľ	965		М	М	M	
CO 3			Н	L	AE.	100			<u>nL</u> o	M				L	М
CO 4	Н	L		М		Μ	(L	I A A A A A A A A A A A A A A A A A A A			М	L	Н	
CO 5		М	Н		L		L		L						
18PPE\$16	М	L	М	М	L	М	L	L	L	М	L	М	L	М	L

COURSE ARTICULATION MATRIX

MICRO MANUFACTURING PROCESSES

Category: PE

0 3

LTPC

3 0

PRE-REQUISITES:

- 1. 18PPC306 Manufacturing Technology
- 2. 18PPC406 Machine Tools and Processes

COURSE OBJECTIVES:

* To be familiar with the principles, basic machine tools, and developments in the micro manufacturing process and research trends in the area of micro manufacturing process.

UNIT- I	MICRO MACHINING I	(9 Periods)						
Mechanical Micro machining - Ultra Sonic Micro Machining - Abrasive Jet Micro Machining -								
Water Jet Micro Machining – Abrasive Water Jet Micro Machining – Micro turning – Chemical								
and Electro Chemical Micro Machining – Electric discharge micro machining.								
UNIT- II	MICRO MACHINING II	(9 Periods)						
Beam Energy	/ based micro machining - Electron Beam Micro Machining - Laser	Beam Micro						
Machining –	Electric Discharge Micro Machining - Ion Beam Micro Machining -H	Plasma Beam						
Micro Machin	ning – Electro Discharge Grinding – Electro Chemical spark micro machi	ning.						
UNIT- III	NANO POLISHING	(9 Periods)						
Abrasive Flow finishing - Magnetic Abrasive Finishing - Magneto rheological finishing -								
Magneto Rheological abrasive flow finishing - Magnetic Float polishing - Elastic Emission								
Machining – chemo-mechanical Polishing.								
UNIT- IV	MICRO FORMING AND WELDING	(9 Periods)						
Micro extrusion - Micro and Nano structured surface development by Nano plastic forming and								
Roller Imprinting - Micro bending with LASER - LASER micro welding - Electron beam for								
micro welding.								
UNIT- V	RECENT TRENDS AND APPLICATIONS	(9 Periods)						
Metrology for micro machined components - Ductile regime machining- AE based tool wear								
compensation-Machining of Micro gear, micro nozzle, micro pins - Applications.								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. Jain V. K. "Micro Manufacturing Processes", CRC Press, Taylor & Francis Group, 2012

REFERENCE BOOKS:

- 1. Jain V.K., "Introduction to Micro machining" Narosa Publishing House, 2011
- 2. Bharat Bhushan "Handbook of nanotechnology", springer, Germany, 2010
- 3. Jain V.K "Advanced Machining Processes", Allied Publishers, Delhi, 2002
- 4. Mcgeough.J.A., "Micromachining of Engineering", Materials", CRC press 2001.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1**: Describe various mechanical micro machining processes
- **CO2:** Describe various beam energy based micro machining processes.
- CO3: Explain various methods of nano polishing techniques.
- **CO4:** Understand and explain the micro forming and welding processes.
- **CO5:** Use the knowledge of micro manufacturing processes into engineering applications.

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ				Н			М	L	М		М	М		
CO2	Μ				Н			М	М	М		М	М		
CO3	Μ				Н				М	М		М	М		
CO4					М				L	М		М	М		
CO5	Η				Н	Μ	2	М	М	М			М		
18PPE\$17	Μ				H	М		Μ	Μ	M		М	М		

COURSE ARTICULATION MATRIX



THEORY OF METAL CUTTING

(Use of approved data book is permitted) (Common to MECH & PRODN Branches)

> Category: PE L T P C 3 0 0 3

PRE-REQUISITES:

- 1. 18PES303 -Engineering Mechanics
- 2. 18PPC304 -Thermal Sciences

COURSE OBJECTIVES:

* To familiarize students about the basic mechanics, thermal, wear and chatter mechanisms in metal cutting processes.

UNIT- I	ORTHOGONAL CUTTING (9 Periods)								
Basic mechanism of chip formation, Techniques for study of chip formation, types of chips, Chip									
breaker, Orthogonal verses Oblique cutting, Shear plane angle, Cutting force and velocity									
relationship in	n orthogonal cutting, Modern theories in Mechanics of cutting, Review	of Merchant							
and Lee Shaffer Theories- limitations, applications.									
UNIT- II	OBLIQUE CUTTING	(9 Periods)							
Direction of C	Chip flow, Normal Velocity and Effective Rake angles, Relationship bet	ween rake							
angles, values	angles, values of various angles for machining of brittle, ductile and elastic materials, Cutting								
ratios in obliq	ue cutting, Shear angle and Velocity relationship, Stabler's rule, Obliqu	e cutting							
applications.									
UNIT- III	THERMAL ASPECTS OF MACHINING	(9 Periods)							
Heat distributions in machining, Experimental determination and analytical calculation of cutting									
tool temperate	ure, measurement of temperature, Heat in primary shear Zone, Heat in T	fool and							
Work Interfac	e, Heat in Areas of Sliding, effects of various parameters on temperature	re, Cutting							
fluids; Effects	fluids; Effects of cutting fluid, functions, requirements, types and selection, commercially								
available cutt	ing fluids.								
UNIT- IV	CUTTING TOOL MATERIALS, TOOL LIFE AND TOOL	(9 Periods)							
	WEAR								
Essential requirements of tool materials, Structure and properties of High speed steel and									
Cemented carbides, development in tool materials, ISO specification for inserts and tool holders,									
tool life, conventional and accelerated tool life tests, concept of machinability index, economics of									
machining, Reasons for failure of cutting tools and mechanisms and measurements of wear in									
single and multi-point cutting tools									
UNIT- V	DESIGN OF CUTTING TOOLS	(9 Periods)							
Nomenclature of Single point and Multi point cutting tools - Design of Turning tool, Drills,									
Milling cutters and tool holders.									

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods
- 1. Shaw.M.C. "Metal cutting principles", oxford Clare don press, 2005.
- 2. Bhattacharya.A. "Metal Cutting Theory and practice", Central Book Publishers, India, 2012.

REFERENCE BOOKS:

- 1. Boothroid D.G. & Knight W.A., "Fundamentals of machining and machine tools", Marcel Dekker, Newyork, 1989.
- 2. HMT "Production Technology", HMT publication, 2017

COURSE OUTCOMES:

On completion of this course, students will be able to

- CO1: Elaborate the mechanisms of chip formation in different metal cutting processes
- **CO2:** Understand the difference between Orthogonal and Oblique cutting and its uses
- CO3: Realize the thermal effects of cutting process and its removal methods
- CO4: Predict the effects of cutting parameters on Tool life

CO5: Design a cutting tool for various cutting process

PO/PSO	PO	PO	PO	РО	РО	РО	РО	РО	РО	РО	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01	Μ	L				N		1		М		М	L		М
CO2	Μ	L	L			516	Xa	E	1110	M		М	М	М	
CO3	Μ		L		1	22		10 and	T			М			
CO4	Μ		М									М	L	L	
CO5	М				М			М		М	М	М	М	Н	М
18PPE\$18	Μ	L	L		М			М		М	М	М	М	Μ	М

COURSE ARTICULATION MATRIX

L- Low, M - Moderate (Medium), H - High

18PPE\$19

ADVANCED CASTING TECHNOLOGY

Category: PE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To impart knowledge on various advanced casting techniques.

UNIT- I	CASTING OF METALS	(9 Periods)									
Factors influe	encing casting of cast iron, steel, aluminium, magnesium, copper - facto	rs influencing									
the casting p	ractice - casting quality control. X-ray, sand control method - control of	of casting and									
casting defect	ts.										
UNIT- II	ROBOTICS IN METAL CASTING	(9 Periods)									
Structure and	Structure and classification of Industrial Robots, Terminology of robot motion, Die cast Robots										
and Foundry	and Foundry Robots- advantages, applications. Robotic automation in permanent mold foundries.										
UNIT- III ADVANCES IN METAL CASTING (9 Periods)											
Hcasting, sh	Hcasting, shell moulding, investment casting, foam casting, centrifugal casting, Die casting,										
continuous ca	sting, squeeze casting - processes and parameters.										
UNIT- IV	CASTING METALLURGY	(9 Periods)									
Solidification	of pure metals, alloys, dendritic growth, homogeneous and heterogeneo	us nucleation,									
constitutional	under cooling, defects in casting causes and remedies. Long range and s	short range									
solidifying al	loys.										
UNIT- V COMPUTER AIDED METAL CASTING (9 Periods)											
Use of computer in runner and riser design, solidification front monitoring, expert system in											
casting defects, software mine-spectroscopy and chemical analysis.											

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Jain P.L "Principles of Foundry Technology", Tata McGraw-Hill Publishers, 4th edition 2008.
- 2. Heineloper & Rosenthal "Principles of Metal Casting", Tata McGraw Hill Publishers, 2nd edition, 2000.

REFERENCE BOOKS:

- 1. Jain R.K. and Gupta S.C. "Production Technology", Khanna Publishers, New Delhi, 17th edition, 2004
- 2. Rao, P. N "Manufacturing Technology", McGraw Hill Publishers, 3rd edition, 2010

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain the factors influencing casting of metals.
- **CO2:** Explain the robots in metal casting.
- **CO3:** Explain various advanced casting processes.
- CO 4: Describe the thermal, metallurgical aspects during solidification in casting.
- **CO 5:** Explain the applications of computer in metal casting.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PO	PO	PO	PO	PO	РО	РО	PO	PO	PO	PO	PSO	PSO	PSO
CO	1	2	3	4	5	6	$\sqrt{2} \sqrt{2}$	8	9	10	11	12	1	2	3
					C	02	RUH	THE.		2					
CO1	Μ	Μ		L	1	L	L	L	A	L		L	Н		L
CO2	L	М	Н		1	М	М	L	L	L		L	Н		L
CO3	М	М	L	L	L	М	L	L	L	L		L	Н		L
CO4	L	Η	М	L	L	Μ		头		L		L	Н		L
CO5	L	М	М	М	М	Ľ	L	L	L	L		L	Н		L
18PPE\$19	L	Μ	Μ	L	(EL)	Μ	L	L	L	L		L	Н		L

L – Low, M- Moderate (Medium), H - High

Category: PE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To enable the students to understand basic concepts of Total Productive Maintenance.
- * Expose the students to the objectives, maintenance models, group activities, logistics, condition monitoring and implementation of Total Productive Maintenance.

UNIT- I	MAINTENANCE CONCEPTS	(9 Periods)								
Introduction	- Objectives and functions - Productivity, Quality, Reliability and M	laintainability								
(PQRM) -	Terotechnology - Reliability Centered Maintenance - Predictive M	laintenance -								
Condition B	ased Maintenance - maintainability prediction - availability and system	effectiveness-								
maintenance	e costs - maintenance organization.									
UNIT- II	MAINTENANCE MODELS	(9 Periods)								
Minimal rep	Minimal repair - As Good As New policy - maintenance types - balancing Preventive Maintenance									
and breakdo	own maintenance - Preventive Maintenance schedules: deviations on	both sides of								
target values - PM schedules: functional characteristics - replacement models.										
UNIT- III	FUNDAMENTALS OF TPM	(9 Periods)								
Zero breakd	owns - Zero Defects and TPM - maximizing equipment effectiveness -	Autonomous								
maintenance	e program - five pillars of TPM - TPM small group activities - TPM of	organization -								
Managemen	t Decision - Educational campaign - Creation of Organizations - Est	ablishment of								
basic policie	es and goals - Formation of master plan - TPM implementation.									
UNIT- IV	MAINTENANCE LOGISTICS	(9 Periods)								
Human facto	ors in maintenance - maintenance manuals - maintenance staffing meth	ods - queuing								
applications	- simulation - spare parts management - maintenance planning and sched	luling.								
UNIT- V ONLINE MONITORING (9 Periods)										
Condition monitoring - Infrared Thermography, Oil Analysis, acoustic emissions testing, Motor										
Current Analysis, Vibration Measurement and Analysis, Wear Debris Monitoring, Visual checks -										
corrosion co	ntrol - Maintenance Management Information System - Expert system ap	plications.								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Nakajima S. "Introduction to TPM", Productivity Press, Chennai, 1992
- 2. Srivastava S.K. "Maintenance Engineering (Pri.Practices& Management)", S. Chand Group, 2011

REFERENCE BOOKS:

- 1. Wireman T "Total Productive Maintenance", Industrial Press Inc., New york, 2004
- 2. Goto F "Equipment planning for TPM Maintenance Prevention Design", Productivity Press, 1992
- 3. Shirose K., "Total Productive Maintenance for Workshop Leaders", Productivity Press, 1992
- 4. Kelly A., "Maintenance planning and control", Butterworths, London, 1991

COURSE OUTCOMES:

- On completion of this course, students will be able to
- **CO1:** Describe the concept of total productive maintenance used in the industries.
- **CO2:** Describe how TPM improves operations by preventing equipment breakdowns and prevention of product defects and rejects.
- **CO3:** Understand the usage of tools for TPM implementation and able to identify and eliminate loss through TPM implementation.
- **CO4:** Describe the logistics involved in Total productive Maintenance.
- **CO5:** Effectively use the total productive maintenance for online monitoring of processes.

PO/PSO	РО	РО	РО	PO	РО	РО	РО	РО	PO	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						Y		М	М	Η		М			
CO2	Μ	Η			1	Μ		М	М	М	М	М			L
CO3	L				М	30	1	М	М	М		М	М		М
CO4				0000		1		М	Μ			Н			
CO5				9	L	103	200	М	М	6.1		М			L
18PPE\$20	L	L			L	М	CO ED	М	М	М	М	М	М		L

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

18PPE\$21

GREEN MANUFACTURING

Category: PE L T P C 3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To introduce the basic concepts needed to proceed green manufacturing

UNIT- I	OUR ENVIRONMENT	(9 Periods)									
The human p	population and the environment, the human population's effects on t	he earth, the									
ecosystem, o	chemical cycling and succession, the biogeochemical cycles, n	najor global									
biogeochemic	cal cycles - carbon, carbon-silicate, nitrogen and phosphorus cy	cles, global									
warming, gre	enhouse effect, major greenhouse gases.										
UNIT- II	MANUFACTURING SYSTEMS	(9 Periods)									
Levels of manufacturing systems, environmentally conscious manufacturing- components,											
system effect	system effects and assessment										
UNIT- III	WATER POLLUTION IN MANUFACTURING SYSTEMS	(9 Periods)									
Metalworking fluids- environmental and health impact, Heavy metals in water, MWF pollution											
prevention th	rough process planning, process modification and in process recy	cling, water									
footprint anal	ysis.										
UNIT- IV	AIR AND SOLID POLLUTION IN MANUFACTURING	(9 Periods)									
	SYSTEMS										
Origin of	airborne particles in manufacturing, traditional and modern	particulates									
mitigation/eli	mination techniques. Industrial solid and hazardous waste managen	nent, Carbon									
footprint anal	ysis.										
UNIT- V	ENVIRONMENTAL MANAGEMENT SYSTEMS	(9 Periods)									
Eco-labeling - Design for the Environment, Concepts of ISO 14001 - requirements of ISO 14001											
– Environmer	- Environmental Management System – frame work and benefits.										

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Daniel B Botkin and Edward A Keller "Environmental Science", John Wiley & Sons, Chichester, 2010
- 2. Madu. C.N "Handbook of Environmentally Conscious Manufacturing", N Kluwer Academic Publisher, 2001.

REFERENCE BOOKS:

- 1. Swamidass, P.M., "Encyclopedia of Production and Manufacturing Management", Kluwer Academic Publisher, 2000.
- 2. Kutz, M "Environmentally Conscious Mechanical Design John Wiley & Sons, 2007
- 3. Davim, J.P Sustainable Manufacturing", John Wiley & Sons, 2010.Koontz and Odonnel-Essentials of Management, McGraw Hill 1992

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain about the effect of humans on ecosystems and various phenomenon of Eco systems
- **CO2:** Explain about the environmentally conscious manufacturing systems.
- **CO3:** Evaluate the effects of water pollution by manufacturing systems and their prevention
- **CO4:** Discuss the effects of air and solid pollution in manufacturing systems
- CO5: Explain about environmental management systems

PO/PSO	РО	PO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01	L					Н	Н	М	L	М	L	Н			L
CO2	L	L	Μ	L		Н	Н	М	L	М	L	Н			L
CO3	L	L	L	L		Н	Н	М	L	М	L	Н			L
CO4	L	L	Μ	L		H	Н	М	L	М	L	Н			L
CO5	L	Μ	Μ	L	193	Η	Н	М	L	М	L	Н			L
18PPE\$21	L	L	Μ	L	2	Н	Н	М	-E	М	L	Н			L

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H - High



COMPUTER AIDED DESIGN

(Common to MECH & PRODN Branches)

Category : PE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES :

- 1. 18PES106 Engineering Graphics
- 2. 18PPC409 Production Drawing

COURSE OBJECTIVES:

* To provide an overview of how computers can be employed to in design the mechanical component

component

UNIT- I	INTRODUCTION	(9 Periods)									
Fundamenta engineering systems- 2I transformat	Fundamentals of Computer Graphics-Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations homogeneous coordinates - Line drawing -Clipping- viewing transformation.										
UNIT- II	GEOMETRIC MODELING	(9 Periods)									
Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves- Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep.											
UNIT- III VISUAL REALISM (9 Periods)											
Hidden line	-surface removal algorithms, shading, colouring, computer animation										
UNIT- IV	ASSEMBLY PARTS	(9 Periods)									
Assembly analysis, to	modeling, interference position and orientation, Geometric tolerance lerance synthesis, mechanism simulation and interface checking.	e, tolerance									
UNIT- V	CAD STANDARDS	(9 Periods)									
Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc communication standards.											

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Ibrahim Zeid "Mastering CAD CAM", Tata McGraw-Hill PublishingCo.2007
- 2. D.Hearn and M.P.Baker "Design of Computer Graphics", Prentice Hall Inc., 1992
- 3. C.McMohan and J.Browne, "CAD/CAM Principles", II edition, Pearson Education, 1999

REFERENCE BOOKS:

- 1. Chris McMahon and Jimmie Browne **"CAD/CAM Principles"**, Practice and Manufacturing management "Second Edition, Pearson Education, 1999.
- 2. Radhakrishnan P, SubramanyanS. and RajuV., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.
- 3. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc, 1992
- 4. Foley, Wan Dam, Feiner and Hughes "Computer graphics principles & practice", Pearson Education -2003
- 5. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- CO 1: Understand the fundamental of computer graphics and 2D and 3D transformation
- **CO2:** Familiar about the geometric, surface and solid modeling technique
- **CO3:** Develop the line , surface and solid removal algorithm and creation of computer animation
- **CO4:** Identify the importance of tolerance during assembly of components
- **CO5:** Summarize the various standards used in CAD

PO/PSO	PO	PO	РО	PO	РО	РО	РО	РО	РО	PO	PO	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L		Н			9			1	М				М	М
CO2		L			М	8	16		5					М	М
CO3		L		003	Н	No.		L	X	L				М	М
CO4		L		L	5	<u></u> ₹//	5		L	L				М	М
CO5					Η	Q.	10. 3	20	2		М			L	М
18PPE\$22	L	L	Η	L	М			L	L	L	М			М	М

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

Category: PE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To familiarize students with the concepts and techniques of robot manipulator, its kinematics, programming and build confidence to evaluate, choose and incorporate robots in engineering systems.

UNIT- I	FUNDAMENTALS OF ROBOT	(9 Periods)					
Robotics – Specification Controls sys motors – ste	Robotics – Introduction – Basic structure – Classification of robot and Robotic systems – Specifications of Robots - laws of robotics – work space, precision movement. Drives and Controls systems: Hydraulic systems, power supply – servo valve – hydraulic motor – DC servo motors – stepper motors – operation – selection of system – control system – servo control.						
UNIT- II	ROBOT MOTION ANALYSIS	(9 Periods)					
Kinematics of and inverse static forces,	of Robot: Introduction, Matrix Representation, homogeneous transform kinematics, Inverse kinematics Programming, Degeneracy, dexterity Basics of trajectory planning.	ation, forward , velocity and					
UNIT- III	GRIPPERS AND SENSORS	(9 Periods)					
Robot end mechanisms grippers – . Potentiomete Torque sense	Robot end effectors: Types of end effectors – Mechanical grippers – Types of Gripper mechanisms – Grippers force analysis – Other types of grippers – Vacuum cups – Magnetic grippers – Adhesive grippers – Robot end effectors interface. Sensors: Position sensors – Potentiometers, encoders, - LVDT, Velocity sensors, Acceleration Sensors, Force, Pressure and Torque sensors. Touch and Tactile sensors. Proximity, Range and sniff sensors						
UNIT- IV	PROGRAMMING AND APPLICATION	(9 Periods)					
Types of pro	gramming – programming languages sample program for different type	es of robots –					
Industrial A inspections -	pplications: Application of robots in processing operations – A - Material handling – Loading and unloading – AI and Robotics.	Assembly and					
UNIT- V	MACHINE VISION	(9 Periods)					
Introduction – image processing Vs image analysis, image acquisition, digital images – sampling and quantization – image definition, levels of computation. Image processing Techniques: Data reduction –Windowing, digital conversion. Segmentation– Thresholding, Connectivity, Noise reduction, Edge detection, Segmentation, Region growing and Region splitting, Binary morphology and grey morphology operation – feature extraction.							

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Pract

Practical: 0 Periods Total: 45 Periods

- 1. Saeed B.Niku **"Introduction to Robotics: Analysis, Systems, Applications",** 2nd edition, Pearson Education India, PHI 2003 (ISBN 81-7808-677-8)
- 2. M.P.Groover "Industrial Robotics Technology, Programming and Applications", McGraw- Hill, USA, 1986

REFERENCE BOOKS:

- 1. Janakiraman P.A "Robotics and image processing", Tata McGraw Hill, 1995
- 2. YoremKoren, "Robotics for Engineers", McGraw-Hill, USA, 1992
- 3. Richard D.Klafter, Thomas A.Chmielewski and Michael Negin "Robotic Engineering", An Integrated Approach, Prentice Hall Inc, Englewoods Cliffs, NJ, USA, 1989.
- 4. Ramesh Jam, RangachariKasturi, Brain G.Schunck "Machine Vision", Tata McGraw Hill.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain the basic concepts like various configurations, classification and parts of robots.
- **CO2:** Explain the concept of kinematics, degeneracy, dexterity and trajectory planning.
- CO3: Describe various end effectors (grippers and tools) and sensors used in robots.
- **CO4:** Explain the concept of Artificial Intelligence in robots, various types of robot programming and its applications.
- **CO5:** Demonstrate the image processing and image analysis techniques by machine vision system.

PO/PSO	PO	РО	PO	PO	PO	PO	PSO	PSO	PSO						
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	L	L									L	М		L
CO2	М	М	М	М								L	Μ		
CO3	М	L	L									L	Μ		
CO4	М	М	Η		М							L	М	Μ	
CO5	Н	М	М	L								L	М	М	
18PPE\$23	Μ	Μ	Μ	L	L							L	М	М	

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H - High

Category: PE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES:

1. 18PPC306 – Manufacturing Technology

COURSE OBJECTIVES:

* To enable the students to understand the difference between investment casting and other casting processes and familiarize them in design and product development, casting process, wax materials and destructive and non destructive testing used in industries.

UNIT- I	INTRODUCTION	(9 Periods)						
Overview of Disadvantages	Overview of investment casting and comparison with other casting processes, Advantages, Disadvantages, Limitations and Applications.							
UNIT- II	DESIGN AND PRODUCT DEVELOPMENT	(9 Periods)						
Product design Cost estimation Selection of of Magma)	Product design- Tool design, Feeder design, Gate Design – spruing techniques – wax tree assembly- Cost estimation of product - Estimation of alloy constituents, wax to metal conversion ratios – Selection of equipments for moulding process- simulation software for metal pouring (Precast, Magma)							
UNIT- III	CASTING PROCESS	(9 Periods)						
Preparation of coating, Dew Knockout, Cu	f wax pattern- inversion, wax injection, wax pattern assembly; Shellin axing; Shell firing – Metal melting, Spectrometer analysis - Pouring toff, Grinding, Heat treatment, Shot blasting – Process control	g – Ceramic g; Fettling –						
UNIT- IV	MATERIALS AND INSPECTION	(9 Periods)						
Types of wax, properties, specification and testing for wax materials – Binders and refractory filler materials – testing of binders, slurry and refractory materials – Material standards- ASTM, BIS, JIS, DIN - Destructive and Non-Destructive testing of castings								
UNIT- V	INDUSTRIAL PRACTICES	(9 Periods)						
Quotation – Follow-up – Costing – Receipt of Purchase order – MRP - PPC – Quality system standards and product certification standards – ISO 9001:2008, Pressure Equipment Directive (Valves) – API(American Petroleum Institute), CE(European Standards), AS(Aerospace).								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0	Periods Total: 45 Periods
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TEXT BOOKS:

- 1. Investment Casting Institute staff "Investment casting Handbook", 1997
- 2. P.R. Beeley, R.F. Smart "Investment Casting", 1995

REFERENCE BOOKS:

- 1. James E. Sopcak, "Handbook of Lost Wax Or Investment Casting", Gembooks, 1968
- 2. C. W. Ammen "Lost Wax Investment Casting", Tab Books 1977

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Compare investment casting process with other casting processes.
- **CO2:** Explain the investment casting process.
- **CO3:** Write types of wax, properties and specifications.

CO4: Explain various destructive and non-destructive testing of investment castings.

COURSE ARTICULATION MATRIX

PO/PSO	РО	РО	РО	РО	РО	PO	РО	РО	РО	РО	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	М	Н		L						Н	М	Н	L	L
CO2	Η	М	Н	Η	L	М	М	Μ	М		М	М	М	L	L
CO3	Η	Η	Η	L		Ы	Μ	MD.		L	L		М	L	
CO4	М	М	L	L	E.	E.	М	L	Μ	L	L	М	Η	L	
18PPE\$24	Η	М	Н	L		L	М	L	Μ	L	L	М	Н	L	

L- Low, M – Moderate (Medium), H - High



Category: PE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES:

1. 18PES403 – Basic Electronics Engineering

COURSE OBJECTIVES:

- * To understand wafer preparation and PCB fabrication, the types of Mounting Technologies and components for electronics assembly & SMT process in detail.
- * To know various Defects, Inspection Equipments SMT assembly process and repair, rework and quality aspects of Electronics assemblies.

UNIT- I	INTRODUCTION TO ELECTRONICS MANUFACTURING	(9 Periods)							
History, defi	History, definition, wafer preparation by growing, machining, and polishing, diffusion,								
microlithogra	microlithography, etching and cleaning, Printed circuit boards, types- single sided, double sided,								
multi layer and flexible printed circuit board, design, materials, manufacturing, inspection.									
UNIT- II	COMPONENTS AND PACKAGING	(9 Periods)							
Introduction	to packaging, types-Through hole technology(THT) and S	urface mount							
technology(SI	MT), Through hole components - axial, radial, multi leaded, odd form.	Surface mount							
components-	active, passive. Interconnections - chip to lead interconnection, die	bonding, wire							
bonding, TA	B, flip chip, chip on board, multi chip module, direct chip array r	nodule, leaded,							
leadless, area	array and embedded packaging, miniaturization and trends.								
UNIT- III	SURFACE MOUNT TECHNOLOGY PROCESS	(9 Periods)							
Introduction	to the SMT Process, SMT equipment and material handling system	ns, handling of							
components a	nd assemblies - moisture sensitivity and ESD, safety and precautions r	eeded, IPC and							
other standard	ls, stencil printing process - solder paste material, storage and handli	ng, stencils and							
squeegees, pr	ocess parameters, quality control. Component placement- equipment t	ype, flexibility,							
accuracy of p	lacement, throughput, packaging of components for automated assemb	ly, Cp and Cpk							
and process c	ontrol. soldering- reflow process, process parameters, profile generati	on and control,							
solder joint r	netallurgy, adhesive, underfill and encapsulation process - applicat	ions, materials,							
storage and ha	andling, process and parameters.								
UNIT- IV	INSPECTION AND TESTING	(9 Periods)							
Inspection te	chniques, equipment and principle - AOI, X-ray. Defects and Corr	rective action -							
stencil printir	ng process, component placement process, reflow soldering process	s, underfill and							
encapsulation	process, electrical testing of PCB assemblies- In circuit test, fun	ctional testing,							
fixtures and ji	gs.								
UNIT- V	REPAIR, REWORK, QUALITY AND RELIABILITY OF	(9 Periods)							
	ELECTRONICS ASSEMBLIES	· · · ·							
Repair tools,	methods, rework criteria and process, thermo-mechanical effect	and thermal							
management,	management, Reliability fundamentals, reliability testing, failure analysis, design for								
manufacturab	ility, assembly, reworkability, testing, reliability and environment.								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

- 1. Prasad R. "Surface Mount Technology –Principles and practice", Second Edition, Chapman and Hall, 1997, New York
- 2. Tummala R.R. "Fundamentals of microsystem packaging", Mc -Graw Hill, 2001

REFERENCE BOOKS:

- 1. PuligandlaViswanadham and Pratap Singh **"Failure Modes and Mechanisms in Electronic Packages",** New York, 1997, N.Y. ISBN 0-412-105591-8.
- 2. Totta P., Puttlitz K. and Stalter K., "Area Array Interconnection Handbook", Kluwer Academic Publishers, Norwell, MA, USA, 2001. ISBN 0-7923-7919-5.
- 3. Lee N.C., "Reflow Soldering Process and Trouble Shooting SMT, BGA, CSP and Flip Chip Technologies", 2001, Elsevier Science
- 4. Zarrow P. and Kopp D. "Surface Mount Technology Terms and Concepts", 1997, Elsevier Science and Technology, ISBN 0750698756.
- 5. Harper C.A., "Electronic Packaging and Interconnection Handbook", McGraw Hill Inc., New York, N.Y., 1997, ISBN 0-07-026694-8.

COURSE OUTCOMES:

On completion of this course, students will be able to

- CO1: Describe wafer preparation and PCB fabrication process.
- CO2: Use different types of mounting technologies for electronic assemblies.
- CO3: Perform quality inspection on the PCBs
- **CO4:** Repair and rework of Electronics assemblies
- CO5: Describe the quality and reliability aspects of Electronics assemblies

PO/PSO	PO	РО	РО	PO	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5 µn	6	7	8	9	/ 10	11	12	1	2	3
CO1	L				3	L	^{ab} L ^{eb}		P			М	Н		
CO2	L				L							L	L		
CO3	Η	М		М	L			L				L			Н
CO4	Η	М		М	L			L				L			L
CO5	L			L								L			М
18PPE\$25	Μ	L		М	L	L	L	L				L	М		М

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

Category: PE

L T P C 3 0 0 3

PRE-REQUISITES: NIL **COURSEOBJECTIVES:**

* To familiarize the students about various components of Intelligent manufacturing systems

UNIT- I	COMPONENTS OF EXPERT SYSTEMS	(9 Periods)						
Expert syste	Expert system concept - comparisons - stages in Expert system - Knowledge Representation -							
Types - com	parison of Knowledge Representation Schemes – Inference engine – Infer	ence models						
–Forward, b	ackward chaining - Knowledge acquisition – Optimization and Knowledge	e based						
systems								
UNIT- II	INTELLIGENT MANUFACTURING	(9 Periods)						
Machine Le	arning - Intelligent Manufacturing – System Components – System archite	cture and						
Data flow –	System operation – Flexible Assembly Systems – Tool management.							
UNIT- III	TECHNOLOGY BASED SYSTEMS	(9 Periods)						
Design of m	echanical parts – Refinement Approach – Model based approach – Design	of						
mechanisms	- Feature based design - Knowledge based design for Automated Asseml	oly – Process						
planning – H	Feature recognition – Machining Optimization – Knowledge Based System	s.						
UNIT- IV	KNOWLEDGE BASED SYSTEM FOR GROUP TECHNOLOGY	(9 Periods)						
Models and	Algorithms – Cluster Analysis Method – Knowledge based systems for G	$\Gamma - Models$						
and Algorith	nms for Machine layout – Knowledge based Systems for machine layout –	scheduling -						
Models and	Algorithms – Knowledge Based Systems.							
UNIT- V	INDUSTRIAL APPLICATION AND RECENT ADVANCES	(9 Periods)						
Industrial application of Artificial Intelligence and Expert systems – Robotic vision systems, image								
processing techniques- application to object recognition and inspection - Application of Artificial								
Neural Networks - Fuzzy Logic and Genetic Algorithms in manufacturing - ANN for tool wear								
monitoring – Fuzzy control of machine tools.								
-								

Contact Periods:			
Lecture: 45 Periods	Tutorial: 0 Periods	Practical: 0 Periods	Total: 45 Periods

TEXT BOOKS:

- 1. Andrew Kusiak, "Intelligent Manufacturing Systems", Prentice Hall, 1998.
- 2. Mohammed Jamshidi, "Design and Implementation of Intelligent Manufacturing systems", Prentice Hall, 1995.

REFERENCE BOOKS:

- 1. Mitsugen, Runweicheng "Genetic Algorithms in Engineering Design", JohWiley, 1997
- 2. Elaine Rich "Artificial Intelligence", TMH, 1995.
- 3. Ibrahim Zeid "CAD/CAM Theory and Practice", McGraw Hill, 1998.
- 4. Robert Levine et al "A Comprehensive guide to AI and Expert Systems", McGraw Hill Inc, 1986.

COURSE OUTCOMES:

On completion of this course, students will be able to

- CO1: Identify various components of expert systems
- CO2: Describe the Architecture and components of intelligent manufacturing systems
- **CO3:** Explain the process of designing mechanisms and Process planning with Knowledge based systems
- CO4: Discuss the Applications of knowledge based systems in Group Technology
- **CO5:** Discuss the various recent advances and industrial applications of Artificial intelligence an Expert systems

PO/PSO	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO						
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	L	Μ	L	Μ			М	L	L	М	М	L	Η	
CO2	Η	L	Н	L	М			М	L	L	М	М	L	Η	
CO3	Η	L	Н	L	Μ	6	2	М	L	L	М	М	L	Η	
CO4	Η	L	Н	L	Μ		160 0	Μ	L	L	М	М	L	Н	
CO5	Η	L	Н	L	М			Μ	Ч	L	М	М	L	Η	
18PPE\$26	Η	L	Н	L	M	1		М	L	L	М	М	L	Η	

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H - High



18COE\$01

(Common to All Branches)

Category : OE

L T P C 3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * Able get knowledge about Climate system and its changes and causes
- * Able to learn about impacts, adaptation and mitigation of climate change
- * Able to learn about clean technology and clean energy

UNIT – I : EARTH'S CLIMATE SYSTEM	(9 Periods)						
Introduction-Climate in the spotlight - The Earth's Climate Machine - Climate	Classification -						
Global Wind Systems - Trade Winds and the Hadley Cell - The Westerlies - Cloud Formation and							
Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation –							
El Nino and its Effect - Solar Radiation - The Earth's Natural Green House Effect - Green House							
Gases and Global Warming – Carbon Cycle.							
UNIT – II: OBSERVED CHANGES AND ITS CAUSES	(9 Periods)						
Observation of Climate Change - Changes in patterns of temperature, precipitation	n and sea level						
rise - Observed effects of Climate Changes - Patterns of Large Scale Variabilit	y – Drivers of						
Climate Change - Climate Sensitivity and Feedbacks - The Montreal Protocol - UN	VFCCC – IPCC						
- Evidences of Changes in Climate and Environment - on a Global Scale and in	India – climate						
change modeling.							
UNIT – III : IMPACTS OF CLIMATE CHANGE	(9 Periods)						
Impacts of Climate Change on various sectors - Agriculture, Forestry and Ecos	ystem – Water						
Resources - Human Health - Industry, Settlement and Society - Methods and	nd Scenarios –						
Projected Impacts for Different Regions - Uncertainties in the Projected Impa	cts of Climate						
Change – Risk of Irreversible Changes.							
UNIT – IV : CLIMATE CHANGE ADAPTATION AND MITIGATION	(9 Periods)						
MEASURES	() 1 011045)						
Adaptation Strategy/Options in various sectors – Water – Agriculture – Infr	astructure and						
Settlement including coastal zones – Human Health – Tourism – Transport –	Energy – Key						
Mitigation Technologies and Practices – Energy Supply – Transport – Building	s – Industry –						
Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)	- Waste (MSW						
& Bio waste, Biomedical, Industrial waste – International and Regional cooperation.							
UNIT – V: CLEAN TECHNOLOGY AND ENERGY	(9 Periods)						
Clean Development Mechanism - Carbon Trading - examples of future Clean Technology -							
Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels –							

Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding. Contact periods:

•	
Lecture: 45 Periods	Tutorial: 0 Periods

Practical:0 Periods

Total: 45 Periods

- 1 Jan C. van Dam, "Impacts of Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2009.
- 2 Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., "Climate Change and Water". Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.
- 3 Dash Sushil Kumar, "Climate Change An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.
- 4 *IPCC Report Technical paper VI Climate change and Water, 2008.*

REFERENCE BOOKS:

- 1 IPCC fourth assessment report The AR4 synthesis report, 2007
- 2 IPCC fourth assessment report Working Group I Report, "The physical Science Basis",2007
- 3 IPCC fourth assessment report Working Group II Report, "Impacts, Adaptation and Vulnerability", 2007
- 4 Climate change 2014: Impacts, Adaptation and Vulnerability, IPCC
- 5 *Climate change 2013: The Physical Science basis, IPCC.*
- 6 *www.environment.gov.au/climate-change/adaptation.*
- 7 www.environment.org/explore-topics/climate-change/what.we.do/climate-adaptation.

COURSE OUTCOMES:

On completion of the course, the students will be able to

- CO1: Understand the climatic system and the factors influencing the climatic changes
- CO2: Assess the uncertainty and impact of climatic changes
- CO3: Understand the impacts of climate change in various sectors.
- CO4: Develop strategies for adaptation and mitigation of climatic changes
- **CO5:** Identify clean technologies for sustainable growth

РО	PO	PSO	PSO	PSO	PSO											
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1			Μ			L	L					L	L	L	L	L
CO2	L					L	L					L	М	М	М	L
CO3						L	L					L		Н	Н	
CO4	М	Μ	L	Μ		L	М					L	L	М	М	М
CO5	L	М	М	Μ		L	Η					L	L	М	L	М
18COE \$01	L	М	М	М		L	М					L	L	М	М	М

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate (Medium), H-High

158

DISASTER MANAGEMENT AND MITIGATION

(Common to All Branches)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

18COE\$02

- * To give knowledge about basics of Disaster Management.
- To impart knowledge about Hazards and Vulnerability. *
- To give knowledge about mitigation and preparedness. *
- To teach about Response and Recovery. *
- To impart knowledge about the participants involved in the disaster management activity. *

INTRODUCTION UNIT - I :

Disaster throughout history, History of disaster management, Capacity by demand, UN International strategy for disaster reduction, the Hyogo framework for action, Post 2015 framework, Disaster trends.

HAZARDS AND RISK VULNERABILITY UNIT – II :

Hazard Identification and Hazard Profiling, hazard analysis, Types of hazards- Natural and technological Components of Risk- likelihood and Consequence, Trends and Computation of likelihood and Consequence. Risk Evaluation – purpose, Risk Acceptibility, Alternatives, Personnel. Political/ social, Economic. vulnerability-Physical Profile, Social Profile, Environmental Profile, Economic Profile. Factors Influncing Vulnerability, risk Perception.

UNIT - III : MITIGATION AND PREPAREDNESS

Mitigation - types of mitigation, Ostacles in mitigation, Assement and selection of Mitigation options, Emergency response capacity as, Incorporating Mitigation into development and relief projects. Prepareness- Government Preparedness, Public Preparedness, Media as a public educator. Obstacles to public education and preparedness.

UNIT - IV: **RESPONSE AND RECOVERY**

Response the Emergency- Pre disaster, post disaster, Provision of water, food and shelter, volunteer management, command, control and coordination. Recovery- short term and long term recovery components of recovery- planning, coordination, information, money and supplies, allocation of relief funds, personnel. Types of recovery- Government, Infrastructure, Debris removal disposal and processing, environment, housing, economic and livelihood, individual, family and social recoveryspecial considerations in recovery.

UNIT - V: PARTICIPANTS

Governmental Disaster management agencies- Fire, law, emergency management, Emergency medical service, Millitary and other resources. Structures- local, regional, national. Bilateral assistance and its types. Types of national agencies involved in international disaster management. Political implications of bilateral assistance.

Non Governmental Organaisations – operations, NGO/ Millitary coordination, standard of conduct. The role of Private sector and academia.

Multilateral organaisations - UN agencies and progammes, Regional & Inernational organaisations. International Financial Institutions- the world bank, IMF, ADB, IADB. Special considerations.

Contact periods: Lecture: 45 Periods

Tutorial: 0 Periods

Practical:0 Periods

Total: 45 Periods



A 3

3 A

(9 Periods)

(9 Periods)

(9 Periods)

(9 Periods)

(9 Periods)

1. Damon P. Coppola, "Introduction to International Disaster management", Elsevier publication, 2015

REFERENCE BOOKS:

- 1. Brassard, Caroline, Giles, David W., Howitt, Arnold M., "Natural Disaster Management in the Asia-Pacific", Policy and Governance.
- 2. "Disaster Management", Global Challenges and Local Solutions, Universities Press, 2009.
- 3. Jack Pinkowski, "Disaster Management Handbook", CRC Press , January 22, 2008.
- 4. Disaster Management Guidelines, GOI-UNDP Disaster Risk Reduction Programme (2009-2012).

COURSE OUTCOME:

- On completion of the course, the students will be able to
- **CO1:** Able to get knowledge about basics of Disaster management.
- CO2: Able to impact knowledge about Hazards and vulnerability
- CO3: Able to know about Mitigation and preparedness.
- **CO4:** Able to attain knowledge about response and recovery.
- CO5: Able to learn about the participants involved in the disaster management activity.

COURSE ARTICULATION MATRIX:

PO/PSO	PO	PO	PO	PO	PO	PS0	PS0	PS0	PS0							
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1		L			L	L		L		1						L
CO2	L	Η		Μ	L	Μ	1					L	L			L
CO3	L	L			H	Μ	2	1				L	L			L
CO4	L	Μ		L	L	Μ	Μ			33						L
CO5		Μ		L	L	Μ	15	1	E E	.)						L
18COE \$02	L	М		L	L	М	М	OC.	E C	2		L	L			L

L-Low, M-Moderate (Medium), H-High

18COE\$03

ENERGY EFFICIENT BUILDINGS

(Common to All Branches)

Ca	tego	ry :	OE
L	Т	Р	С

3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To understand the Concepts of Sustainable Environment, basics of energy analysis, simulation and management.
- * To understand the concept of managing air quality.
- * To understand the Green building concepts.

UNIT - I:INTRODUCTION(9 Periods)Life cycle impacts of materials and products – sustainable design concepts – strategies of design for
the environment -the sun-earth relationship and the energy balance on the earth's surface, climate,
wind – solar radiation and solar temperature – sun shading and solar radiation on surfaces – energy
impact on the shape and orientation of buildings – thermal properties of building materials.

UNIT – II : ENERGY EFFICIENT TECHNIQUES	(9 Periods)
Passive Cooling And Day Lighting - Active Solar And Photovoltaic- Building	Energy Analysis
Methods- Building Energy Simulation- Building Energy Efficiency Standards-	Lighting System
Design- Lighting Economics and Aesthetics- Impacts of Lighting Efficiency - E	Energy Audit and
Energy Targeting- Technological Options For Energy Management.	

UNIT – III: INDOOR ENVIRONMENTAL QUALITY MANAGEMENT (9 Periods)

Psychrometry- Comfort Conditions- Thermal Comfort- Ventilation And Air Quality Air Conditioning Requirement- Visual Perception- Illumination Requirement- Auditory Requirement-Energy Management Options- Air Conditioning Systems- Energy Conservation In Pumps- Fans And Blowers-Refrigerating Machines- Heat Rejection Equipment- Energy Efficient Motors- Insulation.

UNIT – IV : GREEN BUILDING CONCEPTS	(9 Periods)
Green Building Concept- Green Building Rating Tools- Leeds And IGBC Codes I	Material Selection
Embodied Energy- Operating Energy- Façade Systems- Ventilation Systems- Tran	sportation- Water
Treatment Systems- Water Efficiency- Building Economics.	

UNIT – V: GREEN BUILDING DESIGN CASE STUDY

Students To Work Through A Controlled Process of Analysis And Design To Produce Drawings and Models Of Their Own Personal Green Building Project. Topics Include Building Form, Orientation and Site Considerations; Conservation Measures; Energy Modeling; Heating System And Fuel Choices; Renewable Energy Systems; Material Choices; and Construction Budget-Students Will Research Green Construction and Design in A Particular -Construction Context and Report Their Results to the Class.

Contact periods: Lecture: 45 Periods

Tutorial: 0 Periods

Practical:0 Periods

Total: 45 Periods

(9 Periods)

- *Kibert, C. "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 4th Edition, 2016.*
- 2 Edward G Pita, "An Energy Approach- Air-Conditioning Principles and Systems", Pearson Education, 2003.
- 3 Satyajit Ghosh, Abhinav Dhaka, "Green structures: Energy efficient buildings", 2015.

REFERENCE BOOKS:

- 1 Colin Porteous, "The New Eco-Architecture", Spon Press, 2002.
- 2 Ganesan T P, "Energy Conservation in Buildings", ISTE Professional Center, Chennai, 1999.
- 3 NPTEL "Energy Efficiency and Simulation", Prof.E.Rajsekar., IIT Roorkee.
- 4 Energy Conservation Building Codes: www.bee-india.nic.in
- 5 Lever More G J, "Building Energy Management Systems", E And FN Spon, London, 2000.
- 6 NPTEL **"Energy efficiency acoustics and day lighting in building"**, Prof.B.Bhattacharjee., IIT Delhi.

COURSE OUTCOMES:

On completion of the course, the students will be able to

- CO1: Understand the Concepts of Sustainable Environment.
- CO2: Understand the basics of energy analysis, simulation and management.
- **CO3:** Understand the concept of managing air quality.
- **CO4:** Understand the Green building concepts.
- **CO5:** Create drawings and models of their own personal green building project

РО	PO	PO	PO	PO	PO	PO	РО	PO	PO	РО	РО	РО	PSO	PSO	PSO	PSO
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	L	М	L			Μ	М	L	E	L		L	L	М	L	L
CO2			L	L		L	L					L		L		
CO3		L				L	М	L				L		L		
CO4	L	М					Η					М		М		
CO5	М	М	Н	L			Н	L	М		М	М		Н	L	М
18COE \$03	L	М	Н	L		М	Н	L	L	L	М	М	L	Н	L	М

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate (Medium), H-High

(Common to All Branches)

Category	:	OE
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L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To Understand and analyze the concepts of Quantum confinement, Dimensional structures and Properties of Nanosystems
- * To be familiar with various methods of synthesis of Nanomaterials
- * To analyze and understand the mechanical and electrical properties of Nanomaterial and its applications

UNIT – I: PROPERTIES OF NANOMATERIALS	(9 Periods)
Size effect and properties of nanoparticles - particle size - particle shape - particle de	nsity - melting
point, surface tension, wettability - specific surface area and pore size - Properties	s of Individual
nanoparticles. Quantum confinement in 3D, 2D, 1D and zero dimensional structures -	Size effect and
properties of nanostructures- Top down and Bottom up approach.	•
UNIT – II : SYNTHESIS OF NANOMATERIALS	(9 Periods)
Sol-Gel Process - Self-assembly - Electrodeposition - Spray Pyrolysis - Flame Pyroly	rolysis – Metal
nano-crystals by Reduction – Solvo-thermal Synthesis - Chemical Vapor Deposition ((CVD) – Metal
Orgonic Chemical Vapor Deposition (MOCVD).Ball Milling - Inert Gas Condensat	ion Technique
(IGCT) – Thermal evaporation – Pulsed Laser Deposition (PLD) – DC/RF Magnetro	on Sputtering -
Molecular Beam Epitaxy (MBE) – Melt Spinning process – Applications	
UNIT – III : MECHANICAL AND ELECTRICAL PROPERTIES	(9 Periods)
Nanoscale Mechanics - Introduction – Mechanical properties – The H	Elasticity of
Nanomaterials – Elasticity of Bulk Nanomaterials – Plastic Deformation of Nan	omaterials –
Crystals and Crystal Plasticity – From Crystal Plasticity to Polycrystal Plasticity.	
Introduction - Energy Storage Basics - Electrical Energy Storage Devices	and Impact of
Nanomaterials - Electrochemical Properties of Nanoscale Materials - Aerogels	and Structure-
Directed Mesoporous and Macroporous Solids - Nanoparticles - Nanotubes, N	anowires, and
Nanorolls	
UNIT – IV : FUNDAMENTALS OF SURFACE ENGINEERING	(9 Periods)
Surface engineering - classification, definition, scope and general principles, Conver	ntional surface
engineering - Surface engineering by material removal: Cleaning, pickling, etch	ing, grinding,
polishing, buffing / puffing, Surface engineering by material addition - From lie	quid bath, hot
dipping, Electro-deposition / plating.	
UNIT – V : SURFACE MODIFICATION	(9 Periods)
Surface modification of steel and ferrous components - Pack carburizing, Aluminizi	ng, calorizing,
diffusional coatings (principle and scope of application), Surface modification using	g liquid/molten
bath: Cyaniding, liquid carburizing (diffusion from liquid state), Surface modification	using gaseous
medium: Nitriding, Carbo-nitriding (diffusion from gaseous state).	

Contact Periods:

Lecture: 45 Periods

Tutorial: 0 Periods

Practical:0 Periods

Total: 45 Periods

- 1.Kelsall Robert W, Ian Hamley and Mark Geoghegan, —"Nanoscale Science and Technology", Wiley Eastern, 2004.
- 2.N John Dinardo, "Nanoscale Charecterisation of Surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000
- 3. ASM Metals Hand Book Vol. 5, "Surface Engineering", 1996

REFERENCE BOOKS:

- 1.G. Timp. Editor, "Nanotechnology" AIP press, Springer-Verlag, New York, 1999
- 2. Hari Singh Nalwa, Editor, "Nanostructured materials and Nanotechnology", Concise Edition, Academic Press, USA (2002).
- 3. GuozhongGao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications", Imperial College Press (2004).
- 4.K.G. Budinski, "Surface Engineering for Wear Resistances", Prentice Hall, Englewood Cliffs, 1988.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- CO1: Analyze the particle size, particle shape, particle density, Size effect and properties of Nanostructures.
- CO2: Acquire knowledge in various methods of synthesis of Nanomaterials.
- CO3: Analyze the Elasticity of Nanomaterials, Electrical Energy Storage Devices and Aerogels.
- CO4: Apply various Nanomaterials to the LED, Transistor Applications.
- CO5: Apply various surface engineering techniques

	PO	РО	РО	PO	PO	PSO	PSO	PSO							
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	Μ	L	L	Μ	L	Μ	Μ	Μ	L	М	Μ	Μ	Μ	Μ
CO2	Н	Η	Μ	Η	Η	L	L	Μ	Μ	М	L	Н	Μ	Н	Μ
CO3	Н	Η	L	Η	Μ	Μ	L	L	Μ	Μ	Μ	Μ	Μ	Н	Μ
CO4	L	Η	Μ	Η	Μ	Μ	L	L	Μ	Μ	Μ	Μ	Μ	Н	Μ
CO5	Μ	Μ	L	Μ	Μ	L	Μ	Μ	Μ	L	М	Μ	Μ	Н	М
18MOE\$04	Н	Η	L	Μ	Η	Μ	Η	Η	Μ	Η	Μ	Μ	Μ	М	М

COURSE ARTICULATION MATRIX

L-Low, M-Moderate(Medium), H-High

18MOE\$05

MECHATRONICS (Common to All Branches)

Category : OE

L T P C 3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To study the mechatronics system and understanding the concepts of integration and design of mechatronics system.

UNIT – I : SYSTEM MODELS	(9 Periods)
Introduction - Definition of Mechanical Systems, Philosophy and approach. Systems a	and Design -
Mechatronic approach, Integrated Product Design - Modeling- Analysis and Simulation	on, Man-
Machine Interface.	
UNIT – II : SENSORS AND TRANSDUCERS	(9 Periods)
Sensors and transducers - classification, Development in Transducer technology, Opto	pelectronics -
Shaft encoders, CD Sensors, Vision System.	
UNIT – III : DRIVES AND ACTUATORS	(9 Periods)
Drives and Actuators - Hydraulic and Pneumatic drives - Electrical Actuators - servo	motor and
Stepper motor, Drive circuits, open and closed loop control - Embedded Systems - Ha	rdware
Structure, Software Design and Communication, Programmable Logic Devices, Autor	matic Control
and Real Time Control Systems.	
UNIT – IV : SMART MATERIALS	(9 Periods)
Smart materials - Shape Memory Alloy, Piezoelectric and Magnetostrictive Actuators	- Materials,
Static and dynamic characteristics, illustrative examples for positioning, vibration isol	ation.
UNIT – V : MICROMECHATRONIC SYSTEMS	(9 Periods)
Micro mechatronic systems - Microsensors, Microactuators - Micro-fabrication techni	iques - LIGA
Process- Lithography, etching, Micro-joining. Application examples - Case studies Ex	amples of
Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehi	cles and
Medical Technology.	

Contact Periods:

Lecture: 45Periods Tutorial: 0Periods Practical: 0 Periods T

Total: 45 Periods

TEXT BOOKS:

1. W.Bolton, "Mechatronics", Longman, 2nd Edition, 1999

REFERENCE BOOKS:

- 1. Michael B. Histand and David G.Alciatore, "Introduction to Mechatronics and Measurement Systems", Tata McGraw Hill, 2nd Edition, 2003
- 2. D.A.Bradley, D.Dawson, N.C.Buru and A.J.Loader, "Mechatronics" Chapman and Hall, 1993
- 3. Dan S Necsulescu, "Mechatronics", Pearson Education Asia, 2005
- 4. Devdas Shetty, Richard A. Kolk, "Mechatronics System Design", Thomson, PWS publishing, 2007.
- 5. Smaili.A and Mrad.F, "Mechatronics: Integrated Technologies for Intelligent Machines", Oxford university press, 2008

COURSE OUTCOMES:

- Upon completion of the course, the student will be able to
- **CO1:** Identify the key elements of mechatronics system and models.
- CO2: Select appropriate sensors and transducers for industrial application.
- **CO 3:** Integrate mechanical, electrical, electronics, control systems in the mechatronics system design
- **CO 4:** Select the proper smart material for mechatronics system.
- **CO 5:** Apply the principles of mechatronics in industrial needs.

	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO						
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н	Η	Η	Μ	L	Η	L	L	Η	L	Μ	L	Μ	Н	L
CO2	Н	Η	Η	L	L	Η	L	L	Μ	L	Μ	L	Μ	Н	L
CO3	Н	Н	Η	L	L	Η	L	L	Μ	L	Μ	L	Μ	Н	L
CO4	Н	Η	Η	Μ	Η	Η	L	L	Μ	М	L	L	Η	Н	L
CO5	Н	Н	Η	Μ	L	Η	L	L	Η	М	Μ	Μ	Η	Н	L
18MOE\$05	Н	Н	Η	Η	L	Н	$\mathbf{L}_{\mathbf{S}}$	L	Μ	L	Μ	L	М	Н	L

COURSE ARTICULATION MATRIX

L-Low, M-Moderate (Medium), H-High



18EOE\$07

RENEWABLE POWER GENERATION SYSTEMS

(Common to All Branches)

PRE-REQUISITES: NIL

Category : OE

L T P C 3 0 0 3

COURSE OBJECTIVES:

* To elucidate the technologies used for generation and utilization of power from renewable energy resources.

UNIT-I : SOLAR ENERGY	(9 Periods)
Solar radiation, solar spectra-latitude and longitude, Declination angle, solar winde	ow, cosine law,
seasonal variations, hour angle, calculation of angle of incidence, angstroms	equation and
constants, Photo voltaic: p-n junctions. Solar cells, PV systems, Standalone, Grid	connected solar
power - Types of solar thermal collectors - Flat and concentrating collectors	, solar thermal
applications -water heaters, dryers, stills, refrigeration, air-conditioning, solar	pond, central
receiver power generation.	1
UNIT-II : WIND ENERGY	(9 Periods)
Wind energy - Basic principle of wind energy conversion system, wind da	ita and energy
estimation, site selection, components of wind energy conversion systems, design c	consideration of
horizontal axis wind mill- merits and limitations- application.	
UNIT-III : BIOMASS ENERGY	(9 Periods)
Biomass, sources of biomass, thermo-chemical and bio-chemical conversion	of biomass -
Pyrolysis, gasification, combustion and fermentation. Gasifiers - Up draft, downdra	ft and fluidized
bed gasifier. Digesters - Fixed and floating digester biogas plants, economics of	biomass power
generation.	
UNIT-IV : OCEAN AND GEOTHERMAL ENERGY	(9 Periods)
Ocean energy resources - Principles of ocean thermal energy conversion systems - power plants - Principles of ocean wave energy conversion and tidal energy Difference between tidal and wave power generation, Economics of OTEC.	• ocean thermal y conversion -
Definition and classification of Geothermal resources, Utilization for electricity	generation and
direct heating, Wellhead power generating units. Overview of micro and min	i hydel power
generation.	
UNIT-V : RENEWABLE ENERGY POLICIES	(9 Periods)
Renewable energy policies - Feed-in tariffs, portfolio standards, policy targets, tax	incentives, and
biofuels mandates. International policies for climate change and energy secu	rity. Economic
analysis and comparisons, Life cycle analysis, financial analysis, cost of conserv	ed energy, and
externalities. Cost assessment of supply technologies versus energy - Efficiency.	

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. Rao. S. and Dr. Pamlekar B.B "Energy Technology" Khanna Publishers, Second Ed. 2016

2. Rai, G.D., "Non-Conventional sources of Energy", Khanna Publishers, V Ed., 2016

REFERENCE BOOKS:

- 1. Khan. B.H, "Non-Conventional Energy Resources", The McGraw Hills, Second edition, 2016.
- 2. Bansal NK, Kleeman and Meliss, M "Renewable Energy Sources and Conversion Techniques", Tata McGraw Hill, 1996
- 3. Roland Wengenmayr, Thomas Buhrke," Renewable energy: Sustainable energy concepts for the future", Wiley-VCH, 1st edition, 2008.

COURSE OUTCOMES:

- On completion of the course students will be able to
- **CO1:** Understand the concept of various Non-Conventional energy resources
- CO2: Familiarize the principles of operation of renewable energy technologies
- **CO3:** Realize the need for utilizing the energy from clean and Sustainable energy resources.
- CO4: Interpret advantages and disadvantages of different renewable sources of energy
- **CO5:** Comprehend the environmental aspects and the correlation between different operational parameters
- **CO6:** Evaluate the options and estimate the energy generation through renewable sources

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CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
CO	1	2	3	4	5	6	7)	8	9	10	11	12	1	2	3
CO1	Н	Μ	М	М	10	М	Н	-		5	-	-	Н	М	М
CO2	Н	Н	М	L	Μ	М	М	L	- /	-	-	-	Н	Н	Η
CO3	Н	М	М	М	Μ	М	М	1	1-1	-	-	-	М	Н	Η
CO4	М	Н	М	L	Μ	Н	М		- //	-	-	-	Н	Н	Η
CO5	М	Н	L	Н	М	М	Μ	No.	- 1	-	L	-	М	Н	М
CO6	Н	М	М	L	Μ	М	Μ	-	L	-	L	-	М	Н	М
18EOE \$07	Н	Н	М	М	の	М	М	L		3340	L	-	Н	Н	Н

COURSE ARTICULATION MATRIX:

L - Low, M - Moderate (Medium), H - High

18EOE\$08

ELECTRIC VEHICLES

(Common to All Branches)

PRE-REQUISITES: NIL

L T P C 3 0 0 3

COURSE OBJECTIVES:

* To understand the technology of Electric and Hybrid Electric Vehicles and their business perspective

UNIT-I : INTRODUCTION (9 Periods)
Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization
transmission characteristics, and mathematical models to describe vehicle performance. Introduction
to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental
importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.
Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-
train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.
UNIT-II : ELECTRIC TRAINS (9 Periods)
Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train
topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric
Propulsion unit: Introduction to electric components used in hybrid and electric vehicles.
Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor
drives, Switch Reluctance Motor drives- drive system efficiency.
UNIT-III : ANALYSIS OF ENERGY STORAGE (9 Periods)
Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles.
Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super
Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis.
Hybridization of different energy storage devices. Sizing the drive system: Matching the electric
machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power
electronics, selecting the energy storage technology, Communications, supporting subsystems.
UNIT-IV : ENERGY MANAGEMENT STRATEGIES(9 Periods)
Introduction to energy management strategies used in hybrid and electric vehicles, classification of
different energy management strategies, comparison of different energy management strategies.
implementation issues of energy management strategies.
UNIT-V : BUSINESS PERSPECTIVE OF ELECTRIC VEHICLE(9 Periods)
Design of a Hybrid Electric Vehicle (HEV) - Design of a Battery Electric Vehicle (BEV) Hybrid
Electric Heavy Duty Vehicles, Fuel Cell Heavy Duty Vehicles. Business: E-mobility business
electrification challenges, Connected mobility and Autonomous mobility- case study: E-mobility
Indian Roadmap Perspective. Policy: EVs in infrastructure system, integration of EVs in smart grid.
social dimensions of EVs.

Contact Periods: Lecture: 45 Periods

Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

- 1. Mehrdad Ehsani, Yimin Gao, Sebatien Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel cell vehicles: Fundamentals, Theory and Design", CRC press, 2004.
- 2. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
- 3. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.

REFERENCE BOOKS:

- 1. James Larminie and John Loury, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd, 2003.
- 2. Sandeep Dhameja, "Electric Vehicle Battery Systems", Butterworth Heinemann, 2002.
- 3. Ronald K Jurgen, "Electric and Hybrid Electric Vehicles", SAE, 2002.
- 4. Ron Hodkinson and John Fenton, "Light Weight Electric/ Hybrid Vehicle Design", Butterworth – Heinemann, 2001.
- 5. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

COURSE OUTCOMES:

- On completion of the course students will be able to
- **CO1:** Understand the basics of electric vehicle components and configuration.
- **CO2:** Analyze suitable drive scheme for developing an electric vehicle.
- CO3: Able to opt a proper energy management system.
- **CO4**: Analyze the performance of practical HEV and EV.
- CO5: Understand the infrastructure for Electric Vehicles and business potential.

	PO	PSO	PSO	PSO											
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	М	М	М	-	Μ	М	~	-	-	-	L	М	М	-
CO2	-	М	М	М	-	М	М	-	-	-	-	L	М	М	-
CO3	-	М	М	М	-	М	М	-	-	-	-	L	М	М	-
CO4	-	М	М	М	-	М	М	-	-	-	-	L	М	М	-
CO5	-	М	М	М	-	М	М	-	-	-	-	L	М	М	-
18EOE \$08	-	М	М	М	-	М	М	-	-	-	-	L	М	М	-

COURSE ARTICULATION MATRIX:

L - Low, M - Moderate (Medium), H - High

(Common to All Branches)

Category : OE

С

LTP

3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To comprehend the underlying techniques applied to Smart Grid

UNIT-I: BASICS OF POWER SYSTEMS	(9 Periods)
Basics of Power Systems: Load and Generation - Power Flow Analysis- Economic	Dispatch and
Unit Commitment Problems. Smart Grid: Definition – Applications- Government a	and Industry-
Standardization	
UNIT-II: SMART GRID COMMUNICATIONS	(9 Periods)
Two-way Digital Communications Paradigm - Network Architectures - IP-based Syst	ems - Power
Line Communications - Advanced Metering Infrastructure	
UNIT-III: WIDE AREA MEASUREMENT	(9 Periods)
Sensor Networks - Phasor Measurement Units- Communications Infrastructure- Fault I	Detection and
Self-Healing Systems - Applications and Challenges	
UNIT-IV : SECURITY AND PRIVACY	(9 Periods)
Cyber Security Challenges in Smart Grid - Load Altering Attacks- False Data Injec	tion Attacks-
Defense Mechanisms - Privacy Challenges- Cyber Security Standards	
UNIT-V : ECONOMICS AND MARKET OPERATIONS	(9 Periods)
Introduction, Reasons for restructuring / deregulation of power industry, Under	standing the
restructuring process - Entities involved. The market place mechanisms-Energy	and Reserve
Markets- Market Power - Generation Firms- Locational Marginal Prices= Financial	Transmission
Rights	
Contact Periods:	

Lecture: 45 PeriodsTutorial: 0 PeriodsPractical: 0 PeriodsTotal: 45 Periods

TEXT BOOKS:

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage "Smart Grid Technologies and applications" John Wiley Publishers Ltd., 2012.

2. P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan "Electrical Power Systems-Analysis, Security and Deregulation" PHI Learning Private Limited, New Delhi, 2012.

REFERENCE BOOKS:

1. Lars T. Berger, Krzysztof Iniewski "Smart Grid applications, Communications and Security" John Wiley Publishers Ltd., 2012.

2.Yang Xiao, "Communication and Networking in Smart Grids", CRC Press Taylor and Francis Group, 2012.

3. Caitlin G. Elsworth, "The Smart Grid and Electric Power Transmission", Nova Science Publishers Inc, August 2010.

COURSE OUTCOMES:

On completion of the course students will be able to

- CO1: Demonstrate the various aspects of the smart grid, including Technologies,
 - Components, Architectures and applications
- **CO2:** Creating a framework to operate the grid more effectively.
- **CO3:** Evaluate the existing grid with respect to smart grid
- **CO4:** Upgrade the existing grid to smart grid environment

COURSE ARTICULATION MATRIX:

CO	PO	PSO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01	-	-	-	L	L	Μ	Η	L	Μ	Μ	Μ	Η	М	Н	М
CO2	L	L	М	М	М	М	М	L	М	М	М	М	М	М	Н
CO3	-	-	-	Μ	М	Μ	М	М	Μ	Μ	Μ	Н	М	М	М
CO4	L	-	-	Μ	Μ	Μ	Н	-	Μ	Μ	Μ	Н	М	Н	Н
18EOE \$09	L	L	М	М	М	М	Н	L	М	М	М	Н	М	Н	Н

L - Low, M - Moderate (Medium), H - High



18LOE\$10

MOBILE COMMUNICATION

(Common to All Branches)

PRE-REQUISITES: NIL

Category: OE

L	Т	Р	С
3	0	0	3

COURSE OBJECTIVES:

- * To study the concept of Mobile radio propagation, cellular system design
- * To understand mobile technologies like GSM and CDMA.
- * To know the mobile communication evolution of 2G, 3G and 3 GPP in detail.
- * To have overview of immerging technologies application.

UNIT I WIRELESS COMMUNICATION	(9 periods)
Cellular systems- Frequency Management and Channel Assignment- types	of handoff
and their characteristics, dropped call rates & their evaluation -MAC - SDMA	- FDMA $-$
TDMA – CDMA – Cellular Wireless Networks.	
UNIT II WIRELESS NETWORKS	(9 periods)
Wireless LAN - IEEE 802.11 Standards - Architecture - Services - Mol	oile Ad hoc
Networks- WiFi and WiMAX - Wireless Local Loop.	
UNIT III MOBILE COMMUNICATION SYSTEMS	(9 periods)
GSM-architecture-Location tracking and call setup- Mobility management-	- Handover-
Security-GSM SMS - International roaming for GSM- call recording function	ons-subscriber
and service data mgt - Mobile Number portability -VoIP service for Mobile	Networks -
GPRS - Architecture-GPRS procedures-attach and detach procedures-P	DP context
procedure-combined RA/LA update procedures-Billing	
UNIT IV MOBILE NETWORK AND TRANSPORT LAYERS	(9 periods)
Mobile IP - Dynamic Host Configuration Protocol-Mobile Ad Hoc Routin	g Protocols-
Multicast routing-TCP over Wireless Networks - Indirect TCP - Snooping TC	CP – Mobile
TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freez	zing-Selective
Retransmission – Transaction Oriented TCP- TCP over 2.5 / 3G wireless Networks.	
UNIT V APPLICATION LAYER	(9 periods)
WAP Model- Mobile Location based services -WAP Gateway -WAP protoc	cols – WAP
user agent profile- caching model-wireless bearers for WAP - WML - WMLSc	ripts - WTA
- iMode - SyncML.	

Contact periods:Lecture: 45 PeriodsTutorial:0 PeriodsPractical:0 PeriodsTotal:45 Periods

TEXT BOOKS:

1. John Schiller, "Mobile Communications", Second Edition, Pearson Education, 2003.

2. William Stallings, "Wireless Communications and Networks", Pearson Education, 2002.

REFERENCES BOOKS:

- 1. Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", First Edition, Pearson Education, 2003.
- 2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
- 3. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- **CO1:** Understand GSM, CDMA concepts and architecture, frame structure, system capacity, services provided.
- **CO2:** Study of evolution of mobile communication generations 2G, 2.5G, 3G with their characteristics and limitations.

COURSE ARTICULATION MATRIX:

СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	М	М	М	-	-97	Bi r d m	0.00		1493//	2	-	L	М	L	-
CO2	М	Μ	М	-	-		19		200	<u>)</u>	-	L	М	L	-
18LOE \$10	М	М	М	-	-5	-	-	1	h	7	-	L	М	L	-

L - Low, M - Moderate (Medium), H - High



18LOE\$11

INTRODUCTION TO VLSI SYSTEM DESIGN

(Common to All Branches)

Category: OE

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- LTPC
- 3 0 0 3
- * To introduce various aspects of CMOS logic design in combinational and sequential circuit to design CMOS VLSI system components

UNIT I: CMOS LOGIC DESIGN	(9 Periods)						
Inverter- CMOS Logic Gates: Compound Gates - Pass Transistors and Transmission Gates -							
Tristated – Multiplexers – CMOS Fabrication and Layout: Fabrication Process – Layout Design							
rule – Gate Layouts – Stick Diagrams – Design Partitioning							
UNIT II: MOS TRANSISTOR THEORY	(9 Periods)						
Introduction - Long Channel I-V Characteristics - C-V Characteristics - Non-ideal I-V Effects -							
DC Transfer Characteristics - CMOS Technologies - Sources of Power Dissipation - Dynamic							
Power – Static Power.							
UNIT III: COMBINATIONAL CIRCUIT DESIGN	(9 Periods)						
Circuit Families: Static CMOS - Ratioed Circuits - Cascode Voltage Switch Logic - Dynamic							
Circuits - Pass Transistor Circuits. Silicon-on-Insulator Circuit Design - Subthreshold Cirucit							
Design							
UNIT IV: SEQUENTIAL CIRCUIT DESIGN	(9 Periods)						
Sequential static circuits – Circuit design of latched and flip-flops – Sequencing dynamic circuits							
- Synchronizers - Wave pipelining - VLSI clocking: CMOS clocking styles - Pipelined systems -							
Clock generation and distribution.							
UNIT V: DESIGN OF VLSI SYSTEMS	(9 Periods)						
System Specifications - Structural Gate Level Modeling - Switch Level Modeling - Behavioral							
and RTL Modeling - Addition/subtraction - Comparators -countersMultiplexers - Binary							
Decoders - Comparators - Priority Encoders - Latches - Flip-Flops and Registers - SRAM -							
DRAM – ROM.							

Contact Periods:

Lecture: 45 Periods

Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

TEXT BOOKS:

- 1. N. Weste and David Money Harris, "CMOS VLSI Design", Fourth Edition, Pearson Education, 2011.
- 2. Uyemura, John P, "Introduction to VLSI Circuits and Systems", Wiley & Sons, 8th Reprint 2009

REFERENCE BOOKS:

- 1. Jan M. Rabaey, "Digital Integrated Circuits: A Design Perspective", PHI, Second Edition, 2012.
- 2. R. Jacob Baker, "CMOS: Circuit Design, Layout, and Simulation", Wiley-IEEE, Revised Second Edition, 2008.
- 3. Pucknell, "Basic VLSI Design", Prentice Hall, 2006.
Upon completion of the course, the student will be able to

CO1: Realize the CMOS logic design

CO2: Acquire knowledge on combinational and sequential circuit design of CMOS logic

CO3: Use VLSI clocking styles and realize CMOS VLSI system components

COURSE ARTICULATION MATRIX:

СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	М	М	М	-	-	-	-	-	-	-	-	L	Н	L	L
CO2	Μ	М	М	-	-	-	-	-	-	-	-	L	М	L	L
CO3	Μ	Μ	М	-	-	-	-	-	-	-	-	L	Н	L	L
18LOE \$11	М	М	М	-	-	-	-	-	-	-	-	L	Н	L	L

L - Low, M - Moderate (Medium), H - High



18LOE\$12

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PRE-REQUISITES: NIL

COURSE OBJECTIVES:

peripheral devices.

MICROCONTROLLER AND APPLICATIONS

(Common to All Branches)

* Solve real life problem using microcontroller based systems.	
UNIT I: MICROCONTROLLER	(9 Periods)
Microcontroller Features - On chip oscillator, List of Special Function Registers (SF	Rs), On chip
program memory, on chip data memory, I/O Ports, Watch Dog Timer, Architectu	ure of 8051,
Instruction set - Addressing modes.	
UNIT II: ASSEMBLY LANGUAGE PROGRAMMING	(9 Periods)
8051 Assembly Language Programming, Branch Instruction Programming -I/O Port Programming	ogramming –
Arithmetic and Logic Instruction Programming-code conversion programming	
The second	
UNIT III: PROGRAMMING IN C AND INTERFACING-I	(9 Periods)
UNIT III: PROGRAMMING IN C AND INTERFACING-I Timers & Counters programming - Serial Port Programming - Interrupts Program	(9 Periods) nming .8255
UNIT III: PROGRAMMING IN C AND INTERFACING-I Timers & Counters programming - Serial Port Programming - Interrupts Program Interfacing and Programming- External Memory Interfacing - LCD interfacing, LED Int	(9 Periods) nming .8255 terfacing
UNIT III: PROGRAMMING IN C AND INTERFACING-I Timers & Counters programming - Serial Port Programming - Interrupts Program Interfacing and Programming- External Memory Interfacing - LCD interfacing, LED Int UNIT IV: INTERFACING-II	(9 Periods) nming .8255 terfacing (9 Periods)
UNIT III: PROGRAMMING IN C AND INTERFACING-I Timers & Counters programming - Serial Port Programming - Interrupts Program Interfacing and Programming- External Memory Interfacing - LCD interfacing, LED Interfacing - UNIT IV: INTERFACING-II Keyboard Interfacing - ADC, DAC interfacing – Temperature Transducer-Pressure and I	(9 Periods) nming .8255 terfacing (9 Periods) Displacement
UNIT III: PROGRAMMING IN C AND INTERFACING-I Timers & Counters programming - Serial Port Programming - Interrupts Program Interfacing and Programming- External Memory Interfacing - LCD interfacing, LED Int UNIT IV: INTERFACING-II Keyboard Interfacing - ADC, DAC interfacing – Temperature Transducer-Pressure and I Transducer-Light Sensor - Optocoupler - Relays.	(9 Periods) nming .8255 terfacing (9 Periods) Displacement
UNIT III: PROGRAMMING IN C AND INTERFACING-ITimers & Counters programming - Serial Port Programming - Interrupts ProgramInterfacing and Programming- External Memory Interfacing - LCD interfacing, LED IntUNIT IV: INTERFACING-IIKeyboard Interfacing - ADC, DAC interfacing – Temperature Transducer-Pressure and ITransducer-Light Sensor - Optocoupler - Relays.UNIT V: APPLICATIONS OF MICROCONTROLLERS	(9 Periods) nming .8255 terfacing (9 Periods) Displacement (9 Periods)

Design system in block level using microcontroller, memory devices, buses and other

Contact Periods: Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods **Total: 45 Periods**

TEXT BOOKS:

- 1. Mohammad Ali Mazidi, Janice Gillispie Mazidi "The 8051 Microcontroller and Embedded Systems (Using assembly and C)" Pearson education/ Prentice Hall of India Pvt. Ltd., 2007.
- 2. Ajit Pal, "Microcontrollers : Principles and Applications", Prentice-Hall of India Pvt.Ltd; 1 edition (August 2011).

3

Category: OE

Develop assembly program for 8051.

Describe the architecture of 8051 microcontroller.

Apply the instruction set of 8051 to get effective programs.

3 0 0

REFERENCE BOOKS:

- 1. Krishna Kanth, "Microprocessor and Microcontroller Archotecture, Programming and System Design using 8085, 8086, 8051", Prentice Hall of India, 2011.
- 2. *Kenneth J.Ayala*, **"The 8051 Microcontroller"** 3rd edition, Thompson Delmar Learning, 2007, *New Delhi.*
- 3. Jacob Fraden, "Handbook of Modern Sensors: Physics, Design and Applications", 3rd ed, Springer, 2010.
- 4. Michael J. Pont, "Embedded C" Pearson Education India, 1st edition (2007);

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- **CO1:** Describe the architectures of controller
- CO2: Develop Assembly program applying Digital logic and mathematics using 8051 instruction set
- CO3: Design microcontroller based system within realistic constraint like user specification,
- availability of components etc
- CO4: Interface real world sensors
- CO5: Solve real life problem and construct a complete system as a solution

COURSE ARTICULATION MATRIX:

СО	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Μ	М	Μ	-	-//	- @			1	- 1	-	L	Н	L	L
CO2	Μ	М	Μ	-	-	- 8	1	~	-	-	-	L	М	L	L
CO3	Μ	М	Μ	-	J.B.	- %	2	-	-	E.	-	L	Н	L	L
CO4	Μ	М	Μ	-	16	T	1	-		100	-	L	Н	L	L
CO5	Μ	М	Μ	-	L.	U TO	5	222	oru	J.	-	L	М	L	L
18LOE \$12	М	М	М	-	-	19			E Contraction	-	-	L	Н	L	L

L - Low, M - Moderate (Medium), H - High

18POE\$13

RAPID PROTOTYPING (Common to All Branches)

Category: OE

L T P C 3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To educate students with fundamental and advanced knowledge in the field of Rapid Prototyping technology and the associated Aerospace, Architecture, Art, Medical and Industrial applications.

UNIT- I	INTRODUCTION	(9 Periods)						
Need - Deve	lopment of RP systems – Applications in Product Development - Virtual	Prototyping-						
Rapid Toolin	g – Rapid Manufacturing - Classification of RP processes – Benefits - Appl	lications						
UNIT- II	REVERSE ENGINEERING AND CAD MODELING	(9 Periods)						
Basic conce	pt- Digitization techniques – Model reconstruction – Data Processin	ng for Rapid						
Prototyping:	CAD model preparation, Data requirements - Geometric modeling	g techniques:						
Wireframe, s	urface and solid modeling – data formats - Data interfacing, Part orientatio	n and support						
generation, S	Support structure design, Model Slicing, Tool path generation-Software	for RP- Case						
studies.	T							
UNIT- III	LIQUID BASED AND SOLID BASED RAPID PROTOTYPING	(9 Periods)						
	SYSTEMS							
Classification	n – Liquid based systems - Stereo lithography Apparatus (SLA): Princip	ple, pre-build						
process, part	-building and post-build processes, photo polymerization of SL resins, pa	rt quality and						
process plani	ning, recoating issues, materials, advantages, limitations and applications.	Solid Ground						
Curing (SGC): working principle, process, strengths, weaknesses and applications. Fus	ed deposition						
Modeling (F	DM): Principle, details of processes, process variables, types, products,	materials and						
application.	Laminated Object Manufacturing (LOM): Working Principles, details	of processes,						
products, ma	terials, advantages, limitations and applications - Case studies.							
UNIT- IV	POWDER BASED RAPID PROTOTYPING SYSTEMS	(9 Periods)						
Selective La	ser Sintering (SLS): Principle, process, indirect and direct SLS- powd	ler structures,						
materials, po	ost processing, surface deviation and accuracy, Applications. Laser En	gineered Net						
Shaping (LE	NS): Processes, materials, products, advantages, limitations and application	ations – case						
Studies, Sele	ctive Laser Melting and Electron Beam Melting							
UNIT- V	OTHER RAPID PROTOTYPING SYSTEMS	(9 Periods)						
Three dimens	sional Printing (3DP): Principle, basic process, Physics of 3DP, types of principle, basic process, Physics process, Physics process, Physics process, Physics	nting, process						
capabilities, material system. Solid based, Liquid based and powder based 3DP systems, Demerits,								
Applications	Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle							
Manufacturin	g (BPM), Bio Additive Manufacturing.							

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Chua Chee Kai and Leong Kah Fai **"Rapid Prototyping: Principles and Applications in** Manufacturing", John Wiley AND Sons, 1997
- 2. Paul F. Jacobs "Stereo-lithography and other RP & M Technologies", from Rapid Prototyping to Rapid Tooling, SME/ASME,1996

REFERENCE BOOKS:

- 1. Gibson, I., Rosen, D.W. and Stucker, B "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
- 2. Chua, C.K., Leong K.F. and Lim C.S "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010.
- 3. Gebhardt, A "Rapid prototyping", Hanser Gardener Publications, 2003.
- 4. Liou, L.W. and Liou, F.W "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2011.
- 5. Hilton, P.D. and Jacobs, P.F "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2005

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Appreciate the importance of computers and modern tools in manufacturing to reduce cost and matching the societal needs.
- **CO2:** Create and analyze 2D and 3D models using CAD modeling software and integrating with manufacturing systems.
- **CO3:** Understand the variety of Additive Manufacturing (AM) technologies apply to their potential to support design and manufacturing, case studies relevant to mass customized manufacturing.
- CO4: Apply knowledge on latest techniques of manufacturing in their field of career
- CO5: To monitor and control shop floor with the aid of computers

PO/PSO	PO	РО	РО	РО	РО	PO	PSO	PSO	PSO						
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01			L				М						L	L	
CO2			Μ											М	L
CO3			L										М	L	
CO4			Μ		Η	Μ	L						М	Н	L
CO5		М				L					Μ		L	Н	
18POE\$13		М	Μ		Μ	L	L				L		М	М	L

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

18POE\$14

MANAGERIAL ECONOMICS

(Common to All Branches)

Category: OE

L T P C 3 0 0 3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To introduce the fundamental economic principles necessary for production managers.

UNIT- I	FUNDAMENTALS OF MANAGERIAL ECONOMICS	(9 Periods)
Goals and C	constraints - The Nature and Importance of Profits - Understanding	ng Incentives -
Economic rat	ionality, Scarcity and opportunity cost -Marginal and Incremental Ana	lysis.
UNIT- II	DEMAND ANALYSIS	(9 Periods)
Demand and	Supply -Market Equilibrium - Price Elasticity of Demand - Price I	Elasticity, Total
Revenue, and	d Marginal Revenue - Factors Affecting Price Elasticity - Cross Pr	rice Elasticity -
Income Elast	icity of Demand - Other Elasticities, Elasticities for Nonlinear Dema	and Functions -
Elasticity of S	Supply.	
UNIT- III	DEMAND THEORIES	(9 Periods)
Choice and	Utility Theory - Law of Diminishing marginal utility - Consumer	· Equilibrium -
Consumer Su	rplus - Price effect, Substitution Effect and Income Effect.	
UNIT- IV	THEORY OF PRODUCTION AND COST	(9 Periods)
The Product	ion Function - Profit-Maximizing Input Usage - Isoquants and I	socosts - Cost
Minimization	and Optimal Input Substitution - The Cost Function - Break	keven analysis,
Contribution	analysis - Long-run Costs and Economies of Scale - Multiple Cost	Functions and
Economies of	f Scope - Learning curve.	
UNIT- V	THEORY OF MARKET AND PRICING	(9 Periods)
The Nature of	f Industry - Perfect Competition - Monopoly - Monopolistic Competit	ion – Oligopoly
- Product pric	eing.	

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Thomas and Maurice "Managerial Economics: Concept and Applications", McGraw-Hill, 2005
- 2. Maheshwari.Y "Managerial Economics", Prentice Hall of India, 2012

REFERENCE BOOKS:

- 1. D.N. Dwivedi, "Managerial Economics", Vikas Publishing house, 2015
- 2. Christopher R Thomas, S Charles Maurice, "Managerial economics", Mcgraw Hill, 2014

On completion of this course, students will be able to

CO1: Explain fundamentals of managerial economics.

CO2: Discuss the dynamics of market forces.

CO3: Explain about various theories of demand.

CO4: Discuss about the cost concepts related to production.

CO5: Describe about the theory of market and pricing method.

COURSE ARTICULATION MATRIX

PO/PSO	PO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	L							L	М	М	L			L
CO2	L	L	L							М	М	L			L
CO3	L									L	М	L			L
CO4	L					120				L	L	L			L
CO5	L	М	М	L	(and	G A	2			L	М	L			L
18POE\$14	L	L	L	L	S.			Red	S)	L	М	L			L

L- Low, M – Moderate (Medium), H - High



HYDRAULICS AND PNEUMATICS

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To make the students to design the hydraulic and pneumatic circuits for different applications.

UNIT- I	BASIC PRINCIPLES	(9 Periods)						
Hydraulic Pr	inciples; Hydraulic Fluids; Hydraulic pumps – Classification, Characteris	stics, Pump						
Selection; H	ydraulic actuators; Hydraulic valves - Pressure, Flow, Direction Controls	,						
Applications	s, Symbols.							
UNIT- II	HYDRAULIC CIRCUITS	(9 Periods)						
Hydraulic c circuit, Doub	ircuits – Reciprocating, Quick Return, Sequencing, Synchronizing, ble pump hydraulic system; Safety Circuits.	Regenerative						
UNIT- III	POWER GADGETS IN HYDRAULICS	(9 Periods)						
Accumulator	rs - Classification, Circuits; Pressure Intensifier and Circuit; Mechan	ical-hydraulic						
servo systen	n; Selection of components. Installation and Maintenance of Hydraulic	power pack;						
Troubleshoo	ting of fluid power circuits.							
UNIT- IV	PNEUMATIC SYSTEMS	(9 Periods)						
Pneumatic H	Fundamentals; Control Elements; Logic Circuits; Position sensing, Pres	ssure sensing;						
Electrical co	ntrols: Various switches; Electro Pneumatic and Electro Hydraulic Circuit	its.						
UNIT- V	DESIGN AND SELECTION OF PNEUMATIC CIRCUITS	(9 Periods)						
Design of P	neumatic circuits - Classic, Cascade, Step counter; PLC and Microproce	essors – Uses;						
Selection cr	Selection criteria for Pneumatic components; Installation and Maintenance of Pneumatic power							
pack; Fault f	inding; Case studies.							

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

- 1. Anthony Esposito, "Fluid Power with Applications", Pearson Education India, 7th edition, 2013.
- 2. Andrew Parr, "Hydraulics and Pneumatics: A Technician's and Engineer's Guide", Butterworth-Heinemann, 3rd edition, 2011.

REFERENCE BOOKS:

- 1. DudleyA Pease and John J Pippenger "Basic Fluid Power", Prentice Hall PTR, 2nd edition 1987.
- 2. John J Pippenger and Tyler G Hicks "Industrial Hydraulics", McGraw Hill,2nd edition, 1970.
- 3. J. Michael, Pinches and HohnG.Ashby "Power Hydraulics", Prentice Hall, 1989.

On completion of this course, students will be able to

CO1: Describe the principle of fluid power

CO2: Describe the components of hydraulics

CO3: Design the hydraulic circuits for automation

CO4: Describe the components of pneumatics

CO5: Design the pneumatic circuits for automation

COURSE ARTICULATION MATRIX

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	Н										М			
CO2	М											М			
CO3	М	Н										М			
CO4	М					G		B				М			
CO5	М				50		лфа () 1	10		5		М			
18POE\$15	М	Н			Z	PIR N			N	5		М			

L- Low, M – Moderate (Medium), H - High



MEASUREMENT AND CONTROL

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVE

* To learn about the working of different analog and digital instruments.

UNIT I – INTRODUCTION TO MEASUREMENTS	(9 Periods)
Significance of measurements - Methods of measurements - Classification of	Instruments –
Functions of Instruments and Measurement System - Elements of measurement sy	stem – Errors
in measurement — Calibration of instruments: Methods & analysis – Introduction	to Transducer
& types.	
UNIT II – STRAIN AND DISPLACEMENT MEASUREMENT	(9 Periods)
Factors affecting strain measurements – Types of strain gauges – theory of oper gauge materials – strain gauge circuits and applications of strain gauges. Resistive potentiometer (Linear, circular and helical) – L.V.D.T., R.V.D. characteristics – variable inductance and capacitance transducers – Piezo electrical	ration – strain T. and their transducers –
Hall Effect devices and Proximity sensors	unisqueens
UNIT III – PRESSURE AND TEMPERATURE MEASUREMENT	(9 Periods)
Mechanical devices like Diaphragm, Bellows, and Bourdon tube for pressure m Variable inductance and capacitance transducers – Piezo electric transducers – measurement of pressure. Resistance type temperature sensors – RTD & Thermistor – Thermocouples & Therm of thermocouple – Radiation methods of temperature measurement.	easurement – L.V.D.T. for mopiles, Laws
UNIT IV – FLOW AND LEVEL MEASUREMENT	(9 Periods)
Differential pressure meters like Orifice plate, Venturi tube, flow nozzle, Pitot tub Turbine flow meter, Electromagnetic flow meter and Ultrasonic flow meter. Resistive, inductive and capacitive techniques for level measurement – Ultrasonic m purge system (Bubbler method).	be, Rotameter, methods – Air
UNIT V – AUTOMATIC CONTROL SYSTEM	(9 Periods)
Elements of control systems - concept of open loop and closed loop systems - Cont	rollers – Brief
idea of proportional, derivative and integral – Pneumatic Controller – Hydraulic Controller	ntroller.
Contact Periods:	

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS

- 1. A.K. Sawhney, Puneet Sawhney "A Course in Electronic and Electrical Measurements and Instrumentation" S.K.Kataria & Sons, Delhi, 2014.
- 2. E. D. Doeblin, "Measurement Systems: Application and Design", McGraw Hill Publication, 6th Edition 2017.

REFERENCE BOOKS

1. S. K. Singh, "Industrial Instrumentation & Control", 3rd Edition, McGraw Hill, 2016.

2. A.K. Sawhney, Puneet Sawhney **"A Course in mechanical measurements and** Instrumentation & Control", Dhanapat Rai & Co, 2012.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- **CO 1:** Explain the construction and working of instruments used for various measurements.
- **CO 2:** Describe the methods of measurement, classification of transducers and to analyze error.
- **CO 3:** Elaborate the basic concept of control system.
- CO 4: Analyze the characteristics of various measuring instruments
- **CO 5:** Suggest suitable instruments for a particular application

CO/ PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Η	Μ	Η	Μ	Η	Μ	L	Н	Μ	Н	Η	Н	Μ	Η
CO2	Η	М	Μ	Μ	Η	Η	Н	М	Н	L	Н	Η	Н	Н	Μ
CO3	Η	Η	Μ	Н	М	Η	М	L	Н	Μ	Н	Η	Н	Н	Н
CO4	Η	Η	Μ	Η	Μ	Η	Μ	L	Н	Μ	Н	Η	Н	Μ	Η
CO5	Η	Η	Μ	H	Μ	H	Μ	D	Н	Μ	Н	Н	Η	М	М
18NOE\$16	Η	Η	Μ	Η	M	Η	Μ	L	H	M	Н	Η	Μ	Н	Μ

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate (medium), H-High



INDUSTRIAL AUTOMATION

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVE

* To elaborate the basic concept of automation and the components required for automation

UNIT I – INTRODUCTION TO AUTOMATION	(9 Periods)						
Automation overview - requirement of automation systems - architecture of industr	ial automation						
system - power supplies and isolators -relays - switches -transducers - sensors -se	al-in circuits –						
industrial bus systems : modbus and profibus.							
UNIT II – AUTOMATION COMPONENTS	(9 Periods)						
Sensors for temperature - pressure - force - displacement - speed - flow- level - hu	midity and pH						
measurement. Actuators - process control valves - power electronic drives DIAC- TRIAC - power							
MOSFET - IGBT. Introduction to DC and AC servo drives for motion control							
UNIT III – PROGRAMMABLE LOGIC CONTROLLERS	(9 Periods)						
PLC Hardware - PLC programming - ladder diagram - sequential flow chart - PLC							
communication and networking - PLC selection - PLC installation - Advantages -	Application of						
PLC to process control industries and Robotics.							
UNIT IV – DISTRIBUTED CONTROL SYSTEM (DCS)	(9 Periods)						
Overview of DCS – DCS hardware – DCS software configuration – DCS commun	ication – DCS						
supervisory computer tasks – DCS integration with PLC and Computers							
UNIT V – SCADA	(9 Periods)						
Introduction - Supervisory Control and Data Acquisition Systems (SCADA) - SCADA HMI							
Essentials - SCADA Components - SCADA Configuration and Software - HMI hardware and							
software.							

Contact Periods:			
Lecture: 45 Periods	Tutorial: 0 Periods	Practical: 0 Periods	Total: 45 Periods

TEXT BOOKS:

- 1. John.W. Webb Ronald A Reis, "Programmable Logic Controllers Principles and Applications", Prentice Hall Inc., 5th Edition, 2003.
- 2. M. P. Lukcas, "Distributed Control Systems", Van Nostrand Reinhold Co., 1986.

REFERENCE BOOKS :

- 1. Bela G Liptak, "Process software and digital networks Volume 3", 4th Edition, CRC press, 2012.
- 2. Romily Bowden, "HART application guide and the OSI communication foundation", 1999
- 3. Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw Hill, 2016.

Upon completion of the course, the student will be able to

- **CO 1:** Elaborate the basic architecture of automation systems
- **CO 2 :** Describe the various sensors and actuators involved in industrial automation
- **CO 3:** Construct ladder logic diagram using PLC basic functions, timer and counter functions for simple applications
- **CO 4:** Illustrate the functionary components and supervisory control of DCS with relevant diagrams
- **CO 5:** Describe the basics of SCADA technology

COURSE ARTICULATION MATRIX:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Н	Μ	Μ	L	L	L	Η	L	М	L	L	Η	L	L
CO2	Η	Η	Η	Η	L	L	L	Η	L	М	L	L	Η	L	L
CO3	Η	Н	Μ	Μ	L	L	Μ	Н	L	М	L	L	Н	L	L
CO4	Η	Н	Η	H	\mathbf{L}_{M}	L	L	Н	L	М	L	L	Н	L	L
CO5	Η	Н	Μ	M	Μ	L	L	H	$\mathcal{D}_{\mathcal{D}}$	М	L	L	Н	L	L
18NOE\$17	Н	Н	Μ	Μ	L	L	L	Η	L	М	L	L	Н	L	L

L-Low, M-Moderate (medium), H-High



VIRTUAL INSTRUMENTATION

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVE

* To confer applications of virtual instrumentation in various fields.

UNIT I – INTRODUCTION	(9 Periods)							
Virtual Instrumentation and LabVIEW - Evolution of LabVIEW - Difference betw	veen LabView							
and conventional languages - Sequencing and data flow - Graphical programming.								
UNIT II – LabVIEW ENVIRONMENT	(9 Periods)							
Front panel - Block diagram - Icon and Connector - Control Palette - Function Palette-Tools Palette								
- Creating, editing, wiring, debugging and saving VIs - sub-VIs - creating sub-VIs - simple								
examples-Looping: For loop, while loop-Shift registers - case and sequence; structures, formula								
nodes.								
UNIT III – PROGRAMMING TECHNIQUES	(9 Periods)							
Arrays - clusters, charts and graphs, - local and global variables - property node, string and file I/O.								
UNIT IV – DATA ACQUISITION AND INSTRUMENT CONTROL	(9 Periods)							
DAQ - Components - Buffers: Buffered and non buffered I/O - Triggering - Analog I	/O-Digital I/O							
- Counters and timers-Instrument control: VISA, GPIB, VXI and PXI								
UNIT V – ADVANCED Lab VIEW AND APPLICATIONS	(9 Periods)							
Connectivity in LabVIEW: an introduction - IVI - Labwindows/CVI.								
Applications of Lab VIEW: process control, physical, biomedical, Image acquisition and								
processing.								
1950 BCS								
Contact Periods:								

Lecture: 45 Periods Tutorial: 0 Periods Practical:

Practical: 0 Periods To

Total: 45 Periods

TEXT BOOKS

- 1. Sanjay Gupta and Joseph John, "Virtual Instrumentation using LabVIEW" Tata McGraw-Hill, Second edition 2010
- 2. Gary Johnson, Richard Jennings **"Lab view graphical programming",** Tata McGraw Hill, 2011.

REFERENCE BOOKS

- 1. Lisa K Wells and Jeffrey Travels, "Labview for everyone", Prentice Hall, 3rd Edition 2009.
- 2. S. Gupta, J.P. Gupta, "PC interfacing for data acquisition and process control", 2nd Ed., Instrument Society of America, 2011
- 3. Jovitha Jerome, "Virtual Instrumentation Using LabVIEW" PHI Learning Pvt. Ltd 1st Edition, 2010

Upon completion of the course, the student will be able to

- **CO 1:** Recognize the importance and applications of virtual instrumentation.
- **CO 2:** Develop ability for programming in LabVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.
- **CO 3:** Realize the basics of interfacing and programming using related hardware.
- **CO 4:** condition the acquired signal from the transducer to standard data formats
- **CO 5:** Develop real time applications using LabVIEW

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
CO/ PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	Η	Μ	Μ	L	L	L	Н	L	Μ	М	Μ	Н	М	М
CO2		Η	Н	Η	L	L	L	Н	L	Μ	М	Μ	Н	М	М
CO3		Η	Μ	Μ	L	L	Μ	H	L	Μ	Μ	Μ	Н	М	М
CO4		Η	Н	H	L	\mathbf{L}_{2}	L	Н	L	Μ	Μ	Μ	Н	М	М
CO5		Η	Μ	Μ	Μ	L	\mathbf{L}	H	L	М	Μ	Μ	Η	Μ	М
18NOE\$18	Μ	Η	Μ	Μ	L	L	L	Н	L	Μ	Μ	Μ	Η	Μ	М

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate(medium), H-High



18SOE\$19

PROGRAMMING IN JAVA

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

Upon completion of this course the students will be familiar with:

* Basic programming constructs in java to develop simple object oriented programs.

amme

- * Exception handling, multi-threading and I/O programming
- * Development of GUI applications
- * Manipulation of images.
- * Network Programming

UNIT – I : FUNDAMENTALS OF JAVA PROGRAMMING	(9 Periods)							
History and Evolution of Java- Overview of java- Operators- Control Structures- Methods- Classes and								
Objects- Inheritance- Packages and Interfaces- Exception Handling.								
UNIT – II : THREADS , I/O AND STRING HANDLING	(9 Periods)							
Multi threaded Programming- Enumeration- Auto boxing- Annotations- String Handling	g-Input/Output:							
Exploring java.io.								
UNIT – III : APPLETS AND EVENT HANDLING	(9 Periods)							
Applet class- Event Handling. Introducing the AWT: working with windows- graphics and text- Using								
AWT controls- Layout Manager - menus.								
UNIT – IV : IMAGING AND DATABASE CONNECTIVITY	(9 Periods)							
Imaging: Creating- loading and displaying- Image observer- Double buffering- Media	tracker- Image							
producer-consumer-filters-animation- Java Database Connectivity.								
UNIT – V : NETWORKING	(9 Periods)							
Networking – Remote Method Invocation – Java Beans – Java servlets								

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. Herbert Schildt, "Java, The Complete Reference", Tata McGrawHill, Eighth Edition, 2011.

REFERENCE BOOKS:

- 1. Deitel .H.M and Deitel.P.J, **"Java: How to Program",** Pearson Education Asia, Eighth Edition 2010.
- 2. Lay.S&Horstmann Gary Cornell, "Core Java Vol I", Seventh Edition, The Sun Microsystems & press Java Series, 2005.
- 3. Lay.S&Horstmann Gary Cornell, "Core Java Vol II", Eighth Edition, The Sun Microsystems & press Java Series, 2008.

Upon completion of the course, the student will be able to

- **CO1:** Write simple java programs using fundamental concepts of java like control structures, inheritance, packages, interfaces and exception handling. **[Usage]**
- CO2: Write java program using multithreading and string handling. [Usage]
- CO3: Develop GUI based applications using Applets. [Usage]
- CO4: Write java programs to display and manipulation of graphical images. [Usage]
- CO5: Establish database connectivity.[Familiarity]
- CO6: Develop client server programs using RMI and servlets. [Usage]

СО	PO	PO	РО	PO	РО	PSO	PSO	PSO	PSO							
00	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	М	М	Н		Н	М	М				Н	М	М	Н	Н	Н
CO2	Μ	М	Н		Η	Μ	Μ	الدريب	0		Н	М	М	Н	Н	Н
CO3	Μ	Μ	Η		H	Μ	М		6 5.00		Η	М	М	Н	Η	Н
CO4	Μ	Μ	Η		H	Μ	Μ	R	Re		Η	М	М	Н	Η	Н
CO5	Μ	М	Η		H	М	Μ			ſ	Η	М	Μ	Н	Η	Н
CO6	Μ	Μ	Η		H	Μ	М		30		Η	М	Μ	Н	Η	Н
18SOE\$19	Μ	М	Н		Η	М	М		\square		Н	М	М	Н	Н	Н

COURSE ARTICULATION MATRIX:

L - Low, M - Moderate (Medium), H - High

18SOE\$20

CYBER SECURITY

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- * Cybercrime and cyber offenses
- * Cybercrime using mobile devices.
- * Tools and methods used in cybercrime.
- * Legal perspectives of cybercrime.
- * Fundamentals of computer forensics.

UNIT – I : INTRODUCTION TO CYBERCRIME AND CYBEROFFENSES	(9 Periods)					
Cybercrime and Information Security - Classifications of Cybercrimes - The Legal	Perspectives -					
Cybercrime and the Indian ITA 2000 - A Global Perspective on Cybercrimes - Plan of A	Attacks - Social					
Engineering – Cyberstalking - Cybercafe and Cybercrimes – Botnets - Attack Vector.						
UNIT – II : CYBERCRIME: MOBILE AND WIRELESS DEVICES	(9 Periods)					
Proliferation of Mobile and Wireless Devices - Trends in Mobility - Credit Card Frauds	s in Mobile and					
Wireless Computing Era - Security challenges posed by mobile devices - registry set	ting for mobile					
devices - authentication service security - attacks on mobile/cell phones - Organization	al measures for					
handling mobiles.						
UNIT – III : TOOLS AND METHODS USED IN CYBERCRIME	(9 Periods)					
Proxy Servers and Anonymizers - Phishing - Password Cracking - Keyloggers - Spywares - Virus and						
Worms - Trojan Horses and Backdoors - Steganography - DoS and DDoS Attacks - S	SQL Injection -					
Attacks on Wireless Networks.						
UNIT – IV : CYBERCRIMES AND CYBERSECURITY: THE LEGAL	(9 Pariods)					
PERSPECTIVES	(91 errous)					
Cyber laws- The Indian Context - The Indian IT Act - Challenges to Indian Law a	nd Cybercrime					
Scenario in India - Consequences of Not Addressing the Weakness in Information Te	chnology Act -					
Digital Signatures and the Indian IT Act - Amendments to the Indian IT Act - C	cybercrime and					
Punishment.						
UNIT – V : UNDER STANDING COMPUTER FORENSICS	(9 Periods)					
Digital Forensics - Forensics Analysis of E-Mail - Network Forensics - Forensics and S	teganography -					
Forensics and Social Networking Sites - Challenges in Computer Forensics - Data Privacy Issues -						
Energies Auditing Antiferencies						

Forensics Auditing – Antiforensics.

Contact Periods: Lecture: 45 Periods

Tutorial: 0 Periods Practic

Practical: 0 Periods Total: 45

Total: 45 Periods

TEXT BOOKS:

1. Nina Godbole and Sunit Belapur, "Cyber Security Understanding Cyber Crimes, Compute Forensics and Legal Perspectives", Wiley India Publications, April, 2011.

REFERENCE BOOKS:

- 1. Robert Jones, "Internet Forensics: Using Digital Evidence to Solve Computer Crime", O"Reilly Media, October, 2005.
- 2. Chad Steel, "Windows Forensics: The field guide for conducting corporate computer investigations", Wiley India Publications, December, 2006.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Explain the fundamental concepts of cybercrime and cyberoffenses. [Familiarity]

CO2: Describe the cybercrimes occurred in mobile and wireless devices. [Familiarity]

CO3: Elaborate the methods used in cybercrime. [Familiarity]

CO4: Explain the laws for cybercrime and its respective punishments. [Familiarity]

CO5: Explain the forensics Analysis of E-Mail, Network and Social Networking Sites [Familiarity]

COURSE ARTICULATION MATRIX:

60	PO	PO	PO	PO	PO	PO	РО	РО	РО	PO	PO	PO	PSO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	Μ	Μ	Μ	Μ	L	Η	L	М	\square			Н	Η	L	Μ	М
CO2	Μ	Μ	Μ	Μ	Μ	Η	Μ	Μ	5	1		М	Н	Η	М	М
CO3	Н	L	L	L	L	H	H	L		1		Н	Н	Н	L	L
CO4	Η	Μ	Μ	Μ	Μ	Η	H	H		1		М	Н	Η	L	L
CO5	Η	Μ	Μ	Μ	Μ	L	H	L		× Aà		Η	Η	Η	Μ	Μ
18SOE\$20	Η	М	М	Μ	Μ	H	Н	М	d'	U,		Η	Η	Η	М	М

L - Low, M - Moderate (Medium), H - High

18SOE\$21

NETWORK ESSENTIALS

(Common to All Branches)

Category: OE

(9 Periods)

(9 Periods)

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- * Basic taxonomy and terminology of the computer networking
- * Wireless networking
- * Addressing and Routing
- Routing protocols
- * Troubleshooting and security issues.

UNIT – I: INTRODUCTION

Introduction to Computer Networks - Goals and advantages of Computer Networks - Network Topologies – Basic networking devices – Protocols – the need for a layered architecture - The OSI Model and the TCP/IP reference model – the Ethernet LAN – Home Networking – Assembling an office LAN – Testing and Troubleshooting a LAN – Physical layer cabling: Twisted pair and Fiber optics.

UNIT – II : WIRELESS NETWORKING

Importance of Wireless Networking – IEEE 802.11 Wireless LANs – Bluetooth- WIMAX – RFIDs – Securing the Wireless LANs – Configuring a Point to Multipoint Wireless LAN – Interconnecting network LANs – Switch, Bridges and Routers. Interconnecting LANs with the router, Configuring the network interface-Auto negotiation.

UNIT – III : ADDRESSING AND ROUTING FUNDAMENTALS	(9 Periods)				
IPv4 and IPv6 addressing - Subnet masks - CIDR blocks - configuration of a rou	iter – Console				
port connection - user EXEC mode - Privileged EXEC mode - Configuration of a s	switch – Static				
VLAN configuration - Spanning Tree protocol - Network Management - Power over	Ethernet.				
UNIT – IV : ROUTING PROTOCOLS (9 Periods)					
Static Vs Dynamic Routing Protocols - Distance vector Routing - Link State Routing	ting – Hybrid				
Routing – Configuring RIP - Network Services – DHCP, DNS - Analyzing Internet T	raffic.				
UNIT – V : TROUBLESHOOTING AND NETWORK SECURITY	(9 Periods)				
Analyzing Computer Networks - FTP data packets - Analyzing Campus Network	data traffic –				
Troubleshooting the router and switch interface, Troubleshooting fiber optics - Intru	sion - DOS -				
Security software and hardware.					

Contact Periods: Lecture: 45 Periods

Periods Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

TEXT BOOKS:

- 1. Jeffrey S.Beasley Piyasat Nilkaew "Network Essentials" 3rd Edition, Pearson, 2012
- 2. Larry L. Peterson and Bruce S. Davie "Computer Networks, A Systems Approach" 5th edition, Morgan Kaufmann Publishers Inc, 2011.

REFERENCE BOOKS:

- 1. Behrouz A.Ferouzan, "Data Communications and Networking", 5th edition, Tata McGraw-Hill, 2012.
- 2. Andrew S. Tanenbaum, "Computer networks", PHI, 5th edition 2011.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- **CO1:** Identify topologies and types of Computer Networks and enumerate the layers of the OSI model and TCP/IP and Explain the functions of each layer [**Familiarity**]
- CO2: Explain the significance of wireless networks and configure a Wireless LAN [Assessment]
- CO3: Describe basic routing algorithms and network services. [Familiarity]
- CO4: Troubleshoot the router and switch interface [Usage]
- **CO5:** Analyze Campus Network data traffic **[Usage]**

COURSE ARTICULATION MATRIX:

CO	PO	PO	PO	PO	PO	PO	РО	PO	РО	PO	PO	PO	PSO	PSO	PSO	PSO
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	М	М	Н	Н	Н	L	L	Н	H	Н	Н	Н	М	Н	Н	М
CO2	L	L	L	L	Η	L	L	Н	L	L	L	Н	Μ	Н	Н	Μ
CO3	L	Η	М	М	H	L	<u>4</u>	H	H	М	L	Н	L	Н	Н	L
CO4	Н	Η	Η	М	H	L	L	Н	Н	Н	М	Н	Μ	Н	Н	М
CO5	Η	Η	Η	М	H	L	L	Η	H	М	L	Н	Μ	Η	Η	М
18SOE\$21	Μ	Η	Η	М	H	L	L	Н	H	L	М	Н	Μ	Н	Н	Μ
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L - Low, M - Moderate (Medium), H - High

PROGRAMMING IN PYTHON

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- * Data types and variables declaration.
- * Control statements, Functions and the use of basic programming.
- * List, dictionary and operations used in python.
- * File and Exception handling.
- * Object oriented programming and GUI development.

UNIT – I : INTRODUCTION	(9 Periods)						
Introduction to Python - Setting up Python in OS - Python IDLE(write- edit-	run- and save						
programs) - Strings - Numbers - Variables - simple I/O - Getting user input- Using String							
method–Converting values.							
UNIT – II : CONTROL STATEMENTS AND FUNCTIONS	(9 Periods)						
Control statements - Random number generator- Branching and loops - Range function	ons- Functions						
-User defined functions- passing parameters- return function- working with global	variables and						
constants.							
UNIT – III : LISTS AND DICTIONARIES	(9 Periods)						
Lists - create- index- slice a list- Add and delete elements from a list- Append- Sort	and reverse a						
list- nested sequences- Dictionaries - Create- add- delete from a Dictionary- Operativ	ons associated						
with pairs of data.							
UNIT – IV : FILES AND EXCEPTIONS	(9 Periods)						
Files - Read from text files- Write to text files- Read and write more complex data-	Exceptions –						
Intercept and handle errors during program's execution.							
UNIT – V : OBJECT ORIENTED PROGRAMMING AND GUI	(9 Periods)						
Object oriented programming - Create objects of different classes in the same pro	gram- objects						
communication- complex object creation- derive new classes- existing class exten	sion- override						
method- GUI - GUI toolkit- create and fill frames- create buttons- text entries and text	t boxes- create						
check buttons and radio buttons - case study - create a web page using GUI functional	ity.						
Contact Periods:							
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods To	tal: 45 Periods						

TEXT BOOKS:

- 1. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2013.
- 2. David I.Schneider, "Introduction to programming using python", person, 2015.

REFERENCE BOOKS:

- 1. Michael Dawson, "Python Programming for the Absolute Beginner", Premier Press, 2003.
- 2. Charles Dierbach, "Introduction to Computer Science Using Python: A Computational
 - Problem-Solving Focus", Wiley Publications, 2012.

COURSE OUTCOMES:

- Upon completion of the course, the student will be able to,
- CO1: Use various data types. [Understand]
- CO2: Use control statements and functions. [Understand]
- **CO3:** Analyze the arrangement of data elements in Lists and Dictionary structures. **[Analyze] CO4:** Handle exceptions and perform file operations. **[Understand]**
- **CO5:** Develop application using object oriented programming and GUI. [Analyze]

COURSE ARTICULATION MATRIX:

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	М	L		L	ĽV	6		L	3		L		L	L
CO2	Μ	L		L	L		L	L	2		L		L	L
CO3	Μ	Μ	L	Μ	L		L	L	1		L		М	L
CO4	Μ	Μ	L	Μ	L		Μ	M	1		L		М	L
CO5	Μ	Μ	L	Μ	L	1	Μ	Μ	1		М	L	М	L
18IOE \$22	М	М	L	М	L	200	М	М			L	L	М	L
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L - Low, M - Moderate (Medium), H - High

18IOE\$23

BIG DATA SCIENCE

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

(9 Periods)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- * Big Data and its characteristics.
- * Technologies used for Big Data Storage and Analysis.
- * Mining larger data streams.
- * Concepts related to Link analysis and handle frequent data sets.

UNIT – I : THE FUNDAMENTALS OF BIG DATA

Understanding Big Data-Concepts and Technology-Big Data Characteristics-Types of data-Case Study-Business Motivation and Drivers for Big Data Adoption- Planning Considerations-Enterprise Technologies and Big Data Business Intelligence- OLTP-OLAP-Extract Transform Load-Data Warehouses-Data Mart-Traditional and Big Data BI-Case Study.

UNIT – II : BIG DATA STORAGE AND PROCESSING	(9 Periods)	
Big Data Storage Concepts- Clusters-File systems and Distributed File Systems-NoS	QL- Sharding	-
Replication -Sharding and Replication-CAP Theorem-ACID-BASE-Case Stud	ly- Big Dat	a
Processing Concepts- Parallel Data Processing-Distributed Data Processing-Hade	oop-Processin	g
Workloads-Cluster-Processing in Batch mode-Processing in RealTime mode-Case stu	ıdv	

		LIGIG TE CITALOL O CIT	
UNIT – III : BIG DATA STO	RAGE AND ANAL	YSIS TECHNOLOGY	(9 Periods)

Big Data Storage Technology: On-Disk Storage devices-NoSQL Databases-In-Memory Storage Devices-Case study, Big Data Analysis Techniques: Quantitative Analysis-Qualitative Analysis-Data Mining-Statistical Analysis-Machine Learning-Semantic Analysis-Visual Analysis-Case Study.

UNIT – IV : MINING DATA STREAMS

The stream data model – Sampling data streams – counting distinct elements in a stream – Estimating moments. Finding similar items – Applications of nearest neighbor search – shingling of documents - similarity preservation – locality sensitive hashing- distance measures – methods for high degree similarity.

UNIT – V : LINK ANALYSIS AND FREQUENT ITEMSETS	(9 Periods)
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Link analysis – Page rank – Efficient computation of a page rank – topic sensitive page rank – link spam –Frequent datasets – the market basket model – Apriori algorithm – handling larger datasets in main memory –limited pass algorithm – counting frequent items in a stream.

Contact Periods:	
Lecture: 45 Periods	Tutorial: 0 Periods

Practical: 0 Periods

Total: 45 Periods

(9 Periods)

TEXT BOOKS:

- 1. Thomas Erl, WajidKhattak, and Paul Buhler, "Big Data Fundamentals Concepts, Drivers & Techniques", Prentice Hall,2015.
- 2. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

REFERENCE BOOKS:

- 1. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill, 2011.
- 2. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series, 2012.
- 3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series, 2012.
- 4. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big data The big data platform", McGraw Hill, 2012.
- 5. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier, 2007

COURSE OUTCOMES:

Upon completion of the course, the student will be able to,

CO1: Understand the Big Data and usage in Enterprise Technologies. [Understand]

CO2: Store and Process Big Data using suitable Processing Methods. [Understand]

CO3: Handle Big Data using appropriate analysis Techniques. [Analyze]

CO4: Mine larger data streams using suitable algorithms. **[Understand]**

CO5: Rank pages and handle large data sets efficiently. [Analyze]

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Η	L	Μ	L	H	$^{\circ}L$	12		-110				М	L
CO2	Μ				Н	6	Arr 50	L	Ð			L	М	L
CO3		Н			Н							L	М	L
CO4	Μ	Н	М		М							L	М	L
CO5	L	Μ	Н									L	М	L
18IOE \$23	М	Н	М	L	Н	L		L				L	М	L

COURSE ARTICULATION MATRIX:

L - Low, M - Moderate (Medium), H - High

OBJECT ORIENTED PROGRAMMING USING C++

(Common to All Branches)

Category:	OE
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L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with,

- * Fundamentals of object oriented programming
- * Classes and objects
- * Concepts of overloading and type conversions
- * Inheritance and Polymorphisms
- * Files, templates and exception handling

UNIT – I : PRINCIPLES OF OBJECT ORIENTED PROGRAMMING	(9 Periods)						
Basic concepts- benefits - applications of object oriented programming - beginnin	ig with C++ -						
tokens - expressions and control structures - C++ stream classes - Formatted and Ur	nformatted I/O						
operations. Managing output with manipulators.							
UNIT – II : CLASSES AND OBJECTS	(9 Periods)						
Introduction - specifying class - defining member functions - memory allocation co	nstructors and						
destructors - parameterized, copy, default, dynamic and multiple constructors - destruct	ctors.						
UNIT – III : FUNCTIONS AND TYPE CONVERSIONS	(9 Periods)						
Introduction - function prototyping call by reference - return by reference - inli	ne function –						
recursion - friend function - function overloading - operator overloading - manipula	recursion - friend function - function overloading - operator overloading - manipulation of strings						
using operators – type conversions.							
UNIT – IV : INHERITANCE AND POLYMORPHISM	(9 Periods)						
Defining derived classes - single, multiple, multilevel, hierarchical and hybrid inherit	tance – virtual						
base classes - abstract base classes - nesting of classes - pointers - pointers to objects	s – this pointer						
- pointers to derived classes - virtual functions - pure virtual functions virtual con	nstructors and						
destructors.							
UNIT – V : FILES AND TEMPLATES	(9 Periods)						
Classes for file stream operations - opening and closing a file - detecting EOF - open	n file modes –						
file pointers and their manipulations - sequential I/O operations - updating and error	or handling of						
file Class and function template – template with multiple parameters – overload	ding member						

file. Class and function template – template with multiple parameters – overloading, member function and non-type template arguments-Exception handling.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods

Practical: 0 Periods Tot

Total: 45 Periods

TEXT BOOKS:

- 1. Lafort Robert, "Object oriented proframming in C++", 4th Edition.
- **2.** E.Balagurusamy, "Object oriented Programming with C++", McGraw Hill Education Ltd, 7th Edition 2017.

REFERENCE BOOKS:

- 1. R.Rajaram, "Object Oriented Programming and C++", New Age International 2nd edition, 2013.
- 2. K.R. Venugopal, Rajkumar, T. Ravishankar, "Mastering C++", Tata McGraw Hill Education, 2nd edition, 2013.
- 3. Yashavant P. Kanetkar, "Let us C++", BPB Publications, 2nd edition 2003.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to,

CO1: Understand the principles of object oriented programming. **[Understand] CO2:** Develop programs using classes and objects. **[Analyze]**

CO3: Use functions and type conversions in programs. **[Understand]**

CO4: Apply inheritance and polymorphism to develop applications. [Analyze]

CO5: Use files, templates and handle exceptions. **[Understand]**

COURSE ARTICULATION MATRIX:

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Μ	Η	Η	Μ	69	00	М	10 5 121	5	1			М	L
CO2	Μ	Н	Η	Η	ý	02	Μ	14°0					Н	L
CO3	Μ	Н	Η	Η	~	1	М		7				Н	L
CO4	Μ	Н	Η	Η		1	М	页	1				Н	L
CO5	Μ	Н	Η	Η			М	$\langle \rangle$					Н	L
18IOE \$24	М	Η	Н	Н	/	8	М	X					Н	L

L - Low, M - Moderate (Medium), H - High



18BOE\$25

COMPUTATIONAL BIOLOGY

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

Total: 45 Periods

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * Understand the basic concepts and role of computation in biological analysis
- * Familiarize with sequence alignment methods
- * Understand the machine learning tools used for biological analysis

UNIT – I : BASICS OF BIOLOGY	(9 Periods)							
Biomolecules of life: Structure and Composition of DNA, RNA & Protein. Protein Str	ucture basics-							
Primary, Secondary and tertiary Structure of protein.								
UNIT – II : BIOLOGICAL DATABASES	(9 Periods)							
Concept of Relational database, Data archiving, Data mining, Primary databases-NC	CBI, EMBL,							
DDBJ; Structure databases-PDB								
UNIT – III : SEQUENCE ANALYSIS	(9 Periods)							
Pairwise alignment tools-Dot matrix analysis, Dynamic programming-Smith W	aterman and							
Needleman Wunsch algorithm ,Heuristic methods- BLAST,FASTA; Multiple sequer	Needleman Wunsch algorithm ,Heuristic methods- BLAST,FASTA; Multiple sequence alignment							
methods-Progressive alignment (Clustal)								
UNIT – IV : STRUCTURE ANALYSIS AND DRUG DESIGN	(9 Periods)							
Protein secondary prediction-Chou fasman method, GOR method; Tertiary structure	re prediction-							
Homology modelling, Introduction to Computer aided drug design.								
UNIT – V : MACHINE LEARNING	(9 Periods)							
Genetic Algorithm, Neural networks, Artificial Intelligence, Hidden markov model -	application in							
bioinformatics								
Contact Periods:								

TEXT BOOKS:

Lecture: 45 Periods

- 1.David W. Mount, "Bioinformatics: Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press, Second Edition, 2004
- 2. Arthur M. Lesk, "Introduction to Bioinformatics", Oxford University Press, 2008.

Tutorial: 00 Periods

3. Pierre Baldi, Soren Brunak., "Bioinformatics: The machine learning approach", MIT Press, 2001

Practical: 00 Periods

REFERENCE BOOKS:

1. Andreas D. Baxevanis, "Bioinformatics, A Practical Guide to the Analysis of Genes and Proteins", Third edition; Wiley-Interscience, 2004.

2. Baxevanis A.D. and Oullette, B.F., "A Practical Guide to the Analysis of Genes and Proteins", 2nd ed., John Wiley, 2002

3. David L. Nelson, Michael M. Cox., "Lehninger: Principles of Biochemistry", Sixth edition, Freeman, W. H. & Co. Publisher, 2012.

Upon completion of the course the students will be able to

CO1: Understand the basic structure of Biological macromolecules

- **CO2**: Acquire the knowledge of biological databases and its importance.
- **CO3**: Perform pair wise and multiple sequence alignment
- CO4: Predict the secondary and tertiary structure of proteins.
- **CO5**: Understand the machine learning approaches in computational biology

COURSE ARTICULATION MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Μ	М	L	L		L			М				L	
CO2	Μ	L	L	L					L			L	L	L
CO3	L		L			М			L			L	L	
CO4	Μ	М	L	М	М								М	
CO5		М		Н	Н	М	L		М				Н	Н
18BOE \$25	М	М	L	М	М	М	L		М			L	М	Н

L - Low, M-Moderate (Medium), H- High



FUNDAMENTAL CONCEPTS OF BIOLOGY FOR ENGINEERS

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To understand the basic functions of the cell and their mechanisms in transport process.
- * To get familiarize human anatomy and physiology.
- * To learn about microbes, immune system and biomolecules.
- * To know the concepts of applied biology.

UNIT – I : BASICS OF CELL BIOLOGY	(9 Periods)							
An overview of cells - origin and evolution of cells-cell theory-classification of cells	– prokaryotic							
cells and eukaryotic cells; Structure of prokaryotic and eukaryotic cells and their organelles-								
comparison of prokaryotic and eukaryotic cells; Transport across membranes - diffusion - active and								
passive diffusion.								
UNIT – II : BASICS OF MICROBIOLOGY	(9 Periods)							
Classification of microorganism-microscopic examination of microorganisms;	Structural							
organization and multiplication of bacteria-viruses-algae and fungi; Microorganism	used for the							
production of penicillin-alcohol and vitamin B-12.								
UNIT – III : HUMAN ANATOMY AND PHYSIOLOGY	(9 Periods)							
Basics of human anatomy-tissues of the human body-epithelial-connective-nervous	and muscular;							
Nervous system-Respiratory System-Circulatory system and Digestive system.								
UNIT – IV : BIO MOLECULES AND IMMUNE SYSTEM	(9 Periods)							
Introduction to Biochemistry-classification-structure and properties of carbohydrates-p	oroteins- lipids							
and nucleic acids; Innate and acquired immunity; Types of immune responses.								
UNIT – V : APPLIED BIOLOGY FOR ENGINEERS	(9 Periods)							
Overview of biosensors - glucometer applications-medicine; Microarray analysis to	diagnose the							
cancer; Microbial production of biofuels; Applications of stem cells.								

Contact Periods:Lecture: 45 PeriodsTutorial: 00 PeriodsPractical: 00 PeriodsTotal: 45 Periods

TEXT BOOKS:

- 1. Darnell J, Lodish H, Baltimore D. "Molecular Cell Biology", W.H.Freeman; 8th Edition, 2016.
- 2. Pelczar MJ, Chan ECS and Krein NR, "Microbiology", Tata McGraw Hill, 5thEdition, New Delhi.2001.
- 3. Wulf Cruger and Anneliese Cruger, "A Textbook of Industrial Microbiology", Panima Publishing Corporation, 2nd Edition, 2000.

REFERENCE BOOKS:

- 1. David L. Nelson and Michael M Cox, "Lehninger's Principles of Biochemistry", Macmillan Worth Publisher, 4th edition, 2004.
- 2. Brain R.Eggins, "Chemical Sensors and Biosensors", John Wiley & Sons, 2002.
- 3. Anton Moser, **"Bioprocess Technology, Kinetics and Reactors"**, Springer, Berlin (Verlag), 1st edition, 1998
- 4. Kuby J, "Immunology", WH Freeman & Co., 7th edition, 2013.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to CO1: Understand the functions of cell and their structural organization CO2: Describe the mechanisms and role of cell in immune system CO3: Get familiarized biomolecules and human anatomy system CO4: Illustrate the applications of microbes in industrial process CO5: Apply the engineering concepts in biology

COURSE ARTICULATION MATRIX:

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	L	L	-	1	1		A	4	-	-	-	Н	М
CO2	L	М	-	L	H	- (SL/2	М	H	-	-	-	М	М
CO3	L	М	L	L	(}	12		L	Μ	-	-	L	Н	Н
CO4	L	L	L	L	Μ	8)y	1	L	-	-	-	М	Н
CO5	-	-	-	-	JA.	×	-	1			-	-	Н	Н
18BOE \$26	L	М	L	L	M	1916	L	М	М	-	-	L	Н	Н
		•	•	•	19	200	40 00	100-5	2	•	•	•	•	•

L - Low, M-Moderate (Medium), H- High

18BOE\$27

FUNDAMENTALS OF BIOENGINEERING

(Common to All Branches)

Category: OE

L	Т	Р	С
3	0	0	3

(9 Periods)

(9 Periods)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To make the students aware of the overall industrial bioprocess.
- * To understand the basic configuration and parts of a fermentor.
- * To study the production of primary and secondary metabolites.
- * To understand the production of modern biotechnology products.

UNIT I: INTRODUCTION TO INDUSTRIAL BIOPROCESS

Fermentation - Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology - A brief survey of organisms, processes, products. Basic concepts of Upstream and Downstream processing in Bioprocess.

UNIT II : FERMENTATION INDUSTRY

Overview of fermentation industry, Basic configuration of Fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes. Types of fermentation – Solid state, submerged, batch, continuous, fed batch fermentation methods.

UNIT III : PRODUCTION OF PRIMARY METABOLITES(9 Periods)A brief outline of processes for the production of some commercially important organic acids - Citric

acid, lactic acid ,acetic acid; amino acids - glutamic acid, phenylalanine; ethanol.UNIT IV: PRODUCTION OF SECONDARY METABOLITES(9 Periods)

Study of production processes for various classes of secondary metabolites: Antibiotics: beta lactams – penicillin and cephalosporin; aminoglycosides – streptomycin; macrolides - erythromycin, vitamin - B9, B12.

UNIT V: PRODUCTS THROUGH MODERN BIOTECHNIQUES(9 Periods)Production of industrial enzymes - proteases, amylases, lipases; Production of single cell protein
from wastes; biopreservatives – Bacterosin; biopolymers - xanthan gum and PHA. Industrial uses of
enzymes in detergents, beverage and food.(9 Periods)

Contact Periods:			
Lecture: 45 Periods	Tutorial: 0 Periods	Practical: 0 Periods	Total: 45 Periods

TEXT BOOKS

- 1. Peter F. Stanbur., Stephen J. Hall., A. Whitake., "Principles of Fermentation Technology", Science & Technology Books. 2007.
- 2. Presscott, S.C., Cecil G., Dun, "Industrial Microbiology", Agrobios (India), 2005.
- 3. Casida, L.E., "Industrial Microbiology", New Age International (P) Ltd, 1968.

REFERENCE BOOK

- 1. Crueger, W., Anneliese Cruege., "Biotechnology: A Textbook of Industrial Microbiology", Panima Publishing Corporation, Edition 2, 2003.
- 2. Sathyanarayana, U., "Biotechnology", Books and Allied (P) Ltd. Kolkata, 2005.

3. Ratledge C., Kristiansen B., "Basic Biotechnology", Cambridge University Press, second Edition, 2001.

4. Michael J. Waites., "Industrial Microbiology: An Introduction", Blackwell Publishing, 2001. COURSE OUTCOMES:

Upon completion of the course in Bioprocess Principles graduates will be able to **CO1:** Understand the basics of industrial bioprocess.

- **CO2:** Explain the principle of a fermentation process and the chronological development of fermentation industry.
- **CO3:** Understand the basic configuration of a fermentor and its ancillaries.
- **CO4:** Learn the production of various primary and secondary metabolites.
- **CO5:** Understand the production of biotechnological products.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	М	Н	Н	-	-	-	-	-	-	-	-	-	М	-
CO2	Η	М	-	-	-	-	-	-	-	-	-	-	-	-
CO3	Η	Н	Н	М	М	Μ		L	Н	-	-	-	-	Н
CO4	Η	L	L		1	E	0	SL-	100	-	-	-	-	Н
CO5	Η	М	Н	L	М	100	ga gr	L	(2)	-	-	-	-	Н
18BOE \$27	Н	М	Н	М	М	М		L	H	-	-	-	М	Н

COURSE ARTICULATION MATRIX:

L-Low, M-Moderate(Medium), H-High



HUMAN VALUES I

Category: VA

L	Т	Р	С
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

ETHICS

- * Essential complementarily between 'values' and 'skills' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- * The development of a Holistic perspective among students towards life, profession and happiness based on a correct understanding of the Human reality and the rest of existence, which forms the basis of Value based living in a natural way.
- * The plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with nature.

UNIT- I	(5 Periods)						
Introduction- Need, Basic Guidance, Content and Process for Value Education- Basic human							
Aspirations – Prosperity and happiness – Methods to fullfill human aspirations - Understanding							
and living in	and living in harmony at various levels.						
UNIT- II	HARMONY IN THE HUMAN BEING	(5 Periods)					
Coexistence – Happiness and convenience – Appraisal of Physical needs – Mental and Physical							

Coexistence – Happiness and convenience – Appraisal of Physical needs – Mental and Physica health – Human relationship – Mutual Trust and Respect.

(5 Periods)

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue – Caring – Sharing - honesty- Courage – Empathy – Self Confidence -Ethical Human Conduct- Basis for humanistic Education, Constitution and universal order – Competence in professional ethics – Strategy for transition from the present state to Universal human order.

Contact Periods:

UNIT-III

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS:

1. R.R. Gaur, R. Singal, G.P. Bangaria "Foundation Course in Human Values and Professional Ethics", 2009", Excel Book Private Ltd., New Delhi.

REFERENCE BOOKS:

- 1. S. K. Chakraborty and Dabangshu Chakraborty "Human Values and Ethics: Achieving Holistic Excellence", ICFAI University Press, 2006.
- 2. A.N. Tripathy "Human Values", New Age International publishers, 2003.
- 3. M. Govindarajan, S. Natarajan and V.S. Senthil kumar "Engineering Ethics(including human values)", Eastern Economy Edition, Printice Hall of India Ltd., 2004.
- 4. E.G. Seebauer and Rober. L. Berry **"Fundamentals of Ethics for Scientists and Engineers"**, Oxford University Press, 2000.

Upon completion of this course the students will be able to

- **CO1:** Start exploring themselves, get comfortable to each other and to the teacher and start finding the need and relevance for the course.
- **CO2:** See that their practice in living is not in harmony with their natural acceptance most of the time and able to refer to their natural acceptance to remove this disharmony.
- **CO3:** Aware of their activities like understanding, desire,thought and selection and start finding their focus of attention at different moments.
- **CO4:** Able to see that respect is right evaluation and only right evaluation leads to fulfillment in relationship.
- **CO5:** Develop an understanding of the whole existence and interconnectedness in nature.

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			М	Ja	3AG	Η	Н	Н	L				L	L	L
CO2			М	JU)	(d/	Н	Н	H	L				L	L	L
CO3			М	1º		Η	Н	H	L				L	L	L
CO4			М			Η	Η	Η	L				L	L	L
CO5			М			Н	Η	Η	L				L	L	L
18PVA\$01			М			Н	Η	Η	L				L	L	L

COURSE ARTICULATION MATRIX

L- Low, M – Moderate (Medium), H – High

Category: VA

L T P C 1 0 0 1

(5 Periods)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * Engineering Ethics and Human Values
- * Social responsibility of an Engineer
- * Ethical dilemma while discharging duties in Professional life.

UNIT- I ENGINEERING ETHICS

Senses of Engineering Ethics -variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's Theory – Gilligen's Theory – Consensus and contraversy – Models of Professional roles – theories about right actions – Self interest – customs and religion – uses of ethical theories – Valuing time-cooperation-commitment.

UNIT- II	ENGINEERING AS SOCIAL EXPERIMENTATION	(5 Periods)
Engineering a	s experimentation – engineers as responsible experimenters – codes of	of ethics – a

balanced outlook on law – the challenger case study - engineers as managers – consulting engineers - Moral leadership

UNIT- III	SAFTY, RESPONSIBLITIES, RIGHTS AND GLOBAL	(5 Periods)
	ISSUES	1

Safty and risk – assessment of safty and risk – risk benefit analysisand reducing risk – the three mile island and chernobyl case studies.– Environmental ethics – computer ethics – weapons development- Multinational corporations - engineers as expert witnesses and advisors.

Contact Periods:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS:

- 1. Mike Martin and Roland Schinzinger "Ethics in Engineering", McGraw Hill, New York, 1996.
- 2. *M. Govindarajan,S. Natarajan and V.S. Senthil kumar* **"Engineering Ethics (including human values)",** Eastern Economy Edition, Printice Hall of India Ltd., 2004.

REFERENCE BOOKS:

- 1. Charles D.Fleddermann "Engineering Ethics", Pearson Education, 2004.
- 2. Edmund G Seebauer and Robert L. Berry **"Fundamentals of Ethics for Scientists and Engineers, 2001",** Oxford University Press
- 3. Charles E. Harris, Michael S. Protchard and Michael J. Rabins "Engineering Ethics Concepts and Cases", Thomson Learning, 2000.
- 4. John R. Boatright "Ethics and Conduct of Business", Pearson Education, 2003.
COURSE OUTCOMES:

Upon completion of this course the students will be able to

- **CO1:** Understand and appreciate Human values, exhibit self confidence and develop good character
- **CO2:** Sense engineering ethics, professional roles and valuing time, co-operation and commitment
- **CO3:** Uunderstand and practise code of ethics.
- CO4: Assess safty and risk and capabile of doing risk benefit analysis.
- **CO5:** Develop and exhibit moral leadership qualities in exercising Engineering Consultations without compromising envionmental, legal and ethical issues

PO/PSO	РО	РО	PO	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			М			Н	Н	Н	L				L	L	L
CO2			М			Н	Н	Н	L				L	L	L
CO3			М		2	Н	Н	H	L	6			L	L	L
CO4			М		R.	H	Н	Η	\mathbf{L}) (L	L	L
CO5			М		X	Н	Н	Η	L	2			L	L	L
18PVA\$02			М			Н	Н	H	L				L	L	L

COURSE ARTICULATION MATRIX



YOGA FOR YOUTH EMPOWERMENT

(Common to CIVIL, MECH, EEE & PRODN Branches)

Category: VA

L	Т	Р	С
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- * To create awareness and the benefits of yoga and meditation
- * To study and analyze the influential factors, which affect the engineering students' healthy life

UNIT- I	PHYSICAL STRUCTURE AND ITS FUNCTIONS	(5 Periods)									
Yoga - Purpo	ose of life, philosophy of life, Physical structure, Importance of phys	ical exercise,									
Rules and regulation of simplified physical exercises, hand exercise, leg exercise, breathing											
exercise, eye	exercise, eye exercise, kapalapathy, maharasana, body massage, acupressure, body relaxation										
UNIT- II	YOGASANAS	(5 Periods)									
Rules & Regulations – asana, pranayama, mudra, bandha											
UNIT- III	MIND	(5 Periods)									
Bio magnetis	n& mind - imprinting & magnifying - eight essential factors of living be	eings, Mental									
frequency an	d ten stages of mind, benefits of meditation, such as perspicacity, i	magnanimity,									
receptivity,	adaptability, creativity, Simplified Kundalini yoga: Agna, Sant	hi, thuriam,									
thuriyatheetha	ım.										
Contact Perio	ds:										
Lecture: 15 Pe	riods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Perio	ods									

TEXT BOOKS:

- 1. VethathiriMaharashi "Yoga for Modern Age"
- 2. VethathiriMaharashi "Mind"

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1: YOGA which gives healthy & better living, Physical, Mental mood, Intellectual & spiritual.

CO2: Work skillfully and perfectly towards the excellence.

CO3: Achieve meditation practices, which strengthen the mind and increases the will power **CO4:** Concentration, creativity and ultimately to transform the mind to achieve self-realization

COCHOL				0111											
PO/PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						Η							L		
CO2									Μ					L	
CO3							L				L		L		L
CO4							L		Μ						
18PVA\$03						L	L		Μ		L		L	L	L

COURSE ARTICULATION MATRIX

BASICS OF CIVIL ENGINEERING

(Common to MECH & PROD Branches)

Category: VA

L	Т	Р	С
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To make the students aware of basic concepts of Civil Engineering by exposing the students about the building materials and construction methods followed.

UNIT- I	BUILDING MATERIALS	(7 Periods)									
Qualities of g	ood building stone - Qualities of good brick - Cement composition, typ	pes and uses -									
Properties and uses of tor steel, structural steel sections, timber - Concrete - Grade of concrete -											
Properties of reinforced concrete.											
UNIT- II	UNIT- II BUILDING CONSTRUCTION (8 Periods)										
Foundation fu	inctions – Failures - Bearing capacity of soil - Different types of	of foundation.									
Masonry - P	oints to be observed in construction - Brick masonry - Types of	bond - Stone									
masonry - Ra	andom rubble and Ashlar masonry. Flooring - Various types of floor	finishing for									
Residential, In	ndustrial buildings.										

Contact Periods:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS:

- 1. Punmia B.C "Basic Civil Engineering", Lakshmi Publications, 2003
- 2. Bhavikatti S. S "Basic Civil Engineering", New Age International Publishers, 2010

REFERENCE BOOKS:

- 1. Rangwala S.C "Engineering Materials", Charotar Publishing House, 2014
- 2. Punmia B.C "Building Construction", Lakshmi Publications, 2008.

COURSE OUTCOMES:

On completion of this course, students will be able to

- CO1: Know the qualities and properties for building materials used in the field
- **CO2:** Apply the knowledge of construction practices in real life situation in the societal context.

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н	L		L						L					
CO2						L		L	М	М	Н	L	L		L
18PVA\$04	Н	L		L		L		L	М	Μ	Н	L	L		L

COURSE ARTICULATION MATRIX

METALLOGRAPHY

(Common to MECH & PROD Branches)

Category: VA

L T P C 1 0 0 1

PRE-REQUISITES:

1. 18PPC305 – Engineering metallurgy

COURSE OBJECTIVES:

* To understand the preparation of metallographic specimens for micro examination and analyze the microstructures of metals and metallic alloys.

UNIT- I: PREPARATION OF METALLOGRAPHIC SPECIMENS	(5 Periods)
Microscopic and macroscopic examination, Polishing techniques for different metals and a	lloys,
Sectioning- Fracturing, Shearing, Sawing, Abrasive cutting, Electric discharge machining,	Mounting-
Adhesive mounting, Plastic mounting, Grinding and Etching techniques - Electrolytic etch	ing,
Potentiostat etching, Chemical etching.	-

UNIT–II: MICROSTRUCTURES OF FERROUS AND NON FERROUS METALS (5 Periods) Crystalline structure of metals, Phase changes of metals and alloys, Crystal defects in metals,

Microstructures of plain carbon steel, tool steel, grey C.I, SG iron, Brass, Bronze and composites.

UNIT –III: IMAGE ANALYSING TECHNIQUES (5 Periods)

Light microscopy, SEM, TEM, XRD, Quantitative microscopy-Grain size measurement, Inclusion rating methods, Measurements of structural gradients - Decarburization, Case depth, Coating thickness, Quantitative fractography, Image analysis.

Contact Periods:

Lecture: 15 Periods Tutorial:0 Periods Practical:0 Periods Total: 15 Periods

REFERENCE BOOKS:

- 1. O.P. Khanna "Material Science & Metallurgy", Dhanpat Rai Publication ,2011
- 2. Sydney H. Avner "Introduction to Physical Metallurgy", Tata McGraw Hill Book Company, 1994.
- 3. R.C. Gifkins, "Optical Microscopy of Metals", American Elsevier Pub. Co., 1970
- 4. S.Telansky, "Multiple beam interference Microscopy of Metals", Academic Press, New York, 1970.
- 5. Kay Geels, "Metallographic and Materialographic Specimen Preparation, Light Microscopy, Image Analysis and Hardness Testing", ASTM International, U.S.A. ASTM Stock No. MNL46.

COURSE OUTCOMES:

- At the end of the course students will be able to
- **CO1:** Apply the specimen preparation methods in metallographic inspection.
- **CO2:** Identify the phase changes of microstructures and defects in metals and metallic alloys.
- CO3: Analyze the microstructures and defects in metals and metallic alloys.

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ												L		
CO2	Н	Η			Н	Μ				Μ			Н	Μ	
CO3	Н	Η			Н	Μ				Μ			Н	Μ	
18PVA\$05	Η	Η			Η	L				L			Μ	L	

COURSE ARTICULATION MATRIX

L	Т	Р	С
1	0	0	1

PRE-REQUISITES:

- 1. 18PBS302 Partial Differential Equations, Probability and Statistics
- 2. 18PPC504- Metrology and Computer Aided Inspection

COURSE OBJECTIVES:

* To achieve optimized results by approaching various special Experimental Techniques for various design problems.

UNIT- I	INTRODUCTION TO QUALITY BY DESIGN	(3 Periods)								
Introduction ·	goal post philosophy – Taguchi's definition of quality - Taguchi le	oss function -								
quality charac	teristics.									
UNIT- II	DESIGN PROCESS	(3 Periods)								
Objective of engineering design - variability due to noise factors - prediction of the process										
average under optimum condition.										
UNIT- III	ORTHOGONAL ARRAYS AND MATRIX EXPERIMENTS	(3 Periods)								
Matrix experi	ments - orthogonal arrays - degrees of freedom of orthogonal arrays	- interaction								
effects - predi	ction of the process.									
UNIT- IV	SIGNAL-TO-NOISE RATIO	(3 Periods)								
Signal-to-nois	se (SN) ratio for static problems - Relationship between SN ratio and	d quality loss,								
and its applica	ations.									
UNIT- V	CONDUCTING AN EXPERIMENT	(3 Periods)								
Randomized	Randomized block design - completely randomized design - two level factorial experiments -									
analysis of ex	periments.									

Contact Periods:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS:

- 1. Philip J Rose "Taguchi techniques for quality Engineering", Prentice Hall, 2005.
- 2. NicoloBelavendram "Quality by Design, Taguchi techniques for Industrial experimentation", Prentice Hall, 1995.
- 3. Montgomery D.C "Design and Analysis of Experiments", 5th Edition, John Wiley and Sons, NewYork., 2001

REFERENCE BOOKS:

- 1. Sung H Park, "Robust Design and Analysis for Quality Engineering", Chapman and Hall, London, 1996.
- 2. Giani Taguchi, Elssayed A. Elsayed, Thomas C. "Quality Engineering in Production Systems", Mc Graw Hill Book Company, 1989.
- 3. Genichi Taguchi, Subir Chowdhury and Shin Taguchi "Robust Engineering", McGraw Hill, New York, 2000.

COURSE OUTCOMES:

- On completion of this course, students will be able to
- **CO1:** Understand the quality concepts in engineering.
- CO2: Describe the influences of design process related with quality.
- CO3: Explain the concept of orthogonal array and its interaction effects.
- CO4: Explain about signal to noise ratio and quality loss function.
- **CO5:** Conduct experiments on randomized block and completely randomized block for optimization



PO/PSO	PO	PO	PO	PO	РО	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Μ	М	М	L	1	SUP	\geq					L	М	М
CO2	Μ	М	М	Μ	L				1				L	М	М
CO3	М	М	М	М	L	8							L	М	М
CO4	М	Μ	Μ	М	A	No.				30			L	Μ	М
CO5	Μ	М	Μ	М	Ĥ	10				No.			L	Μ	М
18PVA \$06	М	М	М	М	L				200	<i>V</i>			L	М	М

ENTREPRENEURSHIP DEVELOPMENT

Category: VA

L	Т	Р	С
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To familiarise the students in entrepreneurship concepts and processes.

UNIT- I	CONCEPT OF ENTREPRENEURSHIP	(5 Periods)
Definition an Entrepreneuri and zeroing of	nd concept of enterprising –Types and of entrepreneur –Factor al Growth. Project Identification-Methodology of project identification n product/service - problems in project evaluation	ors Affecting - short listing
UNIT- II	FINANCE AND MARKETING	(5 Periods)
Need, Source concepts - ba Small Scale In	es, Capital Structure, and Term Loans. Accounting principles - cor lance sheet - profit and loss account - accounting rate of return, pa industry duty practice. Marketing - Sales strategies.	ventions and yback period,
UNIT- III	ASSISTANCE TO ENTREPRENEUR	(5 Periods)
Small industri industry, Tax Investment.	ies development in India and its concept - ancillary industries - starting ation Benefits to Small Scale Industry: Need, Depreciation, Reha	a small-scale bilitation and
Contact Period	ls:	
Lecture: 15 P	eriods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Per	riods

TEXT BOOKS:

- 1. Robert D Hisrich, Michael P Peters & Dean Shepherd "Entrepreneurship", Tata McGraw Hill, 2007.
- 2. Donald F Kuratko and Richard M Hodgetts "Entrepreneurship", South-Western.

REFERENCE BOOKS:

- 1. Vasant Desai "The Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 2010.
- 2. Sudha G S **"Managementand Entrepreneurship Development",** Indus Valley Publication, 2009.
- 3. Thomas W Zimmerer and Norman M Scarborough "Essential of Entrepreneurship and Small Business Management", Prentice Hall of India, 2009
- 4. Marc J Dollinger, "Entrepreneurship-Strategies and Resources", Pearson Education, 2003

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Describe the basic concept of entrepreneurship.

- **CO2:** Describe the financial concepts and marketing.
- **CO3:** Describe the assistance to entrepreneur.

COURSE ARTICULATION MATRIX

PO/PSO	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO						
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ					Μ		Μ	L		L	Μ			L
CO2	Μ		Μ						Μ	Н	Η				
CO3	Μ	М	L			L		Μ	Μ	Μ		Μ			
18PVA\$07	М	М	L			L	num n	М	Μ	Μ	Μ	Μ			L



Category: VA

L T P C 1 0 0 1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To familiarise the students in patent systems and processes.

UNIT- I	INTRODUCTION TO IPR & PATENTS	(5 Periods)									
Understanding	g of Intellectual Property Rights - IPR Regime - Legislations and Sa	lient Features of									
Patent Act - Content of Indian Patent System.											
UNIT- II	PATENT SEARCH, DRAFTING & FILING PROCEDURE	(5 Periods)									
	IN INDIA										
Patent Search	- Patent Drafting - Patent Filing Procedure in India - Patent Prosecu	tion in India.									
UNIT- III	PATENT ENFORCEMENT IN INDIA AND	(5 Periods)									
	INTERNATIONAL PATENT SYSTEMS										
Enforcement	of Patents - Infringement of Patents - International Patent Systems -	International									
Treaties for P	atent - Multilateral Agreements.										

Contact Periods:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS

- 1. Neeraj Pandey, KhushdeepDharni **"Intellectual Property Rights"**, PHI Learning pvt. Ltd - New Delhi
- 2. S.R.A. Rosedar "Intellectual Property Rights", LexisNexis, 1st edition, 2014.

COURSE OUTCOMES

- On completion of this course, students will be able to
- CO1: Describe the basic concept of Intellectual Property Rights.
- **CO2:** Describe the IPR filing procedure in india.
- **CO3:** Describe the patent enforcement and international patent systems.

PO/PSO	РО	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ					Μ		Μ	L		L	Μ			L
CO2	Μ		Μ						Μ	Н	Н				
CO3	Μ	М	L			L		Μ	Μ	Μ		Μ			
18PVA\$08	Μ	М	L			L		М	М	М	М	Μ			L

COURSE ARTICULATION MATRIX

L	Т	Р	С
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* The main objective of the Industrial Training is to experience and understand real life situations in industrial organizations and their related environments and accelerating the learning process of how student's knowledge could be used in a realistic way.

The students have to undergo practical industrial training for four weeks (During Sixth Semester holidays) in recognized industrial establishments.

At the end of the training they have to submit a report with following information:

- 1. Profile of the Industry,
- 2. Product range,
- 3. Organization structure,
- 4. Plant layout,
- 5. Processes/Machines/Equipment/devices,
- 6. Personnel welfare schemes,
- 7. Details of the training undergone,
- 8. Projects undertaken during the training, if any
- 9. Learning points.

End Semester examination will be a Viva-Voce Examination during Seventh Semester. The assessments will be based equally on the report in the prescribed format and viva- voce examination by a committee nominated by the Head of the Department.

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Understand the different forms of organization, functions of management, organizational behaviour, group dynamics and modern concepts in industrial management.

PO/PSO	PO	PO	PO	РО	PO	РО	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
CO	I	2	3	4	5	0	7	8	9	10	11	12	I	2	3
CO1	Μ	Μ	Н	L	Μ	L		L	Μ	L	Μ	L	М	М	М
18PVA\$09	Μ	М	Н	L	Μ	L		L	Μ	L	Μ	L	М	Μ	Μ

COURSE ARTICULATION MATRIX

PROJECT MANAGEMENT (Common to MECH & PROD Branches)

Category: VA

L	Т	Р	С
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To prepare the students to identify, plan, develop, manage, successfully implement, execute and finish the projects within stipulated time in their chosen area.

UNIT – I: BASICS OF PROJECT MANAGEMENT	(5 Periods)
Introduction, definition of project and project management, project objectives, classi	fication of
projects, need for project management, project management knowledge areas and pr	ocesses, project
life cycle, project management principles.	
UNIT – II: PROJECT IDENTIFICATION AND PLANNING	(5 Periods)
Project identification process - project initiation, pre-feasibility study, feasibility study	dies, project
break-even point, Project planning -need of project planning, project life cycle, roles	s, responsibility
and team work, project planning process.	
UNIT – III: PROJECT IMPLEMENTATION AND EXECUTION	(5 Periods)
Organizational structure influences on projects, project risk management- role of risk	k management in
overall project management, steps in risk management, project execution -project co	ntrol process
and case studies in project management.	
Contact Periods:	
Lecture: 15 Periods Tutorial:0 Periods Practical:0 Periods Total: 15 Pe	eriods
A B	
REFERENCE BOOKS:	

- 1. Clifford F. Gray, Erik W. Larson., "Project Management: The Managerial Process", McGraw Hill, 6th Edition, 2014.
- 2. Gary R.Heerkens., "Project Management" McGraw Hill, 2002.
- 3. Nick Jenkins., "A Project Management Primer", 2006.
- 4. Robert K. Wysocki "Effective Project Management" Wiley Publishers, 2013.
- 5. Jack R. Meredith and Samuel J. Mantel., "Project Management, A Managerial Approach" John Wiley & Sons, 2015.

COURSE OUTCOMES

- On completion of this course, students will be able to
- **CO1:** Apply the concepts of project management in engineering.
- CO2: Identify and plan new projects.
- **CO3:** Implement and execute new projects.

CO/PO	PO	PSO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	L				L	L		L	Η	Μ	L	Η	L	L	L
CO 2	L				L	L		L	Η	Μ	L	Н	L	L	L
CO 3	L				L	L		L	Η	Μ	L	Н	L	L	L
18PVA\$10	L				L	L		L	Н	М	L	Н	L	L	L

COURSE ARTICULATION MATRIX

L-Low, M-Moderate(Medium), H-High

L T P C 1 0 0 1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To introduce the safety awareness among the students.

UNIT- I	INTRODUCTION	(5 Periods)
The importan	ce of safety and health for engineers – Safety and Health professions – Fo	undamental
concepts and	terms.	
UNIT- II	HAZARDS AND CONTROL	(5 Periods)
General princ	iples – Structural failures, Slipping, Electrical hazards, Tools, transportat	ion – Modes,
causes and Pr	evention.	
UNIT- III	SAFETY MANAGEMENT	(5 Periods)
Fundamentals	s – Risk management and Assessment – safety plans and programs.	
Contact Perio	ds:	

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS:

1. Roger.L. Brauer "Safety And Health For Engineers", Wiley Interscience, 2006

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: explain about the importance of safety.

CO2: describe the types of hazards and their prevention methods

CO3: explain about the guidelines for safety management

COURSE ARTICULATION MATRIX

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						Η	Н	Η	М		L		L	L	L
CO2						Н	Н	Η	М		L		L	L	L
CO3						Н	Н	Η	М		L		L	L	L
18PVA\$11						Н	Н	Н	М		L		L	L	L

SIX SIGMA (Common to MECH & PRODN Branches)

Category: VA

L T P C 1 0 0 1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To impart knowledge on six sigma tools on projects and successful completion of projects that drive meaningful business results.

UNIT - I	SIX SIGMA QUALITY AND STANDARDS	(5 Periods)							
Meaning and use of the Six Sigma approach- the underlying concept of variation- the									
relationships to related Quality Management approaches - Basic six sigma tools - Nature of six									
sigma improvements projects.									
UNIT – II	DEFINING THE PROJECT MISSION	(5 Periods)							
Focus on cre	ativity and creativity tools used in coming up with creative form	ulations and							
solutions in Si	x Sigma improvement projectsReview and management of Six Sigma	a projects							
UNIT – III	INTRODUCTION TO STATISTICS AND EXCEL	(5 Periods)							
Statistical techniques for summarizing data and extensive use of Microsoft Excel-Statistical									
Process control.									

Contact Periods:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS:

- 1. Joseph A De Feo, William W BearnardJuran Institute "Six Sigma Break Through and Beyond", M Tata McGraw Hill, New Delhi, 2004
- 2. Richard B Chase F Robert Jacobs and Nicholas J Aquilano "Operations Management for Competitive Advantage", McGraw Hill Inc., New York, Tenth Edition, 2003
- 3. Poka Yoke "Improving Product Quality by Preventing Defects", Productivity Press, Portland, Oregon, 1993

REFERENCE BOOKS:

- 1. George Eckes "Six Sigma for Everyone", John Wiley & Sons", 2003
- 2. J M Juran ,F.M.Gyna & R.S.Bingham "Quality control Hand book", McGraw Hill book co,1979
- 3. Rath, Strong Staff "Six Sigma Leadership Handbook", John Wiley & sons" 2003.
- 4. Mikel J Harry "Six Sigma: The Break through Management Strategy Revolutionizing the World's top Corporations", 2003.
- 5. Robert O Slater "Management Insights and Leadership Secrets of the Legendary CEO", 1998

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Describe the six sigma approach and basic six sigma tools.

CO2: Use the creativity tools.

CO3: Employ the statistical techniques for summarizing datas.

PO/PSO	PO	PO	PO	РО	PO	PSO	PSO	PSO							
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н	Η	М	Η	М	L			L	М	М	L	М	М	М
CO2	Н	М	М	Η	М	L			L	М	М	М	М	М	М
CO3	Н	Η	М	Η	М	L			L	М	М	L	М	М	М
18PVA\$12	Н	Η	М	Η	Μ	L			L	Μ	М	L	М	М	М



PROFESSIONAL SKILLS (Common to MECH & PROD Branches)

Category: VA

L	Т	Р	С
1	0	0	1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To inculcate administrative skills in students minds to make them able to administrate effectively for project implementation.

UNIT – I: SELF ANALYSIS AND CREATIVITY	(5 Periods)							
SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem. Out of box								
thinking, Lateral Thinking.								
UNIT – II: LEADERSHIP	(5 Periods)							
Skills for a good Leader, Assessment of Leadership Skills, Conflicts in Human Relations – Reasons								
Case Studies, Approaches to conflict resolution								
UNIT – III: DECISION MAKING	(5 Periods)							
Importance and necessity of Decision Making, Process and practical way of Decision Making,								
Weighing Positives & Negatives.								

Contact Periods:

Lecture: 15 Periods Tutorial:0 Periods Practical:0 Periods Total: 15 Periods

REFERENCE BOOKS:

- 1. Covey Sean, "Seven Habits of Highly Effective Teens", New York, Fireside Publishers, 1998.
- 2. Carnegie Dale, "How to win Friends and Influence People", New York: Simon & Schuster, 1998.
- 3. Thomas A Harris, "I am ok, You are ok", New York-Harper and Row, 1972
- 4. Daniel Coleman, "Emotional Intelligence", Bantam Book, 2006
- 5. Soft Skills, 2015, "Career Development Centre", Green Pearl Publications.

COURSE OUTCOMES

- On completion of this course the student will be able to
- **CO 1:** Do self analysis and pocess a positive approach.
- **CO 2:** Develop leadership qualities to solve conflicts and maintain good relationship with personals.
- **CO 3:** Make decision for effective project implementation.

COURSE ARTICULATION MATRIX

CO/PO	PO	PSO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1						L		Η	Μ		L	М	L		Н
CO 2								Η	Μ			М	L		Η
CO 3				L		L		Μ	Μ			М	L		М
18PVA\$13				L		L		Η	Μ		L	М	L		Η

L-Low, M-Moderate(Medium), H-High

L T P C 1 0 0 1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To familiarize the importance of solar energy and methods of harnessing solar energy.

UNIT- I	SOLAR THERMAL ENERGY COLLECTORS AND STORAGE	(5 Periods)							
	DEVICES								
A review of energy related environmental problems, introduction to solar energy, Devices for									
thermal colle	ections - Liquid flat plate collector - Solar Air heater - Parabolic	concentrating							
collector - Fresnel reflector - Power tower system - Thermal Storage devices - Latent heat and									
sensible heat storage.									
UNIT- II	UNIT- II THERMAL APPLICATIONS (5 Periods)								
Water heatin	g – Space heating – Space cooling and refrigeration – Distillation Drying	g – Cooking -							
Solar therma	l power plant-Low temperature - medium temperature and high tempe	erature power							
plant.									
UNIT- III	SOLAR PHOTO VOLTAIC SYSTEM	(5 Periods)							
Solar cell – basic principle - Solar Photo voltaic system for power generation – off – grid and grid									
connected system – other PV application.									

Contact Periods:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS:

1. S.P. Sukhatme., "Solar Energy: Principles of Thermal Collection and Storage", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.

REFERENCE BOOKS:

- 1. G.D. Rai., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 1999
- 2. G.N. Tiwari., "solar Energy Fundamentals Design, Modelling and applications", Narosa Publishing House, New Delhi, 2002.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Describe the characteristics of Solar thermal and Solar Photovoltaic Systems. **CO2:** Explain various solar thermal and Photo voltaic applications.

PO/PSO	PO	PSO	PSO	PSO											
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	L					Н					Μ	Μ		
CO2	L	L					Н					Μ	Μ		
18PVA\$14	L	L					Н					М	Μ		

COURSE ARTICULATION MATRIX

Category: VA

L T P C 1 0 0 1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To develop adequate knowledge about wind energy conversion systems.

UNIT- I	WIND ENERGY PRINCIPLES	(5 Periods)						
Principles of wind Energy Conversion- Nature of wind - Power in the wind - Forces on the wind -								
wind energy conversion - wind data and wind energy estimation - Site Selection Considerations.								
UNIT- II	WIND ENERGY CONVERSION SYSTEM	(5 Periods)						
Wind Energy Conversion system- Basic components of WECS - Classification - Advantages and								
Disadvantages of	of WECS- Types of wind energy collectors - horizontal axis machin	nes – design						
considerations -	vertical axis machines – performance of wind machines.							
UNIT- III	WIND ENERGY APPLICATIONS	(5 Periods)						
Applications of WECS - Pumping - wind assisted gas turbine generators - direct heat applications								
- Electricity generation -Interconnected System-Environmental Aspects.								

Contact Periods:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS:

1. G.D. Rai., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 1999.

REFERENCE BOOKS:

- 1. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future"., Oxford University Press, U.K., 1996
- 2. L.L. Freris., Wind Energy Conversion systems", Prentice Hall, UK, 1990

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Describe the various types of Wind Energy Conversion System (WECS) and its components.
- **CO2:** Select suitable site for erecting Wind Energy Conversion System considering environmental aspects.
- **CO3:** Explain various applications of wind energy conversion system.

COURSE ARTICULATION MATRIX

PO/PSO	PO	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01	М												М		
CO2	L	Η	М	М		М	Н								Н
CO3	М						М								М
18PVA\$15	М	Η	Μ	М		М	М						М		М

Category: VA

LTPC 0 0 1

PSO

3

2

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

To develop adequate knowledge about refrigeration systems. *

UNIT- I	REFRIGERATION CYCLES AND REFRIGERANTS	(8 Periods)							
Air refrigeration cycles - reversed Carnot cycle, Bell Coleman cycle, simple vapour compression									
refrigeration cycle, compound compression refrigeration cycles, and cascade refrigeration cycles.									
UNIT- II	VAPOUR ABSORPTION AND OTHER SYSTEMS	(7 Periods)							
Ammonia – wat	er system, Lithium Bromide – water system - Electrolux refrigeration s	ystem, Steam							
jet refrigeration and solar refrigeration systems. Refrigerants - properties and classification- eco									
friendly refriger	ants.								

Contact Periods:

Tutorial: 0 Periods Lecture: 15 Periods Practical: 0 Periods Total: 15 Periods

TEXT BOOKS:

1. Arora C.P., "Refrigeration and Air Conditioning", Tata McGraw Hill Publishing Company Limited, 3rd Edition, NewDelhi, 2009

REFERENCE BOOKS:

1. Roy J Dossat., "Principle of Refrigeration", Wiley Eastern Limited, Fifth Edition 2001.

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Describe various refrigeration cycles.
- CO2: Explain various refrigeration systems operated using heat energy.

PO/PSO PO PSO **PSO** 1 2 3 4 5 6 7 8 9 10 11 12 1 CO **CO1** Μ L L Μ **CO2** L L Μ 18PVA\$16 Μ L L Μ

COURSE ARTICULATION MATRIX

L T P C 1 0 0 1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

* To develop adequate knowledge about air conditioning systems.

UNIT- I	AIR DISTRIBUTION SYSTEMS	(7 Periods)							
Air distribution systems – study of different types of duct systems, duct insulation, air purity – air									
cleaning methods.									
UNIT- II	CONDITIONING AND COOLING LOAD	(8 Periods)							
Psychrometry, psychrometer, psychometric processes, moist air behaviour, effective temperatures,									
sensible heat factor ratio and cooling load estimation for an air conditioned space.									

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Contact Periods:

Lecture: 15 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 15 Periods TEXT BOOKS:

1. Arora C.P., **"Refrigeration and Air Conditioning"**, Tata McGraw Hill Publishing Company Limited, 3rd Edition, NewDelhi, 2009

REFERENCE BOOKS:

1. Manohar Prasad., "Refrigeration and Air Conditioning", Wiley Eastern Limited, 2004

COURSE OUTCOMES:

On completion of this course, students will be able to

- **CO1:** Explain the air distribution systems and components.
- **CO2:** Estimate cooling load for air conditioning

COURSE ARTICULATION MATRIX

PO/PSO	PO	РО	PO	PO	РО	PSO	PSO	PSO							
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М											L	М		
CO2	L		L			L									
18PVA\$17	М		L			L						L	М		