SETHU INSTITUTE OF TECHNOLOGY
(An Autonomous Institution)

Pulloor, Kariapatti, Virudhunagar (Dist.) -Pin: 626 115.

Department of Mechanical Engineering

(Accredited by NBA, New Delhi and NAAC with 'A' Grade)

(Approved Research Centre by Anna University, Chennai)

REGULATION 2015

Choice Based Credit System

CURRICULUM AND SYLLABUS

(Ist Semester To VIIIth Semester)

After Academic Council Meeting

Department Vision statement

- To promote excellence in education and research in mechanical engineering for the benefits of industry and society.

Department Mission Statement

1. To provide quality technical educational experience to enable the graduates to become leaders in their chosen profession.
2. To educate through modern teaching tools and experiential learning to produce proficient engineer.
3. To develop skills in recent technological trends and design software and to facilitate various co-curricular activities to enhance employability and entrepreneurship.
4. To establish collaboration with industries for transfer of technical knowledge.
5. To promote research activities among faculty members and students.
6. To offer beneficial services to the society.

Program Educational Objectives (PEOs)

After few years of graduation our Mechanical Engineering graduates are expected to:	
PEO I (Core Competency)	Develop technical competency to become professionals with expertise in core areas of mechanical engineering.
PEO II (Life Long Learning)	Practice Life Long Learning to solve real time problems and for career development.
PEO III (Professional and Ethical Skills)	Develop professional skills to meet the global standards with ethical and social responsibility.

PROGRAM OUTCOMES (POs):	
1.	Apply knowledge of mathematics, science, basic engineering, manufacturing, design, thermal and industrial engineering to the solution of complex engineering problems. **[Engineering knowledge]**
2.	Identify, formulate, research through relevant literature review, and analyze complex mechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and mechanical engineering. **[Problem analysis]**
3.	Design solutions for complex mechanical engineering problem and design system components that meet the specified needs with appropriate considerations for public health and safety, cultural, societal, and environmental constraints. **[Design/ development of solutions]**
4.	Conduct investigations of complex mechanical problems in design and analysis of machine elements, mechanisms, thermal systems and to manufacture components and systems using research based knowledge and methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. **[Conduct investigations of complex problems]**
5.	Select and apply the latest CAD/CAM/CAE software and sophisticated equipment for modeling and analyzing to predict and solve mechanical engineering problems. **[Modern tool usage]**
6.	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, cultural issues and consequent responsibilities relevant to professional engineering practice. **[The Engineer and Society]**
7.	Understand the impact of solutions for mechanical engineering problems in the context of society and environments, and demonstrate the knowledge of and need for sustainable development. **[Environment and Sustainability]**
8.	Apply ethical principles, and commit to professional ethics and responsibilities and norms of the engineering practice. **[Ethics]**
9.	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. **[Individual and team work]**
10.	Communicate effectively on mechanical 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 presentation, and give and receive clear instructions. **[Communication]**
11.	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. **[Project management and finance]**
12.	Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. **[Lifelong learning]**
PROGRAM SPECIFIC OUTCOMES (PSOs):	
The Mechanical Engineering Graduates will be able to:	
1.	Apply the concepts of design and manufacturing to solve industrial problems.
2.	Apply the knowledge of Mechanical engineering to design solutions, systems and components to meet the needs of Automobile Industry.

Estd.1995

SETHU INSTITUTE OF TECHNOLOGY

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An ISO 9001:2008 Certified Institution

Pulloor, Kariapatti, Virudhunagar (Dist.) -Pin: 626 115.

B.E. MECHANICAL ENGINEERING

REGULATION 2015

Choice Based Credit System

CURRICULUM & SYLLABUS

(1st Semester to 8th Semester)

CHAIRPERSON

Chairperson
Board of Studies
Mechanical Engineering
Sethu Institute of Technology
Kariapatti - 626 115

CHAIRMAN
ACADEMIC COUNCIL

CHAIRMAN
ACADEMIC COUNCIL
Sethu Institute of Technology
Pulloor, Kariapatti - 626 115

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Pulloor, Kariapatti

Department of Mechanical Engineering

CBCS 2015

Sl.No	Category	Credits	% of Credit Distribution
1.	Humanities and social science	14	8.24
2.	Basic Sciences	28	16.47
3.	Engineering Science	30	17.64
4.	Professional Core	56	32.94
5.	Project	15	8.82
6.	Professional Electives	18	10.59
7.	Open Electives	9	5.29
Total		**170**	**100**

Semester – I

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	HS	15UEN101	Technical English (Common to All Branches)	2	0	0	2
2.	BS	15UMA102	Engineering Mathematics - I (Common to All Branches)	3	2	0	4
3.	BS	15UPH103	Engineering Physics (Common to All Branches)	3	0	0	3
4.	BS	15UCY104	Engineering chemistry (common to Mech& Chemical, Fashion Technology)	3	0	0	3
5.	ES	15UCS107	Computer Programming (Common to All Branches)	3	0	0	3
6.	ES	15UME108	Engineering Graphics (Common to All Branches)	3	2	0	4
7.	ES	15UCS109	Computer Programming Laboratory - I (Common to All Branches)	0	0	2	1
8.	ES	15UME110	Engineering Practices Laboratory (Common to Mech, EEE, Civil, Chemical Agricultural and Bio Medical)	0	0	2	1
9.	BS	15UGS112	Basic Sciences Laboratory - I	0	0	2	1
Total Credits :22				**17**	**4**	**6**	**22**

Semester – II

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	HS	15UEN201	Business English and Presentation skills (Common to All Branches)	3	0	0	3
2.	BS	15UMA202	Engineering Mathematics - II (Common to All Branches)	3	2	0	4
3.	BS	15UPH203	Material Science (Common to Mech& Chemical)	3	0	0	3
4.	HS	15UCY207	Environmental Science (Common to All Branches)	3	0	0	3
5.	ES	15UME208	Basic civil and Mechanical Engineering (Common to Mech,EEE,EIE)	3	0	0	3
6.	ES	15UEE208	Basic Electrical and Electronics Engineering (Common to Mech, Civil. Chemical, Agriculture)	3	0	0	3
7.	BS	15UGS210	Basic Sciences Laboratory - II (Common to All Branches)	0	0	2	1
8.	ES	15UME211	Computer Aided Drafting and Modeling Laboratory	0	0	2	1
Total Credits :21				**18**	**2**	**4**	**21**

Semester – III

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	BS	15UMA321	Transform and Partial Differential Equations. (Common to MECH, ECE, EEE, CIVIL, EIE and CHEMICAL, Agriculture, Bio medical)	3	2	0	4
2.	PC	15UME302	Manufacturing Technology-I	3	0	0	3
3.	ES	15UME303	Engineering Thermodynamics	3	0	0	3
4.	ES	15UME304	Fluid Mechanics and Machinery	3	0	0	3
5.	ES	15UME305	Engineering Mechanics	3	0	0	3
6.	ES	15UEE323	Electrical Machines	3	0	2	4
7.	PC	15UME307	Manufacturing Technology Laboratory -I	0	0	2	1
8.	ES	15UME308	Fluid Mechanics and Machinery Laboratory	0	0	2	1
Total Credits : 22				**18**	**2**	**6**	**22**

Semester – IV

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	BS	15UMA423	Statics and Numerical Methods	3	2	0	4
2.	PC	15UME402	Kinematics of Machinery	3	0	0	3
3.	PC	15UME403	Manufacturing Technology II	3	0	0	3
4.	PC	15UME404	Thermal Engineering	3	0	0	3
5.	PC	15UME405	Strength of Materials	3	0	0	3
6.	PC	15UME406	Machine Drawing	2	2	0	3
7.	HS	15UGS431	Reasoning and Quantitative Aptitude (Common to All Branches)	1	0	0	1
8.	PC	15UME407	I.C Engine and Steam Laboratory	0	0	2	1
9.	PC	15UME408	Manufacturing laboratory - II	0	0	2	1
10.	PC	15UME409	Material Testing Laboratory	0	0	2	1
Total Credits : 23				**18**	**4**	**6**	**23**

Semester – V

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	PC	15UME501	Dynamics of Machinery	3	0	0	3
2.	PC	15UME502	Engineering Materials and Metallurgy	3	0	0	3
3.	PC	15UME503	Design of Machine Elements	3	0	0	3
4.	PC	15UME504	Operations Research	3	0	0	3
5.	PE	E 1	Professional Elective - I	3	0	0	3
6.	PE	E 2	Professional Elective - II	3	0	0	3
7.	PC	15UME507	CAD/CAM Laboratory	0	0	2	1
8.	PC	15UME508	Dynamics Laboratory	0	0	2	1
9.	PC	15UME509	Metallurgy Laboratory	0	0	2	1
Total Credits : 21				**18**	**0**	**6**	**21**

Semester – VI

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	PC	15UME601	Design of Transmission Systems	3	0	0	3
2.	PC	15UME602	Engineering Metrology and Measurements	3	0	0	3
3.	PC	15UME603	Heat and Mass Transfer	3	0	0	3
4.	PE	E 3	Professional Elective - III	3	0	0	3
5.	PE	E 4	Professional Elective - IV	3	0	0	3
6.	OE	OE 1	Open Elective - I	3	0	0	3
7.	BS	15UGS531	Soft skills and communication Laboratory (Common to MECH, EIE, Civil, Chemical)	0	0	2	1
8.	P	15UME607	Technical Project	0	0	6	3
9.	PC	15UME608	Metrology and Measurements Laboratory	0	0	2	1
10.	PC	15UME609	Heat and Mass Transfer Laboratory	0	0	2	1
Total Credits : 24				**18**	**0**	**12**	**24**

Semester – VII

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	HS	15UME701	Project Management and Finance (Common to Mech, CSE, ECE, EEE, IT, EIE)	3	0	0	3
2.	PC	15UME702	Finite Element Analysis	3	0	0	3
3.	PC	15UME703	Mechatronics	3	0	0	3
4.	PE	E 5	Professional Elective - V	3	0	0	3
5.	OE	OE 2	Open Elective II	3	0	0	3
6.	PC	15UME706	Computer Aided Analysis Laboratory	0	0	2	1
7.	PC	15UME707	Mechatronics Laboratory	0	0	2	1
Total Credits : 17				**15**	**0**	**4**	**17**

Semester – VIII

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	HS	15UME801	Professional Ethics (Common to all branches)	2	0	0	2
2.	PE	E 6	Professional Elective - VI	3	0	0	3
3.	PE	OE 3	Open Elective - III	3	0	0	3
4.	P	15UME804	Project Work	0	0	24	12
Total Credits : 20				**8**	**0**	**24**	**20**

PROFESSIONAL ELECTIVE:

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	PE	15UME901	Industrial and Quality Management	3	0	0	3
2.	PE	15UME902	Gas Dynamics and Jet Propulsion	3	0	0	3
3.	PE	15UME903	Automobile Engineering	3	0	0	3
4.	PE	15UME904	Applied Hydraulics and pneumatics	3	0	0	3
5.	PE	15UME905	Design of Jigs, Fixtures & Press Tools	3	0	0	3
6.	PE	15UME906	Computational Fluid Dynamics	3	0	0	3
7.	PE	15UME907	Quality Control and Reliability Engineering	3	0	0	3
8.	PE	15UME908	Renewable Sources of Energy	3	0	0	3
9.	PE	15UME909	Industrial Tribology	3	0	0	3
10.	PE	15UME910	Power Plant Technology	3	0	0	3
11.	PE	15UME911	Unconventional Machining Processes	3	0	0	3
12.	PE	15UME912	Composite Materials	3	0	0	3
13.	PE	15UME913	Process Planning and Cost Estimation	3	0	0	3
14.	PE	15UME914	Nano Science and Technology	3	0	0	3
15.	PE	15UME915	Vibration and Noise Control	3	0	0	3
16.	PE	15UME916	Refrigeration and Air conditioning	3	0	0	3
17.	PE	15UME917	Nuclear Engineering	3	0	0	3
18.	PE	15UME918	Entrepreneurship Development	3	0	0	3
19.	PE	15UME919	Maintenance Engineering	3	0	0	3
20.	PE	15UME920	Production Planning and Control	3	0	0	3
21.	PE	15UME921	Design of Heat Exchangers	3	0	0	3
22.	PE	15UME922	Advanced I.C. Engines	3	0	0	3
23.	PE	15UME923	Failure Analysis and Design	3	0	0	3
24.	PE	15UME924	Computer Integrated Manufacturing	3	0	0	3
25.	PE	15UME925	Cryogenics	3	0	0	3
26.	PE	15UME926	Industrial Robotics	3	0	0	3
27.	PE	15UME927	Introduction to aircraft industry and aircraft systems	3	0	0	3
28.	PE	15UME928	Design of aircraft structures	3	0	0	3

OPEN ELECTIVE (Mechanical Department offering course):

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	OE	15UME971	Industrial Psychology and Work Ethics	3	0	0	3
2.	OE	15UME972	Industrial Safety and Engineering	3	0	0	3
3.	OE	15UME973	Synthesis of Nano Materials	3	0	0	3
4.	OE	15UME974	Principles of Management	3	0	0	3
5.	OE	15UME975	Total Quality Management	3	0	0	3

INTER/ MULTI DISCIPLINARY ELECTIVE COURSES:

Sl.No	Course Code	Course Name	L	T	P	C
1.	15UGM951	Smart Manufacturing (Common to Mech& IT)	3	0	0	3
2.	15UGM952	Automation in Agriculture Engineering (Common to Mech, Agri, IT)	3	0	0	3
3.	15UMG953	Electric Vehicles (Common to EEE &Mech)	3	0	0	3
4.	15UMG954	Bio Fluid Mechanics (Common to Biomedical &Mech)	3	0	0	3

ONE CREDIT COURSE:

Sl.No	Course Code	Course Name	L	T	P	C
1.	15UME861	Smart Materials	1	0	0	1
2.	15UME862	CNC programming	1	0	0	1
3.	15UME863	Solar energy	1	0	0	1
4.	15UME864	Basics in Refrigeration and Air-conditioning	1	0	0	1
5.	15UME865	Jigs and Fixtures	1	0	0	1
6.	15UME866	Work Study	1	0	0	1

HUMANITIES AND SOCIAL SCIENCE (HS)

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	HS	15UEN101	Technical English (Common to All Branches)	2	0	0	2
2.	HS	15UEN201	Business English and Presentation skills (Common to All Branches)	3	0	0	3
3.	HS	15UCY207	Environmental Science (Common to All Branches)	3	0	0	3
4.	HS	15UGS431	Reasoning and Quantitative Aptitude (Common to All Branches)	1	0	0	1
5.	HS	15UME701	Project Management and Finance (Common to Mech, CSE, ECE, EEE, IT, EIE)	3	0	0	3
6.	HS	15UME801	Professional Ethics (Common to all branches)	2	0	0	2

BASIC SCIENCES (BS)

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	BS	15UMA102	Engineering Mathematics – I (Common to All Branches)	3	2	0	4
2.	BS	15UPH103	Engineering Physics (Common to All Branches)	3	0	0	3
3.	BS	15UCY104	Engineering chemistry (common to Mech, Chemical and Fashion Technology)	3	0	0	3
4.	BS	15UGS112	Basic Sciences Laboratory – I	0	0	2	1
5.	BS	15UMA202	Engineering Mathematics – II (Common to All Branches)	3	2	0	4
6.	BS	15UPH203	Material Science (Common to Mech&Chemical)	3	0	0	3
7.	BS	15UGS210	Basic Sciences Laboratory – II	0	0	2	1
8.	BS	15UMA321	Transform and Partial Differential Equations. (Common to Mech, ECE, EEE, Civil,Chemical, Agriculture and Bio medical)	3	2	0	4
9.	BS	15UMA423	Statics and Numerical Methods	3	2	0	4
10.	BS	15UGS531	Soft skills and communication Laboratory (Common to MECH, EIE, Civil, Chemical)	0	0	2	1

ENGINEERING SCIENCE (ES)

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1	ES	15UCS107	Computer Programming (Common to All Branches)	3	0	0	3
2	ES	15UME108	Engineering Graphics (Common to All Branches)	3	2	0	4
3	ES	15UCS109	Computer Programming Laboratory - I (Common to All Branches)	0	0	2	1
4	ES	15UME110	Engineering Practices Laboratory (Common to Mech, EEE, Civil, Chemical, Agricultural and Bio Medical)	0	0	2	1
5	ES	15UME208	Basic civil and Mechanical Engineering (Common to Mech,EEE,EIE)	3	0	0	3
6	ES	15UEE208	Basic Electrical and Electronics Engineering (Common to Mech, Civil, Chemical, Agriculture)	3	0	0	3
7	ES	15UME211	Computer Aided Drafting and Modeling Laboratory	0	0	2	1
8	ES	15UME303	Engineering Thermodynamics	3	0	0	3
9	ES	15UME304	Fluid Mechanics and Machinery	3	0	0	3
10	ES	15UME305	Engineering Mechanics	3	0	0	3
11	ES	15UEE323	Electrical Machines	3	0	2	4
12	ES	15UME308	Fluid Mechanics and Machinery Laboratory	0	0	2	1

PROFESSIONAL CORE (PC)

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	PC	15UME302	Manufacturing Technology-I	3	0	0	3
2.	PC	15UME307	Manufacturing Technology Laboratory -I	0	0	2	1
3.	PC	15UME402	Kinematics of Machinery	3	0	0	3
4.	PC	15UME403	Manufacturing Technology II	3	0	0	3
5.	PC	15UME404	Thermal Engineering	3	0	0	3
6.	PC	15UME405	Strength of Materials	3	0	0	3
7.	PC	15UME406	Machine Drawing	2	1	0	3
8.	PC	15UME407	I.C Engine and Steam Laboratory	0	0	2	1
9.	PC	15UME408	Manufacturing laboratory - II	0	0	2	1
10.	PC	15UME409	Material Testing Laboratory	0	0	2	1
11.	PC	15UME501	Dynamics of Machinery	3	0	0	3
12.	PC	15UME502	Engineering Materials and Metallurgy	3	0	0	3
13.	PC	15UME503	Design of Machine Elements	3	0	0	3
14.	PC	15UME504	Operations Research	3	0	0	3
15.	PC	15UME507	CAD/CAM Laboratory	0	0	2	1
16.	PC	15UME508	Dynamics Laboratory	0	0	2	1
17.	PC	15UME509	Metallurgy Laboratory	0	0	2	1
18.	PC	15UME601	Design of Transmission Systems	3	0	0	3
19.	PC	15UME602	Engineering Metrology and Measurements	3	0	0	3
20.	PC	15UME603	Heat and Mass Transfer	3	0	0	3
21.	PC	15UME608	Metrology and Measurements Laboratory	0	0	2	1

22.	PC	15UME609	Heat and Mass Transfer Laboratory	0	0	2	1
23.	PC	15UME702	Finite Element Analysis	3	0	0	3
24.	PC	15UME703	Mechatronics	3	0	0	3
25.	PC	15UME706	Computer Aided Analysis Laboratory	0	0	2	1
26.	PC	15UME707	Mechatronics Laboratory	0	0	2	1

PROJECT (P)

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	P	15UME607	Technical Project	0	0	6	3
2.	P	15UME804	Project Work	0	0	24	12

PROFESSIONAL ELECTIVE

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	PE	15UME901	Industrial and Quality Management	3	0	0	3
2.	PE	15UME902	Gas Dynamics and Jet Propulsion	3	0	0	3
3.	PE	15UME903	Automobile Engineering	3	0	0	3
4.	PE	15UME904	Applied Hydraulics and pneumatics	3	0	0	3
5.	PE	15UME905	Design of Jigs, Fixtures & Press Tools	3	0	0	3
6.	PE	15UME906	Computational Fluid Dynamics	3	0	0	3
7.	PE	15UME907	Quality Control and Reliability Engineering	3	0	0	3
8.	PE	15UME908	Renewable Sources of Energy	3	0	0	3
9.	PE	15UME909	Industrial Tribology	3	0	0	3
10.	PE	15UME910	Power Plant Technology	3	0	0	3
11.	PE	15UME911	Unconventional Machining Processes	3	0	0	3
12.	PE	15UME912	Composite Materials	3	0	0	3
13.	PE	15UME913	Process Planning and Cost Estimation	3	0	0	3
14.	PE	15UME914	Nano Science and Technology	3	0	0	3
15.	PE	15UME915	Vibration and Noise Control	3	0	0	3
16.	PE	15UME916	Refrigeration and Air conditioning	3	0	0	3
17.	PE	15UME917	Nuclear Engineering	3	0	0	3
18.	PE	15UME918	Entrepreneurship Development	3	0	0	3
19.	PE	15UME919	Maintenance Engineering	3	0	0	3
20.	PE	15UME920	Production Planning and Control	3	0	0	3
21.	PE	15UME921	Design of Heat Exchangers	3	0	0	3
22.	PE	15UME922	Advanced I.C. Engines	3	0	0	3
23.	PE	15UME923	Failure Analysis and Design	3	0	0	3
24.	PE	15UME924	Computer Integrated Manufacturing	3	0	0	3
25.	PE	15UME925	Cryogenics	3	0	0	3
26.	PE	15UME926	Industrial Robotics	3	0	0	3
27.	PE	15UME927	Introduction to aircraft industry and aircraft systems	3	0	0	3
28.	PE	15UME928	Design of aircraft structures	3	0	0	3

Sl.No	SUBJECT AREA	SUMMARY OF CREDIT								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HS	2	6	-	1	-	-	3	2	14
2	BS	11	8	4	4	-	1	-	-	28
3	ES	9	7	14	-	-	-	-	-	30
4	PC	-	-	4	18	15	11	8	-	56
5	PE	-	-	-	-	6	6	3	3	18
6	OE	-	-	-	-	-	3	3	3	9
7	P	-	-	-	-	-	3	-	12	15
Total		22	21	22	23	21	24	17	20	170

HS	Humanities and Social Science	PE	Professional Electives
BS	Basic Sciences	OE	Open Electives
ES	Engineering Sciences	P	Project
PC	Professional Cores		

SEMESTER I

Semester – I

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	HS	15UEN101	Technical English (Common to All Branches)	2	0	0	2
2.	BS	15UMA102	Engineering Mathematics – I (Common to All Branches)	3	2	0	4
3.	BS	15UPH103	Engineering Physics (Common to All Branches)	3	0	0	3
4.	BS	15UCY104	Engineering chemistry (common to Mech & Chemical, Fashion Technology)	3	0	0	3
5.	ES	15UCS107	Computer Programming (Common to All Branches)	3	0	0	3
6.	ES	15UME108	Engineering Graphics (Common to All Branches)	3	2	0	4
7.	ES	15UCS109	Computer Programming Laboratory - I (Common to All Branches)	0	0	2	1
8.	ES	15UME110	Engineering Practices Laboratory (Common to Mech, EEE, Civil, Chemical Agricultural and Bio Medical)	0	0	2	1
9.	BS	15UGS112	Basic Sciences Laboratory – I	0	0	2	1
Total Credits :22				**17**	**4**	**6**	**22**

15UEN101	TECHNICAL ENGLISH (Common to ALL Branches)	L 2	T 0	P 0	C 2

OBJECTIVES:

- To enhance the vocabulary of students
- To strengthen the application of functional grammar and basic skills
- To improve the language proficiency of students

UNIT I **6**

Grammar - Parts of Speech-Tense – **Vocabulary** – Technical Word Formation- Prefix- suffix - Synonyms and Antonyms- **Writing** – Instructions – Formal Letters - **Reading** Comprehension - Prose: A Nation's Strength – Dr. Karan Singh

UNIT II **6**

Grammar – Concord -'Wh' Questions – **Vocabulary** – One Word Substitutes – Listening & Speaking – Conducting Meetings – **Writing** - Preparation of the Checklist, Essay writing – **Reading** -Prose: My Vision of India-Dr.A.P.J.AbdulKalam

UNIT III **6**

Grammar – Voice – **Vocabulary** – Compound Nouns **Writing** – Minutes – Agenda - Transformation of Information (Transcoding)-**Reading Prose**: Professions of Women-Virginia Woolf.

UNIT IV **6**

Grammar - Conditional clauses - **Vocabulary** - Idioms & Phrases - **Writing** Letters to Editor - Making Invitations - Acceptance & Declining - Summarizing – **Reading** - Prose: Computers-Peter Laurie.

UNIT V **6**

Grammar – Determiners – **Vocabulary** – Homophones & Homonyms – **Writing** Recommendations- Note Making - Report Writing- **Reading** – Prose: What We Must Learn From the West-Narayana Murthy

TOTAL : 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Use grammar effectively in writing meaningful sentences and paragraphs. (Remember)
2. Exhibit improved reading comprehension and vocabulary. (Understand)
3. Demonstrate writing skills in various formal situations. (Apply)
4. Demonstrate improved oral fluency. (Understand)
5. Presenting reports on various purposes. (Creating)

TEXT BOOKS:

1. Meenakshi Raman, SangeethaSharma,"Technical Communication English for Engineers", Oxford University Press Chennai, 2008.

REFERENCE BOOKS:

1. Faculty members of English, SIT, Technical English, 2015.
2. AsrafRizvi.M, Effective Technical Communication, New Delhi, Tata McGraw-Hill Publishing Company Limited, 2007.
3. Lakshminarayanan. K.R,English for Technical Communication, Chennai, Scitech Publications (India) Pvt. Ltd, 2004.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1									2	3				
CO.2									2	3				
CO.3									2	3				
CO.4									2	3				
CO.5									2	3				

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UEN101									2	3				

Ref: 3 - Strong 2 - Medium 1 - Weak

15UMA102	ENGINEERING MATHEMATICS – I (Common to ALL Branches)	L 3	T 2	P 0	C 4

OBJECTIVES:

- To make the students capable of identifying algebraic eigenvalue problems from practical areas and obtain the eigen solutions in certain cases.
- To make the students knowledgeable in integrating various types of functions using various integration methods.
- To familiarize the students with the basic rules of differentiation and use them to find derivatives of products and quotients that they might encounter in their studies of other subjects in the same or higher semesters.

UNIT I DIFFERENTIAL CALCULUS 9+6

Introduction – Definition of derivatives – Limits and Continuity – Differentiation techniques (Product rule, Quotient rule, Chain rule) – Successive differentiation (nth derivatives) – Leibnitz theorem (without proof) – Maclaurin's series – Physical Applications (Newton's law of cooling – Heat flow problems, Rate of decay of radioactive materials - Chemical reactions and solutions, Ohm's law, Kirchoff's law – Simple electric circuit problems)

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9+6

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobian – Taylor's expansion – Maxima and Minima – Method of Lagrangian Multipliers.

UNIT III INTEGRAL CALCULUS 8 + 6

Definitions and concepts of integrals – Methods of integration (Decomposition method, Substitution method, Integration by parts) – Definite integrals – Properties and problems – Reduction formulae – Beta and Gamma functions – Integration using Beta and Gamma functions.

UNIT IV MULTIPLE INTEGRALS 8 + 6

Double integration – Cartesian and Polar coordinates – Change of order of integration – Change of variables between Cartesian and Polar coordinates – Triple integration in Cartesian coordinates – Area as double integral – Volume as triple integral.

UNIT V MATRICES 8 + 6

Eigenvalue and eigenvector of a real matrix – Characteristic equation – Properties – Cayley-Hamilton theorem (excluding Proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation–Applications of Matrices.

SUPPLEMENT TOPIC(for internal evaluation only) 3

Evocation / Application of Mathematics, Quick Mathematics – Speed Multiplication and Division.

TOTAL : 45 (L) + 30 (T) = 75 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Find the derivative of the given function using the suitable rule. Find its successive differentiation. (Understand)
2. Predict the extreme values of functions with constraints and fine the absolute maximum and minimum of a given function on different domains. (Evaluate)
3. Apply the various methods of integration for evaluating definite integrals. (Apply)
4. Demonstrate the use of double and triple integrals to compute area and volume. (Apply)
5. Find inverse and positive power of given matrix using Cayley Hamilton Theorem, Reduce to canonical form by orthogonal transformation. (Apply)

TEXT BOOKS:

1. BALI N. P and MANISH GOYAL, "A Text book of Engineering Mathematics", Laxmi Publications (P) Ltd, New Delhi, 8thEdition, (2011).
2. GREWAL. B.S, "Higher Engineering Mathematics", Khanna Publications, New Delhi, 42ndEdition, (2012).
3. KREYSZIG. E, "Advanced Engineering Mathematics", John Wiley & Sons, New York, 10th Edition, (2011).

REFERENCE BOOKS:

1. RAMANA B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. GLYN JAMES, "Advanced Engineering Mathematics", Pearson Education, New Delhi, 7th Edition, (2007).
3. JAIN R.K and IYENGAR S.R.K," Advanced Engineering Mathematics", Narosa Publishing House, New Delhi, 3rd Edition, (2007).
4. BHARATI KRISHNA TIRTHAJI, "Vedic Mathematics - Mental Calculation",Motilal Banarsidass Publications, New Delhi, 1st Edition, (1965).

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3												
CO.2	3	3												
CO.3	3	3												
CO.4	3	3												
CO.5	3	3												

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UMA102	3	3												

Ref: 3 - Strong 2 - Medium 1 - Weak

15UPH103	ENGINEERING PHYSICS (Common To All Branches)	L 3	T 0	P 0	C 3

OBJECTIVES:

- To develop knowledge on principles of crystal Physics.
- To make students to understand classification of sound and applications of Ultrasonics
- To use the principles of Lasers and its types.
- To apply principles of Quantum physics in engineering field.
- To develop the research interest in Thermal physics.

UNIT I CRYSTAL PHYSICS 9

Introduction - Crystalline – Amorphous materials – single and poly crystal- Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – parameters of Unit cell – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – crystal growth technique.

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound – decibel- weber- Fechner law – Units of Loudness- decibel- phon-sone- Reverberation – Absorption Coefficient –Introduction to ultrasonics- magnetostriction effect – piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves - properties – Cavitations -Velocity measurement – acoustic grating - Industrial applications – Thermal insulation in building - SONAR.

UNIT III WAVE OPTICS AND LASERS 9

Introduction – interference – refractive index –Expression for plane, circularly and elliptically polarized light LASER: Introduction- Principles of Laser- Einstein theory of stimulated emission- Population inversion Methods - Types of lasers – Co_2 laser - semiconductor laser – homojunction – heterojunction - Applications.

UNIT IV QUANTUM PHYSICS 9

Introduction – free electron theory - Quantum Physics- de Broglie wavelength – Schrödinger's wave equation – Time dependent – Time independent equation – Physical significance of wave function - Compton Effect – Theory and experimental verification.

UNIT V PROPERTIES OF SOLIDS AND THERMAL PHYSICS 9

Elasticity- Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending - Thermal conductivity- Newton's law of cooling – Lee's disc method - Concept of Entropy.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze the basic concepts of crystalline materials and the various crystal Structure like FCC, BCC, HCP, etc. (Analyze)
2. Apply the ultrasonic concepts in different industries for the development of different instruments which has practical applications in submarine to aerospace applications. (Understand)
3. Demonstrate, understanding of and be able to solve problems on operations and basic properties of the laser types like CO2 laser, diode laser etc., (Apply)
4. Apply the quantum mechanical model to explain the behaviour of a system at microscopic level. (Understand)
5. Explain the behaviour of bending beams and calculate the expression for young's modulus. (Apply)

TEXT BOOKS:

1. Dr. Mani.P, “A Text Book of Engineering Physics”, Dhanam Publications, Edition,2014, Chennai.
2. Rajendran.V, “Engineering,Physics”, Tata Mc-Graw Hill Publishing Company limited, New Delhi, Revised Edition 2013.
3. Palanisami P.K., “Physics For Engineers”, Scitech Publications (India), Pvt Ltd., Chennai, 2014.

REFERENCE BOOKS:

1. Raghuvenshi G.S., “Engineering Physics”, PHI Learning Private Limited, New Delhi, Revised Edition 2014.
2. Arul doss .G. “Engineering Physics”, PHI Learning Limited, New Delhi, Revised Edition 2013.
3. Marikani .A. “Engineering Physics”, PHI Learning Private Limited, New Delhi, Revised Edition 2012.
4. Sankar B.N., and Pillai .S.O., “A Text book of Engineering Physics”, New Age International Publishers Private Limited, New Delhi, Revised Edition 2013.
5. Avadhanulu M.N. and Kshirsagar P.G., “A Textbook: of Engineering Physics”, S.Chand& Company Ltd., New Delhi, 2015.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2												
CO.2	3	2												
CO.3	3	3												
CO.4	3	2												
CO.5	3	3												

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UPH103	3	3												

Ref: 3 - Strong 2 - Medium 1 - Weak

15UCY104	ENGINEERING CHEMISTRY (Common to Mechanical, Chemical Engineering &Fashion Tech)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Introduce about bonding concepts and fundamentals of solution preparation
- Understand the principles and application of corrosion science.
- Acquire knowledge about Thermodynamics and Phase Rule
- Create an awareness among present generation about the various fuel sources
- Acquire knowledge about the applications of alloys and composites

MODULE I CHEMICAL BONDING 9

Chemical Bonding: Electronic Configuration- Ionic Bond - Covalent Bond – Metallic bond -Aufbau principle, Octet Rule, Pauli Exclusion principle, Molecular Orbital theory, Valence bond theory and its limitations, Various types of hybridization(Homo nuclear& Hetero nuclear diatomic molecules) and shapes of molecules based on MO theory bond strength and bond energy, Born-Haber cycle, Fajan's rule-Non Covalent Bonding-Hydrogen bonding, Vander Waals forces.

MODULE II ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry: Introduction -Electrochemical cells- reversible and irreversible cells – EMF – measurement of EMF-Single electrode potential-Nernst equation.

Chemical corrosion: Introduction- Definition- Types--(Dry corrosion, mechanism and its Example)-Electrochemical corrosion(Wet corrosion, mechanism and its Types – Galvanic & Differential aeration Corrosion- Pitting, crevice & Wire fence corrosion). Corrosion prevention - Cathodic protection, Corrosion inhibitors, and Protective coatings – Paint, Electro plating – Gold plating-Risk Analysis Electroless plating – Nickel plating.

MODULE III CHEMICAL THERMODYNAMICS AND PHASE RULE 9

Terminology of thermodynamics - Second law: Entropy --reversible and irreversible processes; Free energy and work function; Gibbs Helmholtz equation; Clausius – Clapeyron equation; Maxwell relations.

Phase rule: Introduction, definition of terms with examples, One Component System- water system -- Reduced phase rule.

MODULE IV FUELS AND COMBUSTION 9

Calorific value – classification – Coal – proximate and ultimate analysis. metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus.

MODULEV ALLOYS AND COMPOSITES 9

Metals – Classification and properties, alloys – importance, ferrous alloys –nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze. Composites-Fundamentals of composites, characteristics, need for composites, Enhancement of properties,ceramicfibers,oxide and nonoxidefibers, Matrix materials –Ceramic materials,Surface treatments.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Describe the fundamental concepts of chemical bonds. (Understand)
2. Explain the principles and application of corrosion science. (Understand)
3. Describe the concepts of Thermodynamics and Phase Rule. (Understand)
4. State the various fuel sources. (Understand)
5. Describe various applications of alloys and composites. (Understand)

TEXT BOOKS:

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, DhanpatRai Publishing Company (P)Ltd., New Delhi, 2010.
2. Dr.Sunita Rattan, “A Textbook of Engineering Chemistry” S.K.Kataria& Sons., New Delhi,2013.

REFERENCE BOOKS:

1. Physical chemistry – Samuel Glasstone, Macmillan II edition, 1969.
2. Physical Chemistry – P. L. Sony, Sulthan Chand & Sons, Delhi - 6.
3. A. K. Kaw, Mechanics of Composite Materials, CRC Press, New Delhi 2005.
4. S. C. Sharma, Composite materials, Narosa Publications, New Delhi, 2000.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2												
CO.2	3													
CO.3	3	2												
CO.4	3													
CO.5	3	2												

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UCY104	3	2												

Ref: 3 - Strong 2 - Medium 1 - Weak

15UCS107	COMPUTER PROGRAMMING	L	T	P	C
	(C o m m o n t o A l l B r a n c h e s)	3	0	0	3

OBJECTIVES:

- To impart the concepts in basic organization of computers and problem solving techniques.
- To familiarize the programming constructs of C.
- To explain the concepts of arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION 8

Generation and Classification of Computers - Basic Organization of a Computer – Problem formulation – Problem Solving - Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS 9

Introduction to ' C' programming – fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations.

UNIT III DECISION MAKING AND LOOPING STATEMENTS 10

if – if-else - nested if-else – else-if ladder statement – switch – goto – for- while – do-while – break – continue statements – Problem solving with decision making and looping statements.

UNIT IV ARRAYS, STRINGS AND FUNCTIONS 9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays - String - String operations – string arrays - Function – definition of function – Declaration of function – Parameter passing methods – Recursion - Storage classes – Problem solving with arrays, strings and functions.

UNIT V POINTERS, STRUCTURES AND UNIONS 9

Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays - Dynamic Memory allocation – Structure - need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Pre-processor directives.

Total : 45Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

1. Illustrate the basics about computer.
2. Develop simple programs using branching and looping constructs.
3. Write C program to manage data using arrays.
4. Develop programs using functions.
5. Write C programs for simple applications.

TEXT BOOKS:

1. Balagurusamy, E, “Programming in AnsiC”, Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. PradipDey, ManasGhosh, “Fundamentals of Computing and Programming in C”, Oxford University Press, First Edition, 2009.
3. Behrouz A. Forouzan, Richard F.Gilberg, “A Structured Programming Approach using C”, Third Edition, Thomson Course Technology, 2007.

REFERENCE BOOKS:

1. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 2011.
2. Kernighan.B.W,Ritchie.D.M, “The C Programming language”, Pearson Education,Second Edition, 2006.
3. Stephen G.Kochan, “Programming in C”, Pearson Education India,Third Edition, 2005.
4. Anita Goel,Ajay Mittal, ” Computer Fundamentals and Programming in C””, Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, 2011.
5. Byron S Gottfried, ” Programming with C ”, Schaum’s Outlines, Tata McGraw-Hill,Second Edition, 2006.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2		1										
CO.2	3	2		1										
CO.3	3	2		1										
CO.4	3	2		1										
CO.5	3	2		1										

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UCS107	3	2		1										

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME108	ENGINEERING GRAPHICS (Common to ALL Branches)	L 3	T 2	P 0	C 4

OBJECTIVES:

- To develop in students graphic skill for communication of concepts, ideas and design.of engineering products and expose them to existing national standards related to technical drawings.
- To impart knowledge in development of surfaces, isometric and perspective projections.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 1

Importance of Graphics in Engineering Applications – Use of Drafting Instruments – BIS Conventions and Specifications – Size, Layout and Folding of Drawing Sheets – Lettering and Dimensioning.

UNIT I PLANE CURVES, PROJECTION OF POINTS, LINES AND PLANESURFACES 9+5

Plane Curves: (Not for Examination)

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.

Projections:

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT II PROJECTION OF SOLIDS 9+6

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to Horizontal plane (HP)only.

UNIT III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 9+6

Sectioning of above solids in simple vertical position by cutting planes inclined to Horizontal plane (HP) and perpendicular to the VP – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids inclined to Horizontal plane(HP) only – Prisms, pyramids, cylinders and cones.

UNIT IV ISOMETRIC AND PERSPECTIVE PROJECTIONS 9+6

Isometric Projections

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones when cutting plane inclined to Horizontal plane (HP) only.

Perspective Projections (Not for Examination)

Perspective projection of prisms, pyramids and cylinders by visual ray method.

UNIT V ORTHOGRAPHIC PROJECTION 9+6

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills of multiple views from pictorial views of objects.

TOTAL 45 (L) + 30 (T) = 75 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of First angle projection to draw the projection of points, straight lines and planes. (Apply)
2. Draw the Projection of different simple solids. (Apply)
3. Draw the section of solids and development of lateral surfaces of solids. (Apply)
4. Apply the knowledge of Isometric projection to draw the objects like truncated solids and frustum. (Apply)
5. Sketch the orthographic views from the given pictorial (isometric) view. (Apply)

TEXT BOOKS:

1. Natarajan K.V., "A Text book of Engineering Graphics", Dhanalakshmi Publishers, (2006).
2. Bhatt N.D., "Engineering Drawing", 46th Edition, Charotar Publishing House, (2003).

REFERENCE BOOKS:

1. Venugopal K., and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, (2008).
2. Gopalakrishnan K.R., "Engineering Drawing" (Vol .I&II), Subhas Publications,(1998).
3. DhananjayA.Jolhe, "Engineering Drawing with an introduction to Auto CAD", Tata McGraw Hill Publishing Company Limited, (2008).

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3		2					2	3	3				
CO.2	3		2					2	3	3				
CO.3	3		2					2	3	3				
CO.4	3		2					2	3	3				
CO.5	3		2					2	3	3				

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME108	3		2					2	3	3				

Ref: 3 - Strong 2 - Medium 1 - Weak

COMPUTER PROGRAMMING LABORATORY – I

15UCS109	L	T	P	C
(Common to ALL Branches)				
	0	**0**	**2**	**1**

OBJECTIVES:

- To make the students to work with Office software.
- To familiarize the implementation of programs in C.

LIST OF EXPERIMENTS

a) Word Processing
Document creation, Formatting, Table Creation, Mail merge.

b) Spread Sheet
Chart - Line, XY, Bar and Pie, Formula - formula editor.

c) C Programming

- Programs using simple statements.
- Programs using decision making statements.
- Programs using looping statements.
- Programs using one dimensional and two dimensional arrays.
- Solving problems using string functions.
- Programs using user defined functions and recursive functions.
- Programs using pointers.
- Programs using structures and unions.

Total: 30Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Create the document in Word Processing software.
- Write programs using control constructs.
- Apply functions to reduce redundancy.
- Design and implement C programs for simple applications.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS - 30 NOS.

SOFTWARE

OS – UNIX CLONE **(License free Linux)**
APPLICATION PACKAGE - OFFICE SUITE
COMPILER – C

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3				2				2					
CO.2	3				2				2					
CO.3	3				2				2					
CO.4	3				2				2					
CO.5	3				2				2					

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UCS109	3				2				2					

Ref: 3 - Strong 2 - Medium 1 - Weak

		L	T	P	C
15UME110	**ENGINEERING PRACTICES LABORATORY (Common to Mech, EEE, Civil, Chemical,Agricultural and Bio medical)**	0	0	2	1

OBJECTIVES :

- To demonstrate the plumbing and carpentry works.
- To train the students to perform welding and drilling operations.
- To demonstrate residential house wiring, fluorescent lamp wiring, measurement of earth resistance, colour coding of resistors, logic gates and soldering.

GROUP A (CIVIL & MECHANICAL)

CIVIL ENGINEERING PRACTICE **6**

LIST OF EXPERIMENTS :

1) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2) Preparation of plumbing line sketches for water supply and sewage works.
3) Hands-on-exercise: Basic pipe connections–Mixed pipe material connection Pipe connections with different joining components.
4) Demonstration of plumbing requirements of high-rise buildings.
5) Study of the joints in roofs, doors, windows and furniture.
6) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

MECHANICAL ENGINEERING PRACTICE **9**

LIST OF EXPERIMENTS :

1) Preparation of arc welding of butt joints, lap joints and tee joints.
2) Drilling Practice
3) Model making – Trays, funnels, etc.
4) Study of Different type of joints.
5) Study of centrifugal pump
6) Study of air Conditioner

A minimum of Five experiments shall be offered in GROUP A (CIVIL & MECHANICAL)

GROUP B (ELECTRICAL & ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICE **7**

LIST OF EXPERIMENTS :

(a) Residential house wiring using switches, fuse, indicator, lamp and energy meter and Stair case wiring.
(b) Fluorescent lamp wiring.
(c) Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICE **8**

LIST OF EXPERIMENTS :

(a) Study of Electronic components and equipments – Resistor, colour coding measurement of AC Signal parameter (peak-peak, rms, period, frequency) using CRO.

(b) Study of logic gates AND, OR, EX-OR and NOT Gate.

(c) Soldering practice – Components, Devices and Circuits – Using general purpose PCB.

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

1. Apply the basic knowledge of plumbing to make simple house hold pipe line connections. (Apply)
2. Fabricate the given components using carpentry, sheet metal & welding equipment/tools. (Understand)
3. Perform the operations like machining, drilling and Tapping. (Apply)
4. Apply basic electrical engineering knowledge for house wiring practice. (Apply)
5. Apply the knowledge of basic electrical engineering to practice soldering using general purpose PCB. (Apply)

Total : 30Periods

EQUIPMENT REQUIREMENT

CIVIL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Assorted components for plumbing consisting of metallic Pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings	5 sets
2.	Carpentry vice (fitted to workbench)	15 Nos
3.	Standard working tools	15 sets
4.	Models of industrial trusses, door joints, furniture joints	5 each
5.	Power tool rotary hammer	2 Nos
6.	Demolition hammer	2 Nos
7.	Planer	2 Nos
8.	Hand drilling machine	2 Nos
9.	Jigsaw	2 Nos

MECHANICAL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Arc welding transformer with cables and holders	5 Nos
2.	Welding booth with exhaust facility	5 Nos
3.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 sets
4.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit	2 Nos
5.	Smithy tools	2 sets
6.	Moulding table, foundry tools	2 sets
7.	Study-purpose items: centrifugal pump, air-conditioner	One Each

ELECTRICAL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Assorted electrical components for house wiring	15 sets
2.	Electrical measuring instruments	10 sets
3.	Megger (250V/500V)	1 No
4.	Study purpose items: Iron box, fan and regulator, emergency lamp	One each
5.	Power Tools: (a) Range Finder (b) Digital Live-wire detector	 2 No 2 No

ELECTRONICS ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Logic trainer kit	2 No
2.	CRO,AFO	2 Each
3.	Small multipurpose PCBs	10 No
4.	Soldering guns	10 No
5.	Multimeters	5 No
6.	Assorted electronic components for making circuits	Required quantity

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3							3	3	2				
CO.2	3							3	3					
CO.3	3							3	3	3				
CO.4	3							3	3	3				
CO.5	3							3	3	3				

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME110	3							3	3	3				

Ref: 3 - Strong 2 - Medium 1 - Weak

15UGS112	BASIC SCIENCES LABORATORY I	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To create scientific Temper among the students.
- To know how to execute experiments properly, presentation of observations and arrival of conclusions.
- To view and realize the theoretical knowledge acquired by the students through experiments.
- To impart knowledge on basic concepts in application of chemical analysis.
- To train the students in instrumental methods.
- To develop skills in estimation of various ions by chemical and instrumentation methods.

PHYSICS LABORATORY
LIST OF EXPERIMENTS
(Common to All Branches)

1. Laser – Determination of particle size and wavelength of Laser source using Diode Laser.
2. Ultrasonic Interferometer - Determination of velocity of sound and compressibility of liquid.
3. Poiseuille's method - Determination of viscosity of liquid.
4. Spectrometer – Determination of dispersive power of a prism.
5. Compound pendulum – Determination of the acceleration due to gravity.
6. Air Wedge method - Determination of thickness of a thin wire.

- **A minimum of FIVE experiments shall be offered**

CHEMISTRY LABORATORY
LIST OF EXPERIMENTS
(Common to Mechanical, Chemical Engineering & Fashion Tech)

1. Preparation of molar and normal solutions of the following substances – Oxalic acid , Sodium Carbonate , Sodium Hydroxide and Hydrochloric acid.
2. Estimation of copper in brass by EDTA method.
3. Conductometric Titration of strong acid with strong base.
4. Estimation of Fe^{2+} ion by potentiometry.
5. Determination of Strength of given acid using pH metry.
6. Determination of corrosion rate by weight loss method.
7. Comparison of the electrical conductivity of two samples-conductometric method.

- **A minimum of FIVE experiments shall be offered**

TOTAL: 30Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

1. Determine the thickness of various micro level objects using air wedge method.
2. Analyze the viscous properties of various liquids using Poiseuille's method.
3. Compare the velocity of ultrasonic waves in various liquids by ultrasonic interferometer method.
4. Estimate the ions present in the given sample.
5. Determine the rate of corrosion,molecular weight and amount of solids in water.
6. Estimate the acidity of water sample.

Laboratory classes on alternate weeks for Physics and Chemistry

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2							3					
CO.2	3	2							3					
CO.3	3	2							3					
CO.4	3						2		3					
CO.5	3						2		3					

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UGS112	3	2					2		3					

Ref: 3 - Strong 2 - Medium 1 - Weak

SEMESTER II

Semester – II

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	HS	15UEN201	Business English and Presentation skills (Common to All Branches)	3	0	0	3
2.	BS	15UMA202	Engineering Mathematics – II (Common to All Branches)	3	2	0	4
3.	BS	15UPH203	Material Science (Common to Mech & Chemical)	3	0	0	3
4.	HS	15UCY207	Environmental Science (Common to All Branches)	3	0	0	3
5.	ES	15UME208	Basic civil and Mechanical Engineering (Common to Mech, EEE, EIE)	3	0	0	3
6.	ES	15UEE208	Basic Electrical and Electronics Engineering (Common to Mech, Civil. Chemical, Agriculture)	3	0	0	3
7.	BS	15UGS210	Basic Sciences Laboratory – II (Common to All Branches)	0	0	2	1
8.	ES	15UME211	Computer Aided Drafting and Modeling Laboratory	0	0	2	1
Total Credits :21				**18**	**2**	**4**	**21**

15UEN201 **Business English & Presentation Skills** **(Common to all Branches)**

L	T	P	C
3	0	0	3

OBJECTIVES :

- To use linguistic tools confidently in an English speaking context
- To listen and speak during normal business activities such as interviews, meetings, telephone conversations and negotiations.
- To write business letters, emails, reports, articles and comprehend information on the Internet and other media.
- To gain language skills for real business life situations.

UNIT I **9**

Grammar- Numerical Adjective; **Vocabulary** - Job title and describing jobs; Listening - Listening to company culture; **Reading** - Quiz; **Writing** - Writing formal and semi formal business letters; **Speaking** – Personal information, Companies and products.

UNIT II **9**

Grammar -Modals; **Vocabulary –** Collocations; **Listening** - Business Proceedings; **Reading** - Designing websites and e- mail ; **Writing** – Memo; **Speaking -** Role play on various business situation.

UNIT III **9**

Grammar – prepositions – Articles; **Vocabulary** -Jargons related to Shares and stock; **Listening** – Interviews of celebrities; **Reading** – Shares and stock exchange transactions; **Writing** – Business report – Minutes of the Meeting; **Speaking** – Presentations, Making a business talk.

UNIT IV **9**

Grammar - Connectives; **Vocabulary** -Words related to finance; **Listening** - Listening to statistical information; **Reading** - Interpreting business related bar charts; **Writing** - Letters to express interest in new products; **Speaking** - Presenting a summary of an article.

UNIT V **9**

Grammar - Reported speech; **Vocabulary** – Words related to employment ; **Listening**- Listening to audio and video speech of business people; **Reading** - Reading Newspaper article/magazine articles on business; **Writing** - Writing a Proposal; **Speaking** - Discussing company policies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Use business vocabulary effectively to present the ideas. (Remember)
2. Accomplish verbal and written communications. (Understand)
3. Write effectively in a wide range of business letters. (Apply)
4. Prepare Business Proposals and Business Reports for various business purposes. (Create)
5. Make a presentation in English in various business avenues. (Apply)

TEXT BOOKS:

1. Elankathiravan B.A, "Business English and Presentation Skills", Wakeup Publications, Sivakasi, 2016.

REFERENCE BOOKS:

1. Michael McCarthy, Felicity O'Dell, English Collocations in Use, Noida, Cambridge University Press, 2006.
2. Allan Pease, Body Language, New Delhi, Sudha Publications(P) Ltd,2005.
3. Malcolm Goodale, Professional Presentations, New Delhi, Cambridge University Press, 006.
4. Randolph Hudson.H, Bernard Selzler.J, Business Communication, Jaico Publishing House, 2006.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1									2	3				
CO.2									2	3				
CO.3									2	3				
CO.4									2	3				
CO.5									2	3				

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UEN201									2	3				

Ref: 3 - Strong 2 - Medium 1 - Weak

15UMA202	ENGINEERING MATHEMATICS – II (Common to ALL Branches)	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To develop an understanding of the basics of vector calculus comprising of gradient, divergence and curl, and line, surface and volume integrals and the classical theorems involving them.
- To acquaint the student with the concepts of analytic functions and their interesting properties which could be exploited in a few engineering areas, and be introduced to the host of conformal mappings with a few standard examples that have direct application.
- To make the student acquire sound knowledge of Laplace transform and its properties and sufficient exposure to the solution of certain linear differential equations using the Laplace transform technique.

UNIT I ANALYTICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8+6

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Applications of ODE (Bacterial growth, Population growth, Decayed problems).

UNIT II VECTOR CALCULUS 8+6

Gradient Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields –Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopiped.

UNIT III ANALYTIC FUNCTIONS 8+6

Functions of a complex variable – Analytic function – Necessary and Sufficient Conditions (excluding Proofs) – Harmonic function - Properties of an analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+c, cz, 1/z, and Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9+6

Statement and applications of Cauchy's integral theorem, Cauchy's integral formula and Cauchy Residue Theorem – Taylor's and Laurent's expansions – Applications of residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding Poles on the real axis).

UNIT V LAPLACE TRANSFORM 9+6

Existence conditions – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function, impulse function and periodic function - Inverse Laplace transform – Convolution theorem (excluding Proof) –Solution of linear ODE of second order with constant coefficients.

SUPPLEMENT TOPIC (for internal evaluation only) 3

Evocation / Application of Mathematics, Arithmetical, Ability – Time and Work – Time and Distance.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Solve first and higher order ordinary differential equations analytically and able to apply differential calculus to solve engineering problems. (Apply)
2. Find the integral value using the suitable method like Greens Theorem, Gauss divergence Theorem, Stokes Theorem. (Apply)
3. Construct an analytic function using various methods .Also able to convert a function from one domine to another domine using bilinear transformation. (Apply)
4. Evaluate the values of a contour integral around a given contour in the complex plane. (Evaluate)
5. To apply Laplace transform to solve Ordinary differential equations. (Apply)

TEXT BOOKS:

1. BALI N. P and MANISH GOYAL, "Text book of Engineering Mathematics", Laxmi Publications (P) Ltd., New Delhi, 3rd Edition, 2008.
2. GREWAL. B.S, "Higher Engineering Mathematics", Khanna Publications, New Delhi, 43rd Edition, 2014.
3. SANKAR RAO. K, "Numerical Methods for Scientists and Engineers", Prentice Hall of India, New Delhi, 3rd Edition, 2007.

REFERENCE BOOKS:

1. RAMANA B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, 2010.
2. KREYSZIG. E, "Advanced Engineering Mathematics", John Wiley & Sons, New York, 10th Edition, 2011.
3. JAIN R.K and IYENGAR S.R.K, "Advanced Engineering Mathematics", Narosa Publishing House Pvt. Ltd., New Delhi, 3rd Edition, 2007.
4. GERALD C.F. and WHEATELEY, P.O. "Applied Numerical Analysis", Pearson Education, New Delhi, 7th Edition, 2003.
5. AGARWAL R.S., "Quantitative Aptitude", S. Chand Publications, New Delhi, 7th Edition, 2008, pp. 341-370, 384-404.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3												
CO.2	3	3												
CO.3	3	3												
CO.4	3	3												
CO.5	3	3												

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UMA202	3	3												

Ref: 3 - Strong 2 - Medium 1 - Weak

15UPH203	MATERIALS SCIENCE (Common to Mechanical & Chemical)	L 3	T 0	P 0	C 3

OBJECTIVES :

- To gain knowledge about the physical properties of the various materials.
- To cover the fundamental scientific principles for the different synthesis techniques and assembly of the advanced materials.
- To achieve an understanding of principles of thermodynamics and to be able to use it for physical systems like boiler, pressure vessels etc.,

UNIT I CONDUCTORS AND DIELECTRICS 9

Conductors — Electrical and thermal conductivity – Wiedemann – Franz law – Fermi distribution function- Dielectric Materials: Introduction – Electrical susceptibility-Dielectric constant-Electronic, ionic, orientational and space charge polarization – Internal field – Claussius – Mosotti relation (Derivation).

UNIT II SEMICONDUCTING MATERIALS 9

Introduction- Intrinsic semiconductor – carrier concentration derivation - Fermi level – Variation of Fermi level with temperature – Extrinsic semiconductor (Qualitative)- Hall effect – Determination of Hall coefficient –Applications.

UNIT III MAGNETIC AND SUPER CONDUCTING MATERIALS 9

Introduction– Bohr magneton – Classification of magnetic materials – Domain theory – Hysteresis – soft and hard magnetic materials –Superconductivity: Properties - Types of super conductors – BCS theory of superconductivity (Qualitative) - High Tc superconductors – Applications – SQUID – Maglev.

UNIT IV ADVANCED ENGINEERING MATERIALS 9

Metallic glasses– preparation – properties & applications - Nanomaterial: synthesis- plasma arcing – PVD and Chemical vapour deposition – ball milling - properties and applications – Introduction to CNT.

UNIT V STRENGTHENING MECHANISM AND THERMODYNAMICS 9

Introduction – crystal imperfections - Improvement of mechanical properties- Fracture- Fatigue Failure- Creep-Factors affecting creep –Introduction to Thermodynamics -Boyle's law-Charle's law-function of PVT-Laws of Thermodynamics- path function- Entropy- Enthalpy-expression of a perfect gas –carnot cycle

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the properties and application of Conducting and Dielectric materials. (Understand)
2. Use simple band diagrams to understand the electrical conduction in semiconductor. (Understand)
3. Select various types of magnetic materials. (Apply)
4. Explain the features, types and applications of newer class materials like smart materials, nanomaterials etc., (Understand)
5. Select the proper testing method to characterize the mechanical behavior of metals. (Understand)

TEXT BOOKS:

1. William D. Callister, Jr. "Material Science and Engineering", Seventh Edition, John Wiley & Sons Inc. New Delhi, 2010.
2. Dr. Mani.P, "Engineering Physics II ", Dhanam Publications, Chennai Revised Edition, 2014.
3. Palanisamy P.K., "Engineering Physics', Scitech Publication, Chennai, Edition, 2014.

REFERENCE BOOKS:

1. Pillai S.O, "Solid State Physics", New Age Inc, Revised Edition 2014.
2. Kingery W.D., Bowen H.K. and Dr. Uhlmann, "Introduction to Ceramics', Second Edition, Wiley and son's, Revised Edition 2012.
3. Raghavan.V, "Material Science and Engineering", Prentice Hall of India Private Limited, New Delhi, Revised Edition 2013.
4. Vijayakumari, "Engineering Physics", Vikas Publishing, New Delhi, Revised Edition 2012.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3													
CO.2	3													
CO.3	3	3												
CO.4	3													
CO.5	3													

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UPH203	3	3												

Ref: 3 - Strong 2 - Medium 1 - Weak

15UCY207	ENVIRONMENTAL SCIENCE (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

OBJECTIVES :

- Understanding the concepts of ecosystem and biodiversity.
- Acquire knowledge about the impact of environmental pollution.
- Awareness on various types of resources.
- Understand the importance of social issues and the environment.
- Impart awareness about the value education and population growth.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 10

Definition, scope and importance of environment – Need for public awareness – Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity – Definition: genetic, species and ecosystem diversity – Bio geographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: Causes, effects and control measures of municipal solid wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT III FUTURE POLICY AND ALTERNATIVES 9

Future policy and alternatives - fossil fuels - nuclear energy - solar energy - wind energy - hydroelectric energy - geothermal energy - tidal energy – sustainability - green power – nanotechnology - international policy.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization - Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation – Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 8

Population growth, variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Express the concepts of ecosystem and biodiversity. (Understand)
2. Describe about the impact of environmental pollution. (Understand)
3. State the various types of energy resources. (Understand)
4. Explain the importance of environmental issues in the society. (Understand)
5. Analyze the impact of environmental issues related to human health. (Analyze)

TEXT BOOKS:

1. Anubha Kaushik, kaushik C.P., “Environmental Science and Engineering”, Third Edition, New Age International, New Delhi, 2009.
2. Benny Joseph “Environmental Science and Engineering”, Tata Mc-Graw Hill, New Delhi, 2006.

REFERENCE BOOKS:

1. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Pearson Education, Upper saddle River, New Jersey, 2008.
2. Miller T.G. Jr., Environmental Science”, Wadsworth Publishing Company, Belmont, California, 2005.
3. De A.K., “Environmental Chemistry”, Wiley Eastern Ltd., New Delhi, 2001.
4. Trivedi R.K., Goel P.K., “Introduction to Air Pollution”, Techno-Science Publication, Jaipur, 2005.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3						3							
CO.2	3						3							
CO.3	3						3							
CO.4	3					2	3							
CO.5	3					2	3							

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UCY207	3					2	3							

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME208	BASIC CIVIL AND MECHANICAL ENGINEERING (Common to MECH, EEE, EIE)	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To understand the fundamentals of thermal systems
- To understand the basics of building construction and infrastructures

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying:

Objects – types – classification – principles – measurements of distances – angles –leveling – determination of areas – illustrative examples.

Civil Engineering Materials:

Bricks – stones – sand – cement – concrete – steel sections

UNIT II BUILDING COMPONENTS AND STRUCTURES 9

Foundations:

Types, bearing capacity – Requirement of good foundations - Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

B – MECHANICAL ENGINEERING

UNIT III POWER PLANT ENGINEERING 9

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV IC ENGINES 9

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 9

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Summarize the measurement of landscape and different building materials with norms. (Understand)
2. Classify the different building structure and its applications relevant to civil engineering practice. (Understand)
3. Interpret the ideas of variety of energy sources considering the norms of engineering practice. (Understand)
4. Explain the working principle of I.C engines. (Understand)
5. Discuss the working principle of Refrigeration and Air conditioning systems. (Understand)

TEXT BOOKS:

1. Shanmugam G. and Palanichamy M.S., "Basic Civil and Mechanical Engineering", Tata Mc-Graw Hill Publishing Co., New Delhi, 1996.
2. Venugopal K., Prabhu Raja V., and Sreekanjana G., "Basic Civil and Mechanical Engineering", Anuradha Publications, Third Edition 2010.

REFERENCE BOOKS:

1. Ramamrutham S., "Basic Civil Engineering", DhanpatRai, Publishing Co. (P) Ltd, 1999.
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
3. Shantha Kumar S.R.J., "Basic Mechanical Engineering", Hi-Tech Publications, Mayiladuthurai, 2000.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2					3	2	3						
CO.2	2					3	3	2						
CO.3	2					2	2	3						
CO.4	2													
CO.5	2					2		2						

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME208	2					3	3	3						

Ref: 3 - Strong 2 - Medium 1 - Weak

15UEE208	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to MECH, CIVIL, CHEMICAL& AGRICULTURE)	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To introduce the principles of DC and AC fundamentals.
- To study the Construction and operations of Electrical machines & measuring instruments.
- To attain basic knowledge on semi conductor devices and digital principles.
- To introduce the basic concepts of communication engineering.

UNIT I FUNDAMENTALS OF DC CIRCUITS AND AC CIRCUITS 9

Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor , Kirchhoff's laws, Mesh analysis, Nodal analysis, Ideal sources –equivalent resistor, current division, voltage division. Generation of AC, Average and RMS values, Form and peak factors.

UNIT II ELECTRICAL MACHINES AND MEASURING INSTRUMENTS 9

Working principle, construction and applications of DC machines (Generator and Motor) and AC machines (single phase transformers, single phase induction motors: split phase, capacitor start and capacitor run motors). Basic principles and classification of instruments - Moving coil and moving iron instruments.

UNIT III SEMICONDUCTOR DEVICES 9

Passive components – resistors, capacitors & inductors (properties, common types, I-V relationship and uses). Semiconductor Devices - Overview of Semiconductors - basic principle, operation and characteristics of PN diode, zener diode, BJT.

UNIT IV INTRODUCTION TO DIGITAL ELECTRONICS 9

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms of Boolean expression.

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 9

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Communication Systems: Satellite and Optical Fiber. (Block Diagram Approach only).

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the principles of DC and AC fundamentals.
2. Explain the Construction and operations of Electrical machines & measuring instruments.
3. Analyze the characteristics of semiconductor devices.
4. Develop Boolean expressions using logic gates
5. Explain the concepts of communication engineering.

TEXT BOOKS:

1. Mehta V K, “Principles of Electronics”, S.Chand& Company Ltd, fifth Edition New Delhi, 2008.
2. R. Muthusubramanian, S. Salivahanan, “Basic Electrical and Electronics Engineering”, Tata McGraw-Hill Education, Reprint 2012.
3. Smarajt Ghosh, “Fundamentals of Electrical & Electronics Engineering”, PHI Learning, 2011.
4. B. Somanathan Nair, S.R. Deepa, “Basic Electronics”, I.K. International Pvt. Ltd., 2009.

REFERENCE BOOKS:

1. Kothari D. P and Nagrath IJ, “Basic Electrical Engineering”, Tata McGraw - Hill, 2009.
2. S. K. Bhattacharya, “Basic Electrical and Electronics Engineering”, Pearson Eduaction, 2011.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	1		3	2										
CO.2	1								2		3			
CO.3		2	3				1							
CO.4		2		3								1		
CO.5		1	3	2										

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UEE208	1	2	3	3			1		2		3	1		

Ref: 3 - Strong 2 - Medium 1 - Weak

15UGS210	BASIC SCIENCES LABORATORY –II	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To introduce the experimental procedure for the Band gap of a semiconductor, B-H curve and Potentiometer.
- To demonstrate the working of Spectrometer and Lee's Disc apparatus.
- Develop the practical skills to evaluate the quality parameters of water and industrial effluents.
- Apply the theoretical principles and perform experiments**.**

PHYSICS LABORATORY
(COMMON TO MECH, CHEMICAL, FASHION TECH., & AGRICUTURAL ENGG..)

LIST OF EXPERIMENTS :

1. Determination of band gap of a semiconductor.
2. B-H curve - Study of Hysteresis Loop.
3. Potentiometer - Measurement of Thermo e.m.f.
4. Torsion pendulum – Determination of Moment of inertia of a metallic disc and rigidity modulus of a given wire.
5. Spectrometer - Determination of wavelength of mercury spectrum using Grating.
6. Lee's Disc - Determination of thermal conductivity of a bad conductor.

A minimum of FIVE experiments shall be offered

CHEMISTRY LABORATORY
LIST OF EXPERIMENTS
(Common to All Branches)

1. Estimation of hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of Chloride in water sample (Argentometric method)
4. Determination of DO in water.
5. Estimation of silver ion by Dichrometry.
6. Determination of quality of Surface water (River/pond/lake) and Ground water (well/ bore well) with respect to Hardness, TDS, Chloride and pH.
7. Determination of acidity of industrial effluents.

A minimum of FIVE experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze the thermal conductivities of bad conductors and also the properties of semiconductors.
2. To know the elastic properties of materials using uniform & non-uniform bending method of young's modulus.
3. Understand the theory behind the signal communication through laser in optical fiber.
4. Analyze the properties of water by applying the chemical concepts.
5. Determine the acid quality in the industrial effluents.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2							3					
CO.2	3	2							3					
CO.3	3	2							3					
CO.4	3						3		3					
CO.5	3						3		3					

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UGS210	3	2					3		3					

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME211	COMPUTER AIDED DRAFTING AND MODELING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To demonstrate the capabilities of software for drafting and modeling.
- To train the students understand and draw simple solids, isometric projection of simple objects and residential building.

LIST OF EXPERIMENTS :

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids prism, pyramid with dimensioning
5. Drawing of front view and top view of simple solids cylinder, cone with dimensioning.
6. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
7. Drawing of a plan of residential building (Two bed rooms, kitchen, and hall).
8. Drawing of a simple steel truss.
9. Drawing sectional views of prism.
10. Drawing sectional views of pyramid
11. Drawing sectional views of cylinder, cone.
12. Drawing isometric projection of simple objects.
13. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

A minimum of nine experiments shall be offered

TOTAL:30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Construct the parabola and involutes using B spline or cubic spline. (Apply)
2. Prepare the 2D views of various solids. (Understand)
3. Demonstrate 3D models using modeling packages. (Understand)
4. Show the sectional views of prism, pyramid, cylinder and cone. (Understand)
5. Develop a plan of residential building using AutoCAD software. (Apply)

EQUIPMENT REQUIREMENT

Sl.No.	Name of the equipment	Quantity required
1.	Pentium IV computer or better hardware, with Suitable graphics facility	30
2.	Open source software Modeling for Drafting and Modeling (Autocad)	30
3.	Laser Printer or Plotter to print / plot drawings	02

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3				3				3	3				
CO.2	3				2				3	3				
CO.3	3				3				3	3		3		
CO.4	3				3				3	3				
CO.5	3				3				3	3		3		

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME211	3				3				3	3		3		

Ref: 3 - Strong 2 - Medium 1 - Weak

SEMESTER III

Semester – III

Sl. No	Course Category	Course Code	Course Name	L	T	P	C
1.	BS	15UMA321	Transform and Partial Differential Equations. (Common to MECH, ECE, EEE, CIVIL, EIE and CHEMICAL, Agriculture, Bio medical)	3	2	0	4
2.	PC	15UME302	Manufacturing Technology-I	3	0	0	3
3.	ES	15UME303	Engineering Thermodynamics	3	0	0	3
4.	ES	15UME304	Fluid Mechanics and Machinery	3	0	0	3
5.	ES	15UME305	Engineering Mechanics	3	0	0	3
6.	ES	15UEE323	Electrical Machines	3	0	2	4
7.	PC	15UME307	Manufacturing Technology Laboratory -I	0	0	2	1
8.	ES	15UME308	Fluid Mechanics and Machinery Laboratory	0	0	2	1
Total Credits : 22				**18**	**2**	**6**	**22**

15UMA321	**TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to MECH, ECE, EEE, CIVIL, CHEMICAL, AGRI, BIO MEDICAL)**	**L**	**T**	**P**	**C**
		3	**2**	**0**	**4**

OBJECTIVES :

- To make the student knowledgeable in formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- To familiarize the students to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them numerically and interpret the results.
- To acquaint the student with the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved.

UNIT I FOURIER SERIES 9 + 6

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic analysis - Application of Fourier series - Gibb's Phenomenon.

UNIT II FOURIER TRANSFORM 9 + 6

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity - Application of Fourier Transform.

UNIT III Z-TRANSFORM AND DIFFERENCE EQUATIONS 9 + 6

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value Theorems - Formation of difference equations – Solution of difference equations.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9 + 6

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations – Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 6

Introduction of Partial differential equations - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

1. Find the Fourier series of the given function in the given range. (Apply)
2. Find Fourier transform for a given function. (Apply)
3. Solve the difference equation using Z transform. (Apply)
4. Solve the Partial differential equation using various methods. (Apply)
5. Apply partial differential equation to solve wave and heat equation. (Apply)

TEXT BOOKS:

1. GREWAL B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 42nd Edition, (2012).
2. KANDASAMY.P, THILAGAVATHY.K, and GUNAVATHY.K, Engineering Mathematics III, S.Chand & Company Ltd., New Delhi, 3rd Edition, (1996).

REFERENCE BOOKS:

1. BALI N.P., MANISH GOYALand WATAINS, "Advanced Engineering Mathematics", Firewall Media (An imprint of Laxmi Publication Private limited) New Delhi, 7th Edition, (2009).
2. RAMANA.B.V, "Higher Engineering Mathematics" Tata McGraw Hill, New Delhi, 11th Reprint (2010).
3. GLYN JAMES, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 3rd Edition, (2007).
4. ERWIN KREYSZIG, "Advanced Engineering Mathematics", Wiley India, 10th Edition, (2011).

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3												
CO.2	3	3												
CO.3	3	3												
CO.4	3	3												
CO.5	3	3												

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UMA321	3	3												

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME302	MANUFACTURING TECHNOLOGY – I	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart the knowledge on the concepts of basic manufacturing processes and fabricationtechniques, such as metal casting, metal joining, metal forming and plastics componentmanufacture.
- To expose the various manufacturing methods employed in industries.

UNIT I METAL CASTING PROCESSES 9

Sand casting - Sand moulds - Type of patterns - Pattern materials - Pattern allowances -Types of Moulding sand - Properties - Core making - Methods of Sand testing -Moulding machines - Types of moulding machines - Melting furnaces - Working principle of Special casting processes - Shell, investment casting - Ceramic mould- Lost Wax process -Pressure die casting - Centrifugal casting - CO_2 process - Sand Casting defects and remedies - Inspection methods, Gating and risering. Fettling and cleaning of casting.Introduction to Metal forming and flow analysis software (for metallic /plastic components).

UNIT II JOINING PROCESSES 9

Fusion welding processes - Types of Gas welding -Equipments used - Flame characteristics - Filler and Flux materials - Arc welding equipments - Electrodes - Coating and specifications - Principles of Resistance welding - Spot/butt, seam welding -Percusion welding - Gas metal arc welding - Flux cored - Submerged arc welding - Electro slag welding - TIG welding - Principle and application of special welding processes - Plasma arc welding - Thermit welding - Electron beam welding - Friction welding - Diffusion welding,Friction stir welding and Ultra sonic welding - Weld defects - Brazing and soldering process - Methods and process capabilities - Filler materials and fluxes - Types of Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals - Forging processes - Open impression and closed die forging - Characteristics of the process - Types of Forging Machines - Typical forging operations - Rolling of metals - Types of Rolling mills - Flat strip rolling - Shape rolling operations - Defects in rolled parts - Principle of rod and wire drawing - Tube drawing, Drawing applications, defects. Types of presses - Principles of Extrusion - Types of Extrusion - Hot and Cold extrusion -Equipments used.

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics - Typical shearing operations, bending and drawing operations - Stretch forming operations - Formability of sheet metal - Test methods - Working principle and application of special forming processes - Hydro forming - Rubber pad forming - Metal spinning - Introduction to Explosive forming, Magnetic pulse forming, Peen forming, Super plastic forming, electro magnetic forming, electro hydraulic forming.

UNIT V MANUFACTURING OF PLASTIC COMPONENTS 9

Types of plastics - Characteristics of the forming and shaping processes -Moulding of Thermoplastics - Working principles and typical applications of - Injection moulding- Plunger and screw machines - Compression moulding, Transfer moulding- Typical industrial applications - Introduction to Blow moulding- Rotational moulding- Film blowing - Extrusion - Thermoforming - Bonding of Thermoplastics. powder metallurgy process, composite mouldings.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of casting to select suitable casting method and analyze the component (Analyze)
2. Apply the basic knowledge of welding and select appropriate welding method (Apply)
3. Apply the knowledge of various bulk deformation process to select proper methodology for hot working/ cold working (Apply)
4. Select a suitable sheet metal forming processes to the given application (Apply)
5. Apply the knowledge of moulding to select a suitable moulding method (Apply)

TEXT BOOKS:

1. HajraChoudhury, “Elements of Workshop Technology, Vol. I andII”, Media PromotorsPvt. Ltd, Mumbai, 2001.
2. Sharma. P.C, “A text book of production technology”, S. Chand and Company, I Edition,2003.

REFERENCE BOOKS:

1. MagendranParashar.B.S, Mittal.R.K, “Elements of Manufacturing Processes ”, Prentice Hall of India, 2003.
2. Rao.P.N, “Manufacturing Technology,” Tata McGraw-Hill Publishing Limited, II Edition, 2002.
3. Kumar. K.L, “Engineering Fluid Mechanics ”, Eurasia Publishing House (P) Ltd, Seventh Edition, New Delhi, 1995.
4. Gowri.S, Hariharan.P, Suresh Babu.A, “Manufacturing Technology 1”, Pearson Education, 2008.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2	2			2								3	
CO.2	2	2											3	
CO.3	2												3	
CO.4	2	2		2									2	
CO.5	2	2											3	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME302	2	2		2	2								3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME303	ENGINEERING THERMODYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart the basic thermodynamic principles and developing the skills to performthe analysis of thermodynamic system.
- To explain the general thermodynamic relations and thermodynamic properties.
- To familiarize the usage of steam tables, Mollier Chart and psychrometric chart.

UNIT I BASIC CONCEPT AND FIRST LAW 9

Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work,modes of work, Zeroth law of thermodynamics - concept of temperature and heat. Conceptof ideal and real gases.First law of thermodynamics - application to closed andopen systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW 9

Second law of thermodynamics - Kelvin's and Clausius statements of second law.Reversibility and irreversibility.Carnot theorem, Carnot cycle, efficiency, COP.Thermodynamic temperature scale, Clausius inequality, concept of entropy.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAMPOWER CYCLE 9

Properties of pure substances - Thermodynamic properties of pure substances in solid, liquidand vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams,PVTsurfaces,thermodynamic properties of steam. Calculations of work done and heat transfer in non- flowand flow processes. properties table, Mollier chart, Standard Rankine cycle.

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMICRELATIONS 9

Gas mixtures - properties ideal and real gases, Avogadro's Law, Vander Waal's equation of state, general thermodynamic relations - Dalton's law of partial pressure, exact differentials, T-D relations,Maxwell'srelations,ClausiusClapeyron equations, Joule -Thomson coefficient.

UNIT V PSYCHROMETRY 9

Psychrometry and psychrometric charts, Properties of atmospheric air, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling.

TOTAL : 45 PERIODS

NOTE: Use of Steam Table, Mollier Chart, Psychrometric Chart are permitted in the End Semester Examination.

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of first law of thermodynamics to solve the problems in thermodynamic systems. (Apply)
2. Apply the knowledge of second law of thermodynamics to determine the efficiency in Heat engine and COP in heat pump. (Apply)
3. Design the steam power plant using the knowledge of Rankine cycle. (Analyze)
4. Formulate the thermodynamic relations using the mathematical theorems. (Apply)
5. Design solutions for an air-conditioning plant by applying the knowledge of Psychrometry. (Create)

TEXT BOOKS:

1. Nag.P.K, “Engineering Thermodynamics”, Tata McGraw-Hill, Third reprint, New Delhi, 2008.
2. Natarajan. E, “Engineering Thermodynamics”, Anuragam Publications, First Edition, 2012.

REFERENCE BOOKS:

1. Rajput.R.K, “Engineering Thermodynamics”, Laxmi Publication, Fourth edition, New Delhi, 2010.
2. Holman.J.P, “Thermodynamics”, McGraw-Hill, Third Edition, 1995.
3. Venwylen, Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987.
4. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2		2										3
CO.2	3	2		2										3
CO.3	3	3	3	2									3	
CO.4	3	2												
CO.5	3	3	3	3				2		2			3	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME303	3	3	3	3				2		2			3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME304	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the fluid properties, fluid behavior and the application in various engineering requirements.
- To familiarize the flow measurement devices, roto dynamic machines and positive displacement machines.

UNIT I INTRODUCTION 9

Units & Dimensions. Properties of fluids - Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws - capillarity and surface tension. Types of flow - laminar, turbulent, unsteady, steady, non-uniform and uniform flows. Stream line, streak line and path line. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Statement of Navier Stokes equation, derivation of Euler's equation and Bernoulli's energy equation, examples illustrating the use of energy equations. Laminar flow though circular conduits and circular annuli. Hydraulic and energy gradient. Darcy – Weisbach equation. Friction factor and Moody diagram. Commercial pipes. Minor losses. Flow though pipes in series and in parallel.

UNIT III DIMENSIONAL ANALYSIS 9

Dimension and units: Rayleigh method, Buckingham's π theorem. Discussion on dimensionless parameters Reynolds, Froude, Euler, Weber and Mach number and their application in model testing. Models and similitude. Applications of dimensionless parameters.

UNIT IV ROTO DYNAMIC MACHINES 9

Specific speed. Theory of turbo machines. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pump, Impulse type-Pelton wheel. Reaction type-Francis, Kaplan and Propeller. Principles of operation of turbine calculation of main dimensions, regulation and performance. Draft tube-function and types. Cavitation in turbines

UNIT V POSITIVE DISPLACEMENT MACHINES 9

Radial flow, axial flow and mixed flow pumps - ideal and actual slip - performance calculation and determination of main dimensions. Cavitation in pumps, net positive suction head (NPSH), effect of speed. Reciprocating pumps, Indicator diagrams, Work saved by air vessels. Rotary pumps - Classification and Working.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of fluid mechanics to analyze the fluid properties. (Analyze)
2. Analyze the various energy losses in pipes by using energy equations. (Analyze)
3. Apply the knowledge of dimensional analysis to solve the various problem related to fluid flow. (Apply)
4. Apply the knowledge of rotodynamic machinery to design the turbine and centrifugal pump parameters. (Apply)
5. Apply the knowledge of positive displacement pump technology to select a suitable pump and evaluate the performance for various applications. (Apply)

TEXT BOOKS:

1. Bansal .R.K, “Fluid Mechanics and Hydraulics Machines ”, Laxmi Publications (P) Ltd, Ninth Edition, New Delhi, 2010.
2. Ramamritham. S, “Fluid Mechanics, Hydraulics and Fluid Machines ”, DhanpatRai& Sons, New Delhi, 1988.

REFERENCE BOOKS:

1. Kumar. K.L, “Engineering Fluid Mechanics ”, Eurasia Publishing House (P) Ltd, Seventh Edition, New Delhi, 1995.
2. Streeter. V. L,Wylie, E.B “Fluid Mechanics ”, Tata McGraw-Hill, 1983.
3. Rathakrishnan. E, “Fluid Mechanics ”, Prentice Hall of India, Second Edition, 2007.
4. Frank White, “Fluid Mechanics ”, Tata Mcgraw Hill Education Pvt. Ltd, Seventh Edition, New Delhi, 2011.

HAND BOOKS:

1. Meenatchisundaram. P, ShyamSundar. A, “Hand book on Fluid Mechanics and Machinery “2016.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3												
CO.2	3	3	3										3	
CO.3	3	2												
CO.4	3	3	3										3	
CO.5	3												2	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME304	3	3	3										3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME305	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart knowledge on the vector and scalar representation of forces and moments.
- To make the students to calculate the moment of inertia and centroid for different sections.
- To explain dynamics of particles and different types of friction.

UNIT I BASICS & STATICS OF PARTICLES 9

Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem, Parallelogram andtriangular Law of forces - Equivalent systems of forces - Principle of transmissibility - Single equivalent force - Resolution andComposition of forces - Equilibrium of a particle.Vectors -Vectorial representation of forces and moments - Coplanar Forces - Forces in space - Equilibrium of a particle in space.

UNIT II EQUILIBRIUM OF RIGID BODIES 9

Moments and Couples - Moment of a force about a point and about an axis - Types of supports and their reactions -Varignon's theorem - Free body diagram - Equilibrium of Rigid bodies in two dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9

First moment of area and the Centroid of sections T section, I section, Angle section, Parallel axis theorem and perpendicular axis theorem - second and product moments of plane area of T section, I section. Polar moment of inertia, Principal axes of inertia of I section, L section- Mass momentof inertia simple sections.

UNIT IV DYNAMICS OF PARTICLES 9

Displacements, Velocity and acceleration, their relationship - Relative motion – Newton's law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

UNIT V FRICTION 9

Frictional force - Laws of Coloumb friction - Simple contact friction - Rolling resistance -Screw jack friction – Belt friction.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge for principles of statics of particles and solve the force problem. (Apply)
2. Identify the magnitude of moments and couple forces acting on rigid bodies. (Apply)
3. Calculate moment of surface and solids for different geometries. (Apply)
4. Apply the principles of dynamics of particles to find the momentum, velocity and acceleration for the given rigid body. (Apply)
5. Utilize the principles of various types of friction to solve the engineering problems. (Apply)

TEXT BOOKS:

1. Ferdinand P. Beer, E. Russell JohnstonJr.,David F. Mazurek, Phillip J. Cornwell and Elliot R. Eisenberg "Vector mechanics for Engineers: Static and Dynamic", McGraw-Hill International, Ninth Edition, 2010.
2. Palanichamy.M.S, Nagan.S, "Engineering Mechanics: Statics and Dynamics", Tata McGraw Hill, 2011.

REFERENCE BOOKS:

1. Rajasekaran.S, Sankarasubramanian.G, "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd, 2000.
2. Kottiswaran.N, "Engineering Mechanics, Statics and Dynamics", Sri Balaji Publications, 2015
3. Hibbeller.R.C, "Engineering Mechanics: Statics &Dynamics ", Pearson Education Asia Pvt. Ltd, 2000.
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics ", Pearson Education Asia Pvt. Ltd, IV Edition, 2003.

HAND BOOKS:

1. Gangadharan.T, Thavasilingam.K, "Hand book on Engineering Mechanics ", 2016.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3												2
CO.2	3	3	2		3									2
CO.3	3	3												
CO.4	3	3												3
CO.5	3	3												

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME305	3	3	2		3									3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME307	MANUFACTURING TECHNOLOGY LABORATORY – I	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To train the knowledge about the lathe.
- To train the practical knowledge in welding processes.
- To demonstrate the sheet metal works.
- To demonstrate about moulding for metals and plastics.

List of Experiments

1. Facing, plain turning and step turning
2. Taper turning using compound rest
3. Single start V thread, cutting and knurling.
4. Boring.
5. Horizontal, Vertical, Arc welding.
6. Gas Cutting, Gas Welding - for demonstration purpose.
7. Brazing - for demonstration purpose.
8. Fabrication of sheet metal tray.
9. Fabrication of a funnel.
10. Mould with solid pattern
11. Mould with split pattern
12. Injection Moulding- for demonstration purpose.

A minimum of nine experiments shall be offered

TOTAL : 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of machining to make a part by using lathe. (Apply)
2. Apply the knowledge of welding to make different types of joints. (Apply)
3. Apply the knowledge of development of surfaces to prepare sheet metal models. (Apply)
4. Build sand moulds for various parts by selecting the proper casting tools and resources. (Apply)
5. Make use of knowledge of injection moulding machine and process to make different parts. (Apply)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment	Quantity required
1.	Centre Lathe with accessories	15
2.	Arc welding machine	04
3.	Gas welding machine	01
4.	Brazing machine	01
5.	Hand Shear 300mm	01
6.	Bench vice	05
7.	Standard tools and calipers for sheet metal work	05
8.	Moulding Table	05
9.	Moulding boxes, tools and patterns	05
10.	Injection Moulding Machine	01

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3								3	2			2	
CO.2	3					2		2	3	2			3	2
CO.3	3					2			3	2			2	
CO.4	3								3	2			2	2
CO.5	3								3	2			2	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME307	3					2		2	3	2			3	2

Ref: S- Strong M- Medium W- Weak

15UME308	FLUID MECHANICS AND MACHINERYLABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To train knowledge on calibration technologies.
- To train the students to test &analyze the flow parameters.
- To demonstrate the concept of fluid mechanics practically.

LIST OF EXPERIMENTS : **30**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Determination of minor loss for a given set of pipes.
6. Conducting experiments and drawing the characteristic curves of centrifugal pump
7. Conducting experiments and drawing the characteristic curves of submergible pump.
8. Conducting experiments and drawing the characteristic curves of reciprocating pump.
9. Demonstrate the performance characteristics of Gear pump.
10. Conducting experiments and drawing the characteristic curves of Pelton wheel.
11. Demonstrate the performance characteristicsof Francis turbine.
12. Demonstrate the performance characteristicsof Kaplan turbine.

A minimum of nine experiments shall be offered

TOTAL:30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Make use of various flow measuring devices to calculate the coefficient of discharge. (Apply)
2. Investigate the various losses takes place in fluid flow through pipes. (create)
3. Apply the knowledge of pumps to plot its characteristic curves. (Apply)
4. Apply the knowledge of turbines to draw its characteristics curves. (Apply)
5. Determine the rate of flow using rota meter. (Apply)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment	Quantity required
1.	Orificemetersetup	1 No.
2.	Venturimetersetup	1 No.
3.	Rotametersetup	1 No.
4.	PipeFlowanalysissetup	1 No.
5.	Centrifugalpump/submergible pump setup	1 No.
6.	Reciprocatingpumpsetup	1 No.
7.	Gearpumpsetup	1 No.
8.	Peltonwheelsetup	1 No.
9.	Francisturbinesetup	1 No.
10.	Kaplanturbinesetup	1 No.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2						2	3			2		
CO.2	3	2		3				2	3			2	2	
CO.3	3	2						2	3			2	2	
CO.4	3							2	3					
CO.5	3	2						2	3			2		

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME308	3	2		3				2	3			2	2	

Ref: 3 - Strong 2 - Medium 1 - Weak

SEMESTER IV

Semester – IV

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	BS	15UMA423	Statics and Numerical Methods	3	2	0	4
2.	PC	15UME402	Kinematics of Machinery	3	0	0	3
3.	PC	15UME403	Manufacturing Technology II	3	0	0	3
4.	PC	15UME404	Thermal Engineering	3	0	0	3
5.	PC	15UME405	Strength of Materials	3	0	0	3
6.	PC	15UME406	Machine Drawing	2	2	0	3
7.	HS	15UGS431	Reasoning and Quantitative Aptitude (Common to All Branches)	1	0	0	1
8.	PC	15UME407	I.C Engine and Steam Laboratory	0	0	2	1
9.	PC	15UME408	Manufacturing laboratory - II	0	0	2	1
10.	PC	15UME409	Material Testing Laboratory	0	0	2	1
Total Credits : 23				**18**	**4**	**6**	**23**

15UMA423	STATISTICS & NUMERICAL METHODS	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To make the student acquire sound knowledge of fundamentals and applications of statistics which will greatly help at the data analysis stage of comparative experiments.
- To familiarize the student with the applications of numerical methods in various fields, solving practical, technical problems occurring in Mechanical Engineering using scientific and mathematical tools.

UNIT I TESTING OF HYPOTHESIS 9+6

Sampling distributions - Normal, t, Chi-square and F distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9+6

Completely randomized design – Randomized block design – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUEPROBLEMS 9+6

Newton-Raphson method- Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method – Eigenvalues of a matrix by Power method.

UNIT IV INTERPOLATION AND APPROXIMATION 9+6

Lagrangian Polynomials – Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Interpolating with a cubic spline.

UNIT V NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+6

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two point and Three point Gaussian quadrature formulae – Double Integrals using Trapezoidal and Simpson's rules.

SUPPLEMENT TOPIC (for internal evaluation only)

Applications in real time problems.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Conduct and interpret hypothesis tests for a single population proportion. (Apply)
2. Design and analyze a process, to evaluate which process inputs have a significant impact on the process output using design of experiments. (Analyze)
3. Employ a number of techniques to solve linear and nonlinear equations. (Evaluate)
4. Use Interpolation technique for equal and unequal intervals to find new data points within the range of known data points. (Evaluate)
5. Find numerical integration for single and double integrals. (Apply)

TEXT BOOKS:

1. JOHNSON R.A. and GUPTA C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, New Delhi, 8th edition, (2011).
2. GREWAL, B.S. and GREWAL, J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, (2009).

REFERENCE BOOKS:

1. WALPOLE. R.E., MYERS .R.H., MYERS S.L., and YE. K, "Probability and Statistics for Engineers and Scientists", Pearson Education, New Delhi, 8th edition, (2007).
2. SPIEGEL M.R., SCHILLER J. and SRINIVASAN R.A., "Schaum's Outlines Probability and Statistics", Tata McGraw Hill, New Delhi, (2004).
3. CHAPRA, S. C and CANALE, R. P., "Numerical Methods for Engineers", Tata McGraw-Hill, New Delhi, 5th Edition, (2007).
4. GERALD, C. F. and WHEATLEY, P. O., "Applied Numerical Analysis", Pearson Education, New Delhi, 6th Edition, (2006).

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3												
CO.2	3	3	2	2										
CO.3	3	3												
CO.4	3	3	2	2										
CO.5	3	3												

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UMA423	3	3	2	2										

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME402	KINEMATICS OF MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the concept of machines, mechanisms and related terminologies.
- To impart knowledge to analyze a mechanism for displacement, velocity and acceleration at any point in amoving link.
- To given idea about theory of gears, gear trains, cams and brakes.

UNIT I BASICS OF MECHANISMS 9

Definitions - Link, Kinematic pair, Kinematic chain, Mechanism and Machine.Degree of Freedom - Mobility - Kutzbach criterion (Gruebler's equation) -Grashoff's law -Kinematic Inversions of four-bar chain and slider crank chain. Description of common Mechanisms Pantograph, Straight line generators (Peaucellier and Watt mechanisms), Steering gear for automobile, Hooke's joint, Toggle mechanism, Ratchets and escapements - Indexing Mechanisms.

UNIT II KINEMATIC ANALYSIS 9

Analysis of simple mechanisms (Single slider crank mechanism, four bar mechanism and Toggle mechanism) - Graphical Methods for displacement, velocity and acceleration - Shaping machine mechanism -Computer applications in the kinematics analysis of simple mechanisms.

UNIT III KINEMATICS OF CAMS 9

Classifications - pressure angle - undercutting. Displacement diagrams -Uniform velocity, uniform acceleration and retardation, Simple harmonic and Cycloidal motions - Graphical construction of displacement diagrams and Layout of plate cam profiles for differenttypes of followers - knife edged, roller, mushroom, flat type

UNIT IV GEARS 9

Classification of gears - Gear tooth terminology- Spur gear terminology and definitions - Fundamental Law of toothed gearing and involute gearing - Length of path of contact and contact ratio - Interference and undercutting. Helical, rack and pinion gears (basics only).

UNIT V GEAR TRAIN 9

Gear trains - Simple, compound and Epicyclic gear trains, Automotive transmission gear trains - Differentials.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze the functions of various mechanism like Degree of Freedom and its inversions. (Analyze)
2. Design the configuration, velocity and acceleration diagram for simple mechanisms through analytical method and modern tools. (Create)
3. Construct cams and followers for specified motion profile. (Apply)
4. Design solutions for spur gears for the given industrial problems. (Create)
5. Design suitable gear train for given industrial applications. (Create)

TEXT BOOKS:

1. Khurmi R.S, GupthaJ. K, “Theory of Machines”, S.Chand Company Ltd., Prentice Hall of India, Fourteenth Revised Edition, New Delhi, 2012.
2. Ramamurti. V, “Mechanism and Machine Theory”, Narosa Publishing House, SecondEdition, 2005.

REFERENCE BOOKS:

1. Thomas Bevan, “Theory of Machines”, CBS Publishers and Distributors, 1984.
2. Uicker J.J, Pennock G.R, Shigley J.E, “Theory ofMachines and Mechanisms”, (Indian edition) OxfordUniversity Press, 2003.
3. Ghosh A, Mallick.A.K, “Theory of Mechanisms and Machines”, Affiliated East- West Pvt. Ltd, New Delhi, 1998.
4. Rao J.S, Dukkipati R.V, “Mechanism and Machine Theory”, Wiley-Eastern Ltd, New Delhi, 1992.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3	2											
CO.2	3	3	3		3								3	
CO.3	3									3		3		
CO.4	3		3									3		
CO.5	3	3	3											3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME402	3	3	2			2	3	3		2		3	3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME403	MANUFACTURING TECHNOLOGY – II	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the concept and basic mechanics of metal cutting, working of standard machine tools.
- To impart knowledge on the basic concepts of computer numerical control (CNC) machine tooland CNC programming.

UNIT I THEORY OF METAL CUTTING 9

Introduction: material removal processes, mechanics of metal cutting and types of machine tools - theory of metal cutting: chip formation, orthogonal cutting and oblique cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids, merchant's equation, heat generation, cutting tool life - recent developments and applications (Dry machining and high speed machining).

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 9

Centre lathe, constructional features, Single point cutting tool geometry, various operations,taper turning methods, thread cutting methods, special attachments, machining time andpower estimation. Capstan and turret lathes - automats - single spindle-Swiss type, automaticscrew type, multi spindle - Turret Indexing mechanism, Bar feed mechanism.

UNIT III OTHER MACHINE TOOLS 9

Reciprocating machine tools: shaper, planer, slotter - Milling : types, milling cutters, operations - Hole making - drilling - Quill mechanism , Reaming, Boring, Tapping - Sawing machine - hack saw, band saw, circular saw; broaching machines - broach construction - push,pull, surface and continuous broaching machines.

UNIT IV ABRASIVE PROCESSES AND GEAR CUTTING 9

Abrasive processes: grinding wheel - specifications and selection, types of grinding process - cylindrical grinding, surface grinding, centreless grinding - honing, lapping, super finishing,polishing and buffing - Gear cutting, forming, generation, shaping, hobbing.

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING 9

Numerical control (NC) machine tools - CNC types, constructional details, specialfeatures - design considerations of CNC machines for improving machining accuracy - structural members - slide ways - linear bearings - ball screws - spindle drives and feed drives.Part programming fundamentals - manual programming.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of metal cutting for various industrial applications for better tool life and surface finish. (Apply)
2. Select suitable machining operations, using the working principles of centre lathe and special purpose lathe for manufacturing various components. (Apply)
3. Select suitable machining operations, using the working principles of various types of machine tools for manufacturing various components. (Apply)
4. Apply the knowledge of abrasive processes and gear cutting, for better surface finish and gear manufacturing. (Apply)
5. Develop part programming for CNC machines using NC codes for different components. (Apply)

TEXT BOOKS:

1. HajraChoudry, "Elements of Work Shop Technology – Vol. II ", Media Promoters, 2002.
2. Rao. P.N, "Manufacturing Technology ", Tata McGraw-Hill, New Delhi, 2003.

REFERENCE BOOKS:

1. Rao.P.N, "CAD/CAM Principles and Applications ", TATA Mc Craw Hill, 2007.
2. Groover.M.P, ZimersJr, "CAD/CAM ", Prentice Hall of India Ltd, 2004.
3. Vijayaraghavan.G.K, Rajappan.R, "Manufacturing Engineering and Technology-II ", A.R. Publications,Sixth Edition, Chennai2010.

4.Rajput R.K, "A text book of Manufacturing Technology ", Lakshmi Publications, 2007.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2												3	
CO.2	2												3	
CO.3	2												3	
CO.4	2												3	
CO.5	2				3			2		3			3	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME403	2				3			2		3			3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME404	THERMAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the concepts, laws and different gas power cycles.
- To impart knowledge on the working principles of IC engines, Steam Turbines, Compressors, Refrigeration and Air conditioning systems.

PREREQUISITE : ENGINEERING THERMODYNAMICS

UNIT I GAS POWER CYCLES 9

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency.

UNIT II INTERNAL COMBUSTION ENGINES 9

Classification - Components and their function, Carburetor system, Diesel pump and injector system, Ignition Systems, Lubrication system and Cooling system.

UNIT III STEAM NOZZLES AND TURBINES 9

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio,supersaturated flow, Impulse and Reaction principles, compounding, velocity diagram forsimple and multi-stage turbines, speed regulations - Governors.

UNIT IV AIR COMPRESSOR 9

Classification and working principle of various types of compressors, work of compressionwith and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropicefficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor.

UNIT V REFRIGERATION AND AIR CONDITIONING 9

Vapour compression refrigeration cycle, vapour absorption system, Alternate refrigerants - Air conditioning system - Types, Concept of RSHF, GSHF, ESHF

TOTAL : 45 PERIODS

NOTE: Use of Steam Table, Refrigeration table, Mollier Chart, Psychrometric Chart are permitted in theEnd Semester Examination.

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze the various gas power cycles by applying the knowledge of thermodynamics. (Analyze)
2. Apply the knowledge of various I.C. engine components for the effective function of automobile. (Apply)
3. Analyze the performance of steam nozzle and turbine by applying the knowledge of properties of steam. (Analyze)
4. Analyze the performance of air compressors by applying the knowledge of various compression processes. (Analyze)
5. Identify the suitable refrigeration and air conditioning system for a requirement by considering the environmental issues. (Apply)

TEXT BOOKS:

1. Sarkar.B.K, “Thermal Engineering ”, Tata McGraw-Hill, 2007.
2. Kothandaraman.C.P, Domkundwar.S, Domkundwar.A.V, “A course in thermal engineering ”, DhanpatRai&sons, Fifth edition, 2002.

REFERENCE BOOKS:

1. Rajput. R. K, “Thermal Engineering ”, S.Chand Publishers,2000.
2. Arora.C.P, “Refrigeration and Air Conditioning ”, Tata McGraw-Hill Publishers, 1994.
3. Ganesan. V, “Internal Combustion Engines ”, Tata Mcgraw-Hill, Third Edition, 2001.
4. Rudramoorthy. R, “Thermal Engineering ”, Tata McGraw-Hill, New Delhi, 2003.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3								2		3		3
CO.2	3					2	2					3		3
CO.3	3	3	2					3					3	
CO.4	3	3	2											2
CO.5	3	3	2			2	3					3	3	3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME404	3	3	2			2	3	3		2		3	3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME405	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart knowledge of simple stresses, strains and deformation in components due to external loads.
- To familiarize the student to calculate stresses, deflections and torsion for beams, twisting bars or combinations of both.

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS 9

Rigid and Deformable bodies - Strength, Stiffness and Stability - Stresses Tensile, Compressive and Shear - Deformation of simple and compound bars under axial load -Stress and strain due to axial force, elastic limit, Hooke's law-factor of safety - stepped bars, uniformly varying sections, stresses in composite bar due to axial force and temperature. Strain Energy due to axial force- proof resilience, stresses due to gradual load, sudden load and impact load. Thermal stress - Elastic constants - Strain energy and unit strain energy - Strain energy in uniaxial loads.

UNIT II SHEAR FORCE AND BENDING MOMENT 9

Types of beams - Supports and Loads - Shear force and Bending Moment in beams - Cantilever Simply supported and Overhanging beams - Stresses in beams - Application to simple problems; Bending moment and shear force diagram of a typical shaft elastic in stability.

UNIT III TORSION 9

Analysis of torsion of circular bars - Shear stress distribution - Bars of Solid and hollow circular section - Stepped shaft - Twist and torsion stiffness - Compound shafts - Fixed and simply supported shafts - Application to close-coiled helical springs - Maximum shear stress in spring section including Wahl Factor - Deflection of helical coil springs under axial loads - Design of helical coil springs - stresses in helical coil springs under torsion loads.

UNIT IV COLUMN 9

Columns - End conditions - Equivalent length of a column - Euler equation - Slenderness ratio - Rankine formula for columns.

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS 9

Biaxial state of stresses - Thin cylindrical and spherical shells - Deformation in thin cylindrical and spherical shells –Thick cylinders and spheres- Biaxial stresses at a point - Stresses on inclined plane Principal planes and stresses - Mohr’s circle for biaxial stresses - Maximum shear stress.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the principles of solid mechanics, to determine the mechanical behavior of machine members and structures for the applied load. (Apply)
2. Analyze the resistance offered by the beam by constructing shear force and bending moment diagrams and solve practical problems in real world scenario. (Analyze)
3. Analyze torque and shear stress distribution for Shafts and Deflection for Springs. (Analyze)
4. Analyze columns and struts with different end conditions using Euler's and Rankine's method (Analyze)
5. Analyze the deformation behavior for thin, thick cylinders and spheres and the principal stresses for a component using analytical & graphical method (Analyze)

TEXT BOOKS:

1. Ramamrutham.S, Narayanan.R, "Strength of Materials", DhanpatRai Publishing Company (P) Ltd, New Delhi, 2012.
2. Dr.Bansal.R.K,"Strength of Materials", Laxmipublications,Fifthedition ,Chennai,2013.

REFERENCE BOOKS:

1. Beer F. P, Johnston R, "Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.
2. Ryder G.H, "Strength of Materials", Macmillan India Ltd, Third Edition, 2002.
3. Ray Hulse, Keith Sherwin, Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2004.
4. Timoshenko S.P, "Elements of Strength of Materials", Tata McGraw-Hill, New Delhi, 1997.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3												2	
CO.2	3	3	2			2				2			2	
CO.3	3	3	2										2	2
CO.4	3	3											2	
CO.5	3	3								3			2	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME405	3	3	2			2				3			2	2

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME406	MACHINE DRAWING	L	T	P	C
		2	2	0	3

OBJECTIVES :

- To familiarize the fundamentals of Types of fits used, limits and tolerances of dimensions and surface finish methods which are to be used in industrial drawing
- To impart knowledge on the production and the assembly process without wastage of Man/Machine and Materials to have economical overall process.

UNIT I SECTIONAL VIEWS 6

Review of sectioning - Conventions showing the section - symbolic representation of cutting plane- types of section - full section, half section, offset section, revolved section, broken section, removed section – section lining.

UNIT II LIMITS FITS TOLERANCES AND SURFACE TEXTURE 6

Tolerances - Allowances - Unilateral and Bilateral tolerances.Limits - Methods of tolerances - Indication of tolerances on linear dimension of drawings - Geometrical tolerances - application - Fits - Classifications of fits - Selection of fits - examples.Surface texture - importance - controlled and uncontrolled surfaces - Roughness - Waviness - lay - Machining symbols.

UNIT III KEYS, SCREW THREADS AND THREADED FASTENERS 6

Types of fasteners - temporary fasteners - keys - classification of keys - Heavy duty keys - light duty keys. Screw thread - Nomenclature - different types of thread profiles - threads in sections - threaded fasteners - bolts - nuts - through bolt - tap bolt, stud bolt - set screw - cap screws - machine screws -foundation bolts.

UNIT IV MANUAL DRAWING PRACTICE – I (Joints and Couplings) 6+15

Detailed drawings of following joints are given to students to assemble and draw the sectional or plain elevations / plans / and side views with dimensioning and bill of materials.Sleeve & Cotter joint -Spigot & Cotter joint- Knuckle joint -Universal Coupling- Protected type flanged coupling.

UNIT V MANUAL DRAWING PRACTICE –II (Machine components) 6+15

Detailed drawings of following machine parts are given to students to assemble and draw the sectional or plain elevations / plans / and side views with dimensioning and bill of materials. Screw Jack- Stuffing Box -Foot step bearing-Plummer Block-Swivel Bearing-Simple Eccentric-Machine Vice-Connecting Rod-Tail Stock.

TOTAL 30(L) + 30(T) = 60 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of sectional views to identify interior parts of the components. (Apply)
2. Apply the knowledge of different types of limits, fits, tolerance and surface texture for various types of machine parts. (Apply)
3. Apply the design principles for drawing of mechanical components like keys, screw threads and threaded fasteners. (Apply)
4. Analyze the given mechanical components and develop the assembly drawings for various machine parts like Sleeve & Cotter joint ,Spigot & Cotter joint, Knuckle joint, Universal Coupling, Protected type flanged coupling.(Analyze)
5. Analyze the given mechanical components and assemble them into a mechanical assembly. (Analyze)

TEXT BOOKS:

1. Gopalakrishna K R, "Machine Drawing", Seventeenth Edition, Subhas Stores, Bangalore, 2003.
2. Gupta.R.B , “A Text book of Engineering Drawing ”, Technical India Publications, 2007.

REFERENCE BOOKS:

1. Diwan.R.K, “A Text book of Machine Drawing ”, S.Chand limited,1998
2. Sadhu singh, sah.P.L, “Fundamentals of machine drawing ”, PHI learning private limited, 2013.
3. Narayana.K.L, Dr.P.Kannaiah,K.Venkata Reddy “Machine Drawing ”,McGraw- Hill, 1998.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3							2		3			3	
CO.2	3							2		3				
CO.3	3							2		3				
CO.4	3	2						2		3			3	3
CO.5	3	2						2		3			3	3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME406	3	2						2		3			3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

QUESTION PATTERN

S.NO	PARTICULARS	MARKS
1	PART – A (20 MARK) EITHER OR PATTERN ONE QUESTION FROM EACH UNIT - 1 and 21*20	20
2	PART – A (20 MARKS) EITHER OR PATTERN ONE QUESTION FROM UNIT – 31*20	20
3	PART – B (60 MARKS) EITHER OR PATTERN ONE QUESTION FROM EACH UNIT - 4 and 51*60	60
TOTAL		100

15UME407	I.C ENGINE AND STEAM LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To study the engine components and working principles of SI and CI engines.
- To study the performance characterization of diesel and petrol engines.
- To study the performance of steam generator and steam turbine.

LIST OF EXPERIMENTS :

I.C ENGINE AND STEAM LABORATORY **30**

1. Study of I.C engine components and its working.
2. Study of the working principles of SI and CI engines.
3. Study of steam generators and turbines.
4. Determination of Valve TimingDiagrams.
5. Determination of Port Timing Diagrams.
6. Performance Test on 4-stroke Diesel Engine with mechanical loading.
7. Heat Balance Test on 4-stroke Diesel Engine.
8. Performance Test on Petrol Engine.
9. Performance test on 4 stroke diesel engine with eddy current dynamometer.
10. Performance test on 4-stroke by variable Compression ratio Diesel Engine.
11. Determination of exhaust emissions from 4-stroke Diesel Engine using exhaust gas analyzer.
12. Determination of smoke opacity from 4-stroke Diesel Engine using smoke meter.
13. Performance and energy balance test on a steam generators.
14. Performance and energy balance test on steam turbine.

A minimum of nine experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Demonstrate the components of IC engines and explain their functions. (Understand)
2. Draw the valve timing, port timing diagram of given IC engines. (Understand)
3. Investigate the fuel properties and engine performance in different I.C engines (Evaluate)
4. Make use of Exhaust analyzer and smoke meter to determine the various pollutants level for different fuels. (Apply)
5. Calculate the performance parameters of steam generators/turbines. (Apply)
6. Accomplish emission test using gas analyzer and smoke meter for a diesel engine to enhance its performance. (Apply)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment	Quantity required
1.	I.C Engine – 2 stroke and 4 stroke model	1 set
2.	Red Wood Viscometer	1 No.
3.	Apparatus for Flash and Fire Point	1 No.
4.	4-stroke Diesel Engine with mechanical loading.	1 No.
5.	4-stroke Diesel Engine with hydraulic loading.	1 No.
6.	4-stroke Diesel Engine with electrical loading.	1 No.
7.	Multi-cylinder Petrol Engine	1 No.
8.	Single cylinder Petrol Engine	1 No.
9.	Data Acquisition system with any one of the above engines	1 No.
10.	Steam Boiler with turbine setup.	1 No

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2							2	3				2	3
CO.2	2							2	3				2	3
CO.3	3	2		3				2	3					3
CO.4	3	2			3	2	3	2	3				2	3
CO.5	3	2						2	3				2	3
CO.6	3							3	3				1	3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME407	3	2		3	3	2	3	3	3				2	3

Ref: 3 - Strong 2 - Medium 1 – Weak

15UME408	MANUFACTURING TECHNOLOGY LABORATORY - II	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To train the various metal cutting operations using machine tools.
- To demonstrate the operation of shapers, lathes, grinding machine, and gear hobbing machine.

LIST OF EXPERIMENTS : **30**

1. One exercise in Metal Cutting Experiment (Example:Cutting Force.)
2. One or More Exercises in Shaper, Slotter,Drilling, Milling Machines (Example: V block, Internal keyway cutting in Slotter, Drilling and tapping in Drilling machine, Gear Milling in Milling machine.)
3. One or Two Exercises in Grinding / Abrasive machining (Example: Surface Grinding, Cylindrical Grinding.)
4. One Exercise in Assembly of Machined Components for different fits. (Example: Parts machined using Lathes)
5. One Exercises in Capstan or Turret Lathes.
6. Study of Gear Machining in gear Hobbingmachine.

A minimum of nine experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of manufacturing technology to find cutting force and thrust force with tool dynamometer.(Apply)
2. Make a job for the required shape and size with the application of shaper, slotter, and drilling machine. (Apply)
3. Apply the knowledge of machining process to make the components for assembly. (Apply)
4. Apply the concept of milling machine indexing mechanism to make a spur gear. (Apply)
5. Make use of capstan lathe to produce a job for the given dimension. (Understand)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment	Quantity required
1.	Centre Lathe	2
2.	Capstan & Turret Lathe	1
3.	Horizontal Milling Machine	1
4.	Surface Grinding Machine	1
5.	Cylindrical Grinding Machine	1
6.	Shaping Machine	2
7.	Slotting Machine	1
8.	Planer	1
9.	Radial Drilling Machine	1
10.	Tool Dynamometer	1
11.	Gear Hobbing Machine	1

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3								3	2			3	2
CO.2	3								3	2			3	2
CO.3	3							2	3	3			3	2
CO.4	3							3	3	2			3	2
CO.5	2								3	2			3	2

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME408	3							3	3	3			3	2

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME409	MATERIAL TESTING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To impart practical knowledge on experimentally test the tension, shear, torsion, deflection and hardness for different materials.
- To demonstrate the strain measurement, tempering and microscopic examination.

LIST OF EXPERIMENTS : **30**

1. Tension test on a mild steel rod.
2. Double shear test on Mild steel specimen.
3. Torsion test on mild steel rod.
4. Impact test on metal specimen.
5. Hardness test on metals - Brinnell Hardness Number.
6. Hardness test on metals – Rockwell Hardness Number.
7. Deflection test on beams.
8. Compression test on helical springs.
9. Tension test on helical springs.
10. Effect of hardening- Improvement in hardness and impact resistance of steels.
11. Study Experiment in Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen.
    (ii) Quenched Specimen.
    (iii) Quenched and tempered specimen.

A minimum of nine experiments shall be offered

TOTAL:30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Calculate the modulus and shear strength for the given mild steel specimen by performing tensile test, shear test and deflection test. (Apply)
2. Calculate the modulus of rigidity of helical spring using spring testing machine for compressive and tensile loads. (Apply)
3. Find the modulus of rigidity of the given material using torsion testing machine. (Apply)
4. Make use of Charpy and Izod testing machine to measure the impact strength of the given material. (Apply)
5. Experiment with Brinnell and Rockwell hardness test to determine the hardness of the given specimen. (Apply)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment	Quantity required
1.	Universal Tensile Testing machine with double	1 No.
2.	Shear attachment – 40 Ton Capacity	1 No.
3.	Torsion Testing Machine (60 NM Capacity).	1 No.
4.	Impact Testing Machine (300 J Capacity).	1 No.
5.	Brinell Hardness Testing Machine	1 No.
6.	Rockwell Hardness Testing Machine	1 No.
7.	Spring Testing Machine for tensile and compressive loads (2500 N)	1 No.
8.	Muffle Furnace (800 °C)	1 No.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3				2			2	3	2			2	2
CO.2	3							2	2				2	2
CO.3	3							2	2				2	2
CO.4	3			2				2	2				2	2
CO.5	3			2				2	2					

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME409	3			2	2			2	3	2			2	2

Ref: 3 - Strong 2 - Medium 1 - Weak

SEMESTER V

Semester – V

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	PC	15UME501	Dynamics of Machinery	3	0	0	3
2.	PC	15UME502	Engineering Materials and Metallurgy	3	0	0	3
3.	PC	15UME503	Design of Machine Elements	3	0	0	3
4.	PC	15UME504	Operations Research	3	0	0	3
5.	PE	E 1	Professional Elective - I	3	0	0	3
6.	PE	E 2	Professional Elective - II	3	0	0	3
7.	PC	15UME507	CAD/CAM Laboratory	0	0	2	1
8.	PC	15UME508	Dynamics Laboratory	0	0	2	1
9.	PC	15UME509	Metallurgy Laboratory	0	0	2	1
Total Credits : 21				**18**	**0**	**6**	**21**

15UME501	DYNAMICS OF MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the method of static force analysis and dynamic force analysis of mechanisms.
- To impart knowledge in the concept of vibratory systems and their analysis.

UNIT I FORCE ANALYSIS AND FLYWHEELS 9

Static force analysis of mechanisms - D ' Alembert's principle - Inertia force and Inertia torque - Dynamic force analysis - Dynamic Analysis in Reciprocating Engines - Bearing loads - Crank shaft Torque - Engine shakingForces - Turning moment diagrams - Flywheels of engines and punch press.

UNIT II BALANCING 9

Static and dynamic balancing - Balancing of rotating masses - Balancing a singlecylinder Engine - Primary and secondary unbalanced forces - Balancing Multi-cylinder Engines.

UNIT III FREE VIBRATION 9

Basic features of vibratory systems - Degrees of freedom - Single degree of freedom - Free vibration - natural frequency - Types of Damping - Damped free vibration - Whirling of shafts andcritical speed - Torsional systems; Natural frequency of two and three rotor systems.

UNIT IV FORCED VIBRATION 9

Response to periodic forcing - Harmonic Forcing - Forced vibration caused byunbalance - Support motion - Force transmissibility and amplitude transmissibility -Vibration isolation.

UNIT V MECHANISMS FOR CONTROL 9

Governors - Types - Centrifugal governors - Gravity controlled and spring controlledgovernor Gyroscopes - Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in ships.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze the static and dynamic forces, torque, turning moment of mechanical systems for various industrial applications. (Analyze)
2. Categorize the balancing concepts to solve the problems related to rotating and reciprocating masses. (Analyze)
3. Design the free vibration and damping system for mechanical systems. (Analyze)
4. Analyze the frequency of under damped forced vibration systems, vibration isolation and transmissibility for given system. (Analyze)
5. Solve the problems in control mechanism of governors and gyroscope. (Apply)

TEXT BOOKS:

1. Rattan.S.S, “Theory of Machines”, Tata McGraw Hill, Fourth Edition, New Delhi, 2014.
2. Khurmi.R.S, Gupta.J.K, “Theory of Machines”, Eurasia Publishing House, 14thedition,2015.

REFERENCE BOOKS:

1. Shigley J.E, Uicker J.J, “Theory of Machines and Mechanisms”, Oxford press, Fourth edition, 2014.
2. Sadhu Singh, “Theory of Machines”, Pearson Education, 2002.
3. Ghosh.A,Mallick A.K, “Theory of Mechanisms and Machines”, Affiliated East- West Press Pvt. Ltd, New Delhi, 1998.
4. RaoJ.S,Dukkipati R.V, “Mechanism and Machine Theory”, Wiley-Eastern Limited,New Delhi, 1998.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3											3	
CO.2	3	3												
CO.3	3	3	3											
CO.4	3	3												2
CO.5	3													

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME501	3	3	3										3	2

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME502	ENGINEERING MATERIALS AND METALLURGY	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.
- To explain the various tests and experiments available to improve the quality characteristics.

REVIEW (NOT FOR EXAM):

Crystal structure - BCC, FCC and HCP structure - unit cell - crystallographic planes and directions, miller indices - crystal imperfections, point, line, planar and volume defects - Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys - Solid solutions, substitution and interstitial - phase diagrams, Isomorphous, eutectoid, eutectic, peritectic, and peritectroid reactions, Iron - Iron carbide equilibrium diagram. Classification of steel and cast Iron, microstructure, properties and applications.

UNIT II HEAT TREATMENT 9

Definition - Full annealing, stress relief, recrystallization and spheroidizing-normalizing, hardening and tempering of steel. Isothermal transformation diagrams - cooling curves superimposed on I.T. diagram, CCR – Hardenability -Austempering, martempering- case hardening - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening.

UNIT III MECHANICAL PROPERTIES AND TESTING 9

Mechanism of plastic deformation, slip and twinning - Types of fracture - Testing of materials under tension, compression and shear loads - Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, S-N curves Fatigue and creep tests, fracture toughness tests.

UNIT IV FERROUS AND NON FERROUS METALS 9

FERROUS MATERIAL: Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti &W) - stainless and tool steels - HSLA - maraging steels – Cast Irons - Grey, White malleable, spheroidal - Graphite, Alloy cast irons.

NON FERROUS MATERIALS: Copper and Copper alloys - Nickel, Magnesium, Titanium, Lead, Tin. Important alloys - their composition properties and applications of Brass, Bronze and Cupronickel - Aluminum and Al-Cu alloy.

UNIT V NON-METALLIC MATERIALS **9**

Polymers - types of polymer, commodity and engineering polymers - Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK,PTFE Polymers - Urea and Phenol Formaldehydes - Engineering Ceramics – Introduction to Fiber reinforced plastics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of phase diagrams to interpret the microstructure of different types of alloys. (Apply)
2. Identify and analysis the heat treatment process for different applications and explain TTT and CCT diagrams. (Apply)
3. Analyze the various testing methods to study the mechanical properties and fracture mechanism. (Analyze)
4. Demonstrate the properties & application of Ferrous and Non-Ferrous materials. (Apply)
5. Interpret the properties and application of non-metallic materials. (Apply)

TEXT BOOKS:

1. Kenneth G Budinski, Michael K.Budinski, "Engineering Materials", Prentice-Hall of India Private Limited, 4th Indian Reprint,2002.
2. William DCallister, "Material Science and Engineering", John Wiley and Sons, 2007.

REFERENCE BOOKS:

1. Srinivasan. R, "Engineering Materials and Metallurgy", Tata McGraw-Hill Publishing Limited, 2013.
2. Raghavan. V, "Materials Science and Engineering," Prentice Hall of India Pvt., Ltd, 2007.
3. Sydney H. Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 2007.
4. O.P. Khanna, "A text book of Materials Science and Metallurgy", Khanna Publishers, 2003.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2								3			3	
CO.2	3				3								3	
CO.3	3	2			3								3	
CO.4	3												3	3
CO.5	3												3	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME502	3	2			3					3			3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME503	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the students about various steps involved in the Design Process.
- To explain the principles involved in evaluating the shape and dimensions of acomponent to satisfy functional and strength requirements.

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINEMEMBERS 9

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties - Direct, Bending and torsional stress equations - Impact and shock loading - calculation of principle stresses for various load combinations, eccentric loading - Design of curved beams - crane hook and 'C' frame - Factor of safety - theories of failure – stress concentration - design for variable loading -Soderberg, Goodman and Gerber relations.

UNIT II DESIGN OF SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed - Design of keys, key ways and splines - Design of crankshafts - Design of rigid and flexible couplings.

UNIT III DESIGN OF TEMPORARY AND PERMANENT JOINTS 9

Threaded fasteners - Design of bolted joints including eccentric loading, Knuckle joints, and Cotter joints – Design of welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS 9

Design of various types of springs, optimization of helical springs - rubber springs - Design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT V DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS 9

Sliding contact and rolling contact bearings - Design of hydrodynamic journal bearings, McKee's Equation. Sommerfield Number, Raimondi & Boyd graphs - Selection of Rolling Contact bearings - Design of Seals and Gaskets - Design of Connecting Rod.

TOTAL : 45 PERIODS

Note: Use of P S G Design Data Book is permitted in the End Semester examination.

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of basic design concepts to solve the problems under steady and variable stresses developed in the machine members. (Apply)
2. Design the couplings and shafts based on the various types of the stress developed. (Create)
3. Design temporary and permanent joints for mechanical assembly. (Create)
4. Design Energy Storing Elements for various applications with safety consideration. (Create)
5. Design bearings, seals gaskets and connecting rods for various applications. (Create)

TEXT BOOKS:

1. Shigley J.E, Mischke C. R, "Mechanical Engineering Design", Tata McGraw-Hill, Sixth Edition,2003.
2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill, Second Edition, 2007.

REFERENCE BOOKS:

1. Khurmi.R.S, Gupta.J.K, "Machine Design ", Eurasia Publishing House , 2005.
2. Sundararajamoorthy T. V, Shanmugam .N, " Machine Design ", Anuradha Publications,Chennai,2003.
3. Orthwein W, "Machine Component Design", Tata McGraw-Hill, New Delhi, 2003.
4. Ugural A.C, "Mechanical Design – An Integral Approach", McGraw-Hill Book Co, 2004.

STANDARDS:

- IS 10260: Part 1: 1982 Terms, definitions and classification of Plain bearings Part 1: Construction.
- IS 10260: Part 1: 1982 Terms, definitions and classification of Plain bearings Part 2: Friction and Wear.
- IS 10260: Part 1: 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2				2	2	3					3	
CO.2	3	3	3			2	2	3					3	
CO.3	3	3	3			2	2	3					3	3
CO.4	3	3	3			2	2	3						3
CO.5	3	3	3			2	2	3					3	3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME503	3	3	3			2	2	3					3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME504	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize knowledge about optimization and utilization of resources.
- To impart knowledge on operations research techniques in industrial operations.

UNIT I INTRODUCTION 9

Introduction to OR-Meaning and scope –characteristics - modes in OR LPP-formulation graphical method-simplex method-Big M method application in business- merits and demerits.

UNIT II TRANSPORTATION AND ASSIGNMENT MODEL 9

Transportation model- basic feasible solution- formulation solving a TP. Assignment models-formulation- solution. Sequencing Problems – Processing 'n' jobs through two machines and three machines.

UNIT III NETWORK MODEL 9

Network models – Basic Concepts – Construction of Networks – Project Network – CPMand PERT –Shortest route – Minimal spanning tree and Maximum flow.

UNIT IV INVENTORY AND REPLACEMENT MODEL 9

Types of Inventory- EOQ – ERL- Deterministic inventory problems -Price breaks - Selective inventory control techniques. Replacement of items that deteriorate with time - value of money changing with time - not charging with time -optimum replacement policy - individual and group replacement.

UNIT V QUEUING THEORY AND GAME THEORY 9

Queuing models – queuing systems and structures – notation –parameter – single server and multiserver models – Poisson input – exponential service – constant rate service – infinite population. Game theory -two person zero-sum games, maximin – minimax principle- saddle point –value of the game. Mixed –pure strategies, Dominance property- arithmetic method-graphical method – Simulation.

TOTAL : 45PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze the optimum solution of Linear Model by applying the knowledge of Simplex and Graphical method.(Analyze)
2. Analyze the optimum solution of Transportation and Assignment problems.(Analyze)
3. Analyze the optimum solution of network model by applying the knowledge of various mathematical techniques. (Analyze)
4. Analyze the various replacement and inventory problems of manufacturing sector. (Analyze)
5. Examine various queuing and game theory problems to find optimal solution. (Analyze)

TEXT BOOKS:

1. Sundaresan.V, Ganapathy Subramanian .K.S, Ganesan.K, "Resource Management Techniques (Operations Research)", AR Publications, 10th edition, 2016.
2. Taha H.A, "Operation Research",Pearson Education,Sixth Edition,2003.

REFERENCE BOOKS:

1. Srinivasan.G, "Operations research principles and applications", PHI (EEE), 2007.
2. Wayne.L.Winston, "Operations research applications and algorithms", Thomson learning, Fourth Edition,2007.
3. Panneerselvam, "Operations Research", Prentice Hall of India, 2003.
4. Hira and Gupta "Problems in Operations Research", S.Chand and Co, 2002.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3									2			
CO.2	3	3											3	
CO.3	3	3				2					3	2	2	2
CO.4	3	3									3		3	
CO.5	3	3											2	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME504	3	3				2					3	2	3	2

Ref: 3 - Strong 2 - Medium 1 – Weak

15UME507	CAD/CAM LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To demonstrate the knowledge on interpret drawings of machine components and assembly drawings using standard CAD packages.
- To train the students in the Indian standards on drawing practices and standard components.

LIST OF EXPERIMENTS :

ASSEMBLY DRAWING (USING APPLICATION PACKAGES) **20**

1. Preparation of assembled views ofshaft coupling
2. Preparation of assembled views of Plummer block
3. Preparation of assembled views of Screw jack
4. Preparation of assembled views of Universal Joint
5. Preparation of assembled views of Stuffing box

CAM **10**

1. Develop CNC program for step turning and generate the tool path simulation.
2. Develop CNC program for multiple turning and generate the tool path simulation.
3. Develop CNC program for grooving and generate the tool path simulation.
4. Develop CNC program for drilling and generate the tool path simulation.
5. Develop CNC program for rectangular and circular pocketing and generate the tool path simulation.
6. Machine simple components using CNC milling and turning

A minimum of nine experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of cad software for different part drawing. (Apply)
2. Select and apply the latest cad software CERO for assembly drawing. (Apply)
3. Generate the bill of Materials from the assembly view of the components. (Understand)
4. Explain the various functions of CNC Machine tools(Understand)
5. Select and apply the latest CAM software for CNC Part Programming Using Standard G and M Codes to run and simulate. (Apply)
6. Make a simple machining operation in CNC machine to produce simple components.

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment/software	Quantity required
1.	Computer Server	1
2.	A3 size plotter	1
3.	Laser Printer	1
4.	Trainer CNC Lathe	1
5.	Trainer CNC milling	1
6.	Computer system	30
7.	SOLIDWORKS /Auto CAD/Pro-E	30
8.	CAD/CAM software (Pro-E or IDEAS orUnigraphicsorCATIA	15
9.	CAM Software (CNC Programming and toolpathsimulation for FANUC /SinumericandHeiden controller)	15
10.	Licensed operating system	Adequate

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3				3				3	3		3	3	
CO.2	3	2	2		3				3	3		3	3	
CO.3	2	2	2						3	3		3	3	3
CO.4	2												3	
CO.5	3	2	2		3				3	3		3	2	
CO.6	3	2	2		3				3	3		3	2	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME507	3	2	2		3				3	3		3	3	3

Ref: 3 - Strong 2 - Medium 1 – Weak

15UME508	DYNAMICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To realize how certain measuring devices are used for dynamic testing.
- To demonstrate the operation of measuring devices used for dynamic testing.

LIST OF EXPERIMENTS : **30**

1. Determination of mass moment of inertia using connecting rod and flywheel.
2. Determination of mass moment of inertia using bifilar suspension.
3. Determination of mass moment of inertia using turn table apparatus.
4. Determine the characterization of Watt governor.
5. Determine the characterization of porter governor.
6. Determine the characterization of Proell governor.
7. Determine the characterization of Hartnell governor.
8. Determine the natural frequency of single rotor system.
9. Determine the natural frequency of two rotor system.
10. Determine the natural frequency of helical spring.
11. Determination of gyroscopic couple.
12. Balancing of rotating and reciprocating masses.
13. Determination of transmissibility ratio using vibrating table.

A minimum of nine experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of dynamics principles to find the moment of inertia for given object using oscillation method. (Apply)
2. Conduct experiments to analyze the Sensitiveness of the governors.(Apply)
3. Apply the knowledge of vibration to calculate the natural frequency of longitudinal and torsional vibrating systems.(Apply)
4. Examine the effect of the Gyroscopic Couple.(Create)
5. Demonstrate the experimental procedure to examine the unbalance forces in rotating and reciprocating masses.

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment/software	Quantity required
1.	Motorized gyroscope	1
2.	Governor apparatus	1
3.	Dynamic balancing of Rotating system	1
4.	Dynamic balancing of reciprocating system	1
5.	Vibrating table	1
6.	Compound pendulum attachment with flywheel & connecting rod	1
7.	Vibration test facilities apparatus.	1

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3								2					2
CO.2	3	3												3
CO.3	3								2					
CO.4	3	3	3						2					2
CO.5	2								2					

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME508	3	3	3						2					3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME509	METALLURGY LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To demonstrate about the structure of metals and alloys using metallurgical microscope.
- To train the practical exposure in preparation of specimens.

LIST OF EXPERIMENTS : **30**

1. Study of Metallurgical Microscope
2. Study of specimen preparation for metallographic studies
3. Draw the micro structure and identify the Gray cast iron, SG iron using Metallurgical Microscope
4. Draw the micro structure and identify the malleable cast iron using Metallurgical Microscope
5. Draw the micro structure and Identify the low carbon steel, medium carbon steel using Metallurgical Microscope
6. Draw the micro structure and Identify the high carbon steel, hardened and tempered steel using Metallurgical Microscope
7. Draw the micro structure and identify the case carburized steel, high speed steel using Metallurgical Microscope
8. Draw the micro structure and Identify the Austenitic stainless steelusing Metallurgical Microscope
9. Draw the micro structure and Identify theAl and Cu alloys using Metallurgical Microscope
10. Study of Muffle furnace and crucible furnace.
11. Study of High temperature tubular furnace.
12. Study of Jominy end quench test
13. Study of composite materials manufacturing method (Demo on hand layup method).

A minimum of nine experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Demonstrate the Metallurgical Microscope and to prepare the specimen for the metallographic Inspection. (Understand)
2. Identify the microstructures of various cast iron specimens.(Apply)
3. Identify the microstructures of various steel specimens. (Apply)
4. Identify the microstructures of various alloy specimens. (Apply)
5. Demonstrate the working and application of furnaces and Jominy end quench test. (Understand)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment/software	Quantity required
1.	LYZER Trinocular Co-Axial Metallurgical Microscope LT-22C With Metallographic Software With 2 MP USB Video Eye piece.	1
2.	KRISH Abrasive Cut Off Machine Open type	1
3.	KRISH Lineisher polisher model:KMT-02	1
4.	High Temperature Tubular furnance-1600 º C	1
5.	Speciman mounting press	1
6.	Jominy End Quench apparatus	1

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2							2	2					
CO.2	3				3				2					
CO.3	3				3				2					
CO.4	3				3				2					
CO.5	2													

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME509	3				3			2	2					

Ref: 3 - Strong 2 - Medium 1 - Weak

SEMESTER VI

Semester – VI

Sl. No	Course Category	Course Code	Course Name	L	T	P	C
1.	PC	15UME601	Design of Transmission Systems	3	0	0	3
2.	PC	15UME602	Engineering Metrology and Measurements	3	0	0	3
3.	PC	15UME603	Heat and Mass Transfer	3	0	0	3
4.	PE	E 3	Professional Elective - III	3	0	0	3
5.	PE	E 4	Professional Elective - IV	3	0	0	3
6.	OE	OE 1	Open Elective - I	3	0	0	3
7.	BS	15UGS531	Soft skills and communication Laboratory (Common to MECH, EIE, Civil, Chemical)	0	0	2	1
8.	P	15UME607	Technical Project	0	0	6	3
9.	PC	15UME608	Metrology and Measurements Laboratory	0	0	2	1
10.	PC	15UME609	Heat and Mass Transfer Laboratory	0	0	2	1
Total Credits : 24				**18**	**0**	**12**	**24**

15UME601	DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the principles and procedure for the design of power Transmission components.
- To impart knowledge on the design aspects of gear boxes, clutches and brakes.
- To familiarize the usage of standard data and catalogues.

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLEELEMENTS 9

Selection of V belts and pulleys - selection of Flat belts and pulleys - Wire ropes andpulleys - Selection of Transmission chains and Sprockets.Design of pulleys andsprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Gear Terminology-Speed ratios and number of teeth-Force analysis -Tooth stresses -Dynamic effects - Fatigue strength - Factor of safety - Gear materials - Module and Face width-power rating calculations based on strength and wear considerations Parallel axis Helical Gears Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces and stresses. Estimating the size of the helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number ofteeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits anddemerits-terminology. Thermal capacity, materials-forces and stresses, efficiency,estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV DESIGN OF GEAR BOXES 9

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design ofsliding mesh gear box – Constant mesh gear box – Design of multi speed gear box.

UNIT V DESIGN OF CAM CLUTCHES AND BRAKES 9

Cam Design: Types-pressure angle and under cutting base circle determination-forces andsurface stresses. Design of plate clutches –axial clutches-cone clutches-internal expandingrim clutches- Internal and external shoe brakes.

TOTAL :45PERIODS

Note: Use of P S G Design Data Book is permitted in the End Semester examination

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Create and design a suitable flexible transmission system using belt, chain and wire ropes for different applications. (Create)
2. Design the Spur gear and parallel axis Helical gears by considering strength and life for various field of mechanical engineering. (Create)
3. Create and design the Bevel, Worm and Cross Helical gears for various power transmission gear boxes. (Create).
4. Compile the various kinematic arrangements and design the Gear box for various speeds.(Create)
5. Estimate the power requirement for clutch, brakes and cam used in Automobiles. (Create)

TEXT BOOKS:

1. Dr.Mothilal.S, Venkatram.B, Eswaraprasath.N, Dinesh Kumar.N, "Design of Transmission systems ", Shanlax publications, Second Edition, Madurai, 2015.
2. Sundararajamoorthy.T.V, Shanmugam.N , " Machine Design ", Anuradha Publications , Chennai, 2003.

REFERENCE BOOKS:

1. Prabhu. T.J, "Design of Transmission Elements", Mani Offset,Chennai,2000.
2. Bhandari.V.B,"Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2005.
3. MaitraG.M,Prasad L.V, "Hand book of Mechanical Design ", Tata McGraw-Hill,New Delhi,1985.
4. Ugural A, C, "Mechanical Designan Integrated Approach", McGraw-Hill, 2003.

STANDARDS:

- IS 4460: Parts 1 to 3: 1995, Gears – Spur and Helical Gears – Calculation of Load Capacity.
- IS 7443: 2002, Methods of Load Rating of Worm Gears.
- IS 15151: 2002, Belt Drives – Pulleys and V-Ribbed belts for Industrial applications – PH, PJ, PK, PI and PM Profiles: Dimensions.
- IS 2122:Part 1: 1973, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 1 Flat Belt Drives.
- IS 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 2 V-Belt Drives.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3	3										3	
CO.2	3	3	3										3	
CO.3	3	3	3										3	
CO.4	3	3	3							3			3	3
CO.5	3	3	3										3	3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME601	3	3	3							3			3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME602	ENGINEERING METROLOGY AND MEASUREMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the basic principles of measurements.
- To impart knowledge in the various linear and angular measuring equipments.

UNIT I CONCEPT OF MEASUREMENT 9

General concept - Generalized measurement system-Units and standards-measuringinstruments: sensitivity, stability, range, accuracy and precision-static and dynamicresponse-repeatability-systematic and random errors-correction, calibration - Introduction to Dimensional and Geometric Tolerance – interchangeability.

UNIT II LINEAR AND ANGULAR MEASUREMENT 9

Definition of metrology-Linear measuring instruments Vernier, micrometer, Slip gaugesand classification - Tool Makers Microscope - interferometer, optical flats -Comparators: limit gauges Mechanical, pneumatic and electrical comparators, applications. Angular measurements -Sine bar, Sine center, bevel protractor and angle Decker.

UNIT III FORM MEASUREMENT 9

Measurement of screw threads: Thread gauges, floating carriage micrometer- measurementof gear tooth thickness constant chord and base tangent method-Gleason gear testingmachine - radius measurements-surface finish: equipment and parameters, straightness,flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY 9

Precision instruments based on laser-Principles - laser interferometer-application inmeasurements and machine tool metrology- Coordinate measuring machine (CMM): need,construction, types, applications. - Computer aided inspection.

UNIT V MEASUREMENT OF MECHANICAL PARAMETERS 9

Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Pressuremeasurement - Flow: Venturi, orifice, rotameter, and pitot tube - Temperature: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of metrology to identify the errors of measuring instruments. (Apply)
2. Identify the various linear and angular measuring instruments to use in appropriate places. (Apply)
3. Identify the suitable measuring instruments to measure various threads. (Apply)
4. Apply the knowledge of metrology to measure the dimensions of machine parts (Apply)
5. Apply the knowledge of metrology to measure the various mechanical parameters. (Apply)

TEXT BOOKS:

1. Jain R.K, “Engineering Metrology”, Khanna Publishers, 2009.
2. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997.

REFERENCE BOOKS:

1. Vijayaraghavan.G.K, Rajappan.R, “Engineering Metrology and Measurements”, A.R.S Publication, 2009
2. Gupta S.C, “Engineering Metrology”, Dhanpatrai Publications,2005.
3. Donald Deckman, “Industrial Instrumentation”, Wiley Eastern, 1985.
4. Jayal A.K, “Instrumentation and Mechanical Measurements”, Galgotia Publications, 2000.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2	2											3	
CO.2	2												2	
CO.3	2	2												
CO.4	2												2	
CO.5	2	2												

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME602	2	2											3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME603 **HEAT AND MASS TRANSFER**

L	T	P	C
3	0	0	3

OBJECTIVES :

- . To give knowledge on heat transfer processes
- To familiarize the student about practical heat transfer problems.
- To impart knowledge on the design aspect of heat transfer equipments and processes.

UNIT I CONDUCTION **9**

Basic Concepts - Mechanism of Heat Transfer - Conduction, Convection and Radiation - Fourier Law of Conduction - General Differential equation of Heat Conduction - Cartesian and Cylindrical Coordinates - One Dimensional Steady State HeatConduction - Conduction through Plane Wall, Cylinders and Spherical systems - Composite Systems - Conduction with Internal Heat Generation - Extended Surfaces - Unsteady Heat Conduction - Lumped Analysis - Use of Heislers Chart. Extended surfaces (fins)-numerical methods for varying sections of fins with different end conditions.

UNIT II CONVECTION **9**

Basic Concepts - Heat Transfer Coefficients - Boundary Layer Concept - Types ofConvection - Forced Convection - Dimensional Analysis - External Flow - Flow overPlates, Cylinders and Spheres - Internal Flow - Laminar and Turbulent Flow Combined Laminar and Turbulent - Flow over Bank of tubes - Free Convection - Dimensional Analysis Flow over Vertical Plate, Horizontal Plate, Inclined Plate,Cylinders and Spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS **9**

Types-tube arrangements, single and multi tube types, parallel, counter and cross flow-Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers - Heat Exchanger Analysis - LMTD Method and NTU – Effectiveness – Overall Heat Transfer Coefficient - Fouling Factors.

UNIT IV RADIATION **9**

Basic Concepts, Laws of Radiation - Stefan Boltzman Law, Kirchoff's Law –Black BodyRadiation - Emissive power, Grey body radiation, Radiation heat transfer betweensurfaces, -Shape Factor Algebra - Electrical Analogy - Radiation Shields –Introduction toGas Radiation.

UNIT V MASS TRANSFER **9**

Basic Concepts - Diffusion Mass Transfer - Fick's Law of Diffusion – Steady stateMolecular Diffusion - Convective Mass Transfer Rate equations. Mass diffusion in binarymixtures, evaporation in a column, forced convective mass transfer - Momentum, Heatand Mass Transfer Analogy - Convective Mass Transfer Correlations.

TOTAL : 45 PERIODS

NOTE: Use of Steam Table, HMT tableare permitted in the End SemesterExamination.

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze the Steady state and transient heat conduction problems for various thermal applications. (Analyze)
2. Apply the Knowledge of free and forced convection with the flow of fluids. (Apply)
3. Design the heat exchangers using LMTD and NTU method. (Create)
4. Analyze the heat transfer in radiation process and determine the factors affecting radiation. (Analyze)
5. Solve the problems involving mass transfer due to diffusion and convection. (Apply)

TEXT BOOKS:

1. Sachdeva R C, “Fundamentals of Engineering Heat and Mass Transfer”, New Age International, 1995.
2. Frank.P.Incropera, David P. DeWitt “Fundamentals of Heat and Mass Transfer”, John Wiley and Sons, 1998.

REFERENCE BOOKS:

1. Kothandaraman C.P, “Fundamentals of Heat and Mass Transfer”, New Age International,New Delhi, 1998.
2. Holman J.P, “Heat and Mass Transfer,” Tata McGraw-Hill, 2000.
3. Nag P.K, “Heat Transfer”,Tata McGraw Hill, New Delhi, 2002.
4. Yadav R, “Heat and Mass Transfer”, Central Publishing House, 1995.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3						2						
CO.2	3	2						2						2
CO.3	3	3	3					2					3	
CO.4	3	3						2						3
CO.5	3	2												

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME603	3	3	3					2					3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME607	TECHNICAL PROJECT	L	T	P	C
		0	0	6	3

OBJECTIVES :

- To make the student in integrated activities ofreading, research, discussion and presentation around a designated subject.
- To impart knowledge to implement their skills acquired in the previous semesters to practical problems.
- To familiarize the students to make fabrication work.

PROJECT DESCRIPTION:

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the memberof the faculty of the institution and if possible with an industry guide also.

The item chosen may be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.

The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

TOTAL: 90 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Identify the systematic way of organizing various resources for completing the project in time.
2. Implement most appropriate manufacturing processes for a specific task.
3. Build the proto type model for engineering applications.
4. Demonstrate the working of fabrication project.
5. Prepare and present the project along with report.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3				3							3	3
CO.2		3	3										3	3
CO.3				3	3								3	3
CO.4									3		3		3	3
CO.5										3			3	3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME607	3	3	3	3	3	3			3	3	3		3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

‘

15UME608	METROLOGY AND MEASUREMENT LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To demonstrate the students with the use of measurement instruments and their Characteristics.
- To train in calculating the analysis of uncertainty (error) in experimental data.

LIST OF EXPERIMENTS : **30**

1. Calibration of Verniercaliper usingslip gauge.
2. Calibration of Micrometer using Dial gauge
3. Calibration of Dial gauge using slip gauge.
4. Checking Dimensions of part using slip gauges.
5. Measurements of Gear Tooth Dimensions using gear tooth vernier& profile projector.
6. Measurement of Angle using sine bar.
7. Measurement of Angle using bevel protector.
8. Measurement of Angle using tool makers microscope.
9. Measurement of Temperature using Thermocouple.
10. Measurement of Displacement.
11. Measurement of Force
12. Measurement of Torque
13. Inspection of the component using different probe in CMM.
14. Study of straightness, flatness and thread parameters.

A minimum of nine experiments shall be offered

TOTAL:30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of metrology to calibrate the measuring instruments using slip gauges. (Apply)
2. Experiment with sine bar / tool makers microscope to find out the angle. (Apply)
3. Demonstrate the thread parameters using gear tooth vernier& profile projector. (Understand)
4. Apply the knowledge of Metrology and measurements to find the displacement, force, torque, temperature. (Apply)
5. Demonstrate the CMM with different probe to measure the dimensions.(Understand)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment	Quantity required
1.	Micrometer	5
2.	Vernier Caliper	5
3.	Vernier Height Gauge	2
4.	Vernier Depth Gauge	2
5.	Slip Gauge Set	1
6.	Gear Tooth Vernier	1
7.	Sin Bar	2
8.	Bevel Protractor	1
9.	Floating Carriage Micrometer	1
10.	Profile Projector	1
11.	Mechanical / Electrical / Pneumatic Comparator	1
12.	Temperature Measuring Setup	1
13.	Displacement Measuring Setup	1
14.	Force Measuring Setup	1
15.	Torque Measuring Setup	1
16.	Autocollimator	1
17.	Coordinate measuring machine	1
18.	Tool makers microsciope	1
19.	Dial gauge calibration	1

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3							3	2				3	3
CO.2	3							2	2	2				
CO.3	2				3			2	2	2			2	2
CO.4	3							2	2					
CO.5	2				3				3	2			2	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME608	3				3			3	3	2			3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME609	HEAT AND MASS TRANSFER LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To demonstrate the concept of energy balances and the three modes of heat transfer- conduction, convection and radiation.
- To train the students in heat transfer problems in practical engineering applications.

LIST OF EXPERIMENTS :

HEAT TRANSFER **20**

1. Thermal conductivity measurement by guarded plate method.
2. Thermal conductivity of pipe insulation using lagged pipe apparatus.
3. Natural convection heat transfer from a vertical cylinder.
4. Forced convection inside tube.
5. Heat transfer from pin-fin (natural & forced convection modes).
6. Determination of Stefan-Boltzmann constant.
7. Determination of emissivity of a grey surface.
8. Effectiveness of Parallel/counter flow heat exchanger.

REFRIGERATION AND AIR CONDITIONING **10**

1. Determination of COP of a refrigeration system.
2. Experiments on air-conditioning system.
3. Performance test on single/two stage reciprocating air compressor.

A minimum of nine experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Estimate the thermal conductivity of a material in guarded hot plate and lagged pipe apparatus. (Apply)
2. Determine the heat transfer coefficient in natural and forced convection. (Apply)
3. Apply the knowledge of radiation to determine the Stefan Boltzmann constant and emissivity. (Apply)
4. Determine the effectiveness of a concentric tube heat exchanger for parallel and counter flow. (Apply)
5. Apply the knowledge of refrigeration and air conditioning to estimate its performance. (Apply)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment	Quantity required
1.	Guarded plate apparatus	1
2.	Lagged pipe apparatus	1
3.	Natural convection-vertical cylinder apparatus	1
4.	Forced convection inside tube apparatus	1
5.	Pin-fin apparatus	1
6.	Stefan-Boltzmann apparatus	1
7.	Emissivity measurement apparatus	1
8.	Parallel/counter flow heat exchanger apparatus	1
9.	Single/two stage reciprocating air compressor	1
10.	Refrigeration test rig	1
11.	Air-conditioning test rig	1

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3					2			3					
CO.2	3							2	3					
CO.3	3							2	3					
CO.4	3	2				2		2	3				3	
CO.5	3					2	2		2				2	3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME607	3	2				2	2	2	3				3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

SEMESTER VII

Semester – VII

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	HS	15UME701	Project Management and Finance (Common to Mech, CSE, ECE, EEE, IT, EIE)	3	0	0	3
2.	PC	15UME702	Finite Element Analysis	3	0	0	3
3.	PC	15UME703	Mechatronics	3	0	0	3
4.	PE	E 5	Professional Elective - V	3	0	0	3
5.	OE	OE 2	Open Elective II	3	0	0	3
6.	PC	15UME706	Computer Aided Analysis Laboratory	0	0	2	1
7.	PC	15UME707	Mechatronics Laboratory	0	0	2	1
Total Credits : 17				**15**	**0**	**4**	**17**

15UME701	PROJECT MANAGEMENT AND FINANCE (Common to MECH, CSE,ECE, EEE, IT,& EIE)	L 3	T 0	P 0	C 3

OBJECTIVES :

- To impart knowledge to find solutions and approaches for various projects.
- To familiarize the utilization of project within time, resource and financial constraints.

UNIT I PROJECT MANAGEMENT CONCEPTS 9

Concept and characteristics of a project, importance of project management, types of project, project organizational structure, project life cycle, Statement of Work, Work Breakdown Structure.

UNIT II PROJECT PLANNING 9

Project Planning and Scheduling techniques - developing the project network using CPM/PERT, Limitations of CPM/PERT, Precedence Diagramming Method, constructing diagram and computations using precedence diagramming method, PERT/CPM simulation, reducing project duration.

UNIT III RESOURCE SCHEDULING & CRITICAL CHAIN SCHEDULING 9

Resource Scheduling - Resource allocation method, splitting and multitasking, Multi project resources scheduling - Critical Chain Scheduling -Concept of critical chain scheduling - critical chain scheduling method, application of Critical chain scheduling and limitations.

UNIT IV PROJECT QUALITY MANAGEMENT 9

Concept of project quality, responsibility for quality in projects, quality management at different stages of project, tools and techniques, Quality Management Systems, TQM in projects - Project Performance Measurement and Control - Monitor and assess project performance, schedule, and cost.Earned Value Management, performance measurement methods to monitor, evaluate and control planned cost and schedule performance - Project Closure/ Termination - Meaning of closure/ termination, project audit process, termination steps, final closure.

UNIT V FINANCIAL ACCOUNTING 9

Balance sheet and related concepts - Profit & Loss Statement and related concepts - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis – Comparative financial statements. Investments - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze different types of projects and identify the suitable project for the given constraints. (Analyze)
2. Analyze and identify Critical Path using PERT/CPM for the given project. (Analyze)
3. Analyze Theory of Constraints, Multi project scheduling and heuristic methods for allocating resources to a project. (Analyze)
4. Apply the knowledge of Quality Management and TQM Concepts to different stages of project and design a suitable Quality Management System. (Apply)
5. Investigate the financial data such as balance sheet, income expenditure statement, cash flow statement and budget to interpret, synthesize to provide valid solution for a variety of business problems. (Analyze)

TEXT BOOKS:

1. Prasanna Chandra, "'Fundamentals of Financial Management' ", Tata Mcgraw-Hill Publishing Ltd, 2005.
2. Jack Meredith, Samuel J.Mantel, "Project Management- A Managerial Approach", John Wiley and Sons.

REFERENCE BOOKS:

1. Clifford F Gray, Erik W Larson, "Project Management-The Managerial Process ", Tata Mcgraw-Hill Publishing Co Ltd.
2. John M Nicholas, "Project Management For Business And Technology", Prentice Hall of India Pvt Ltd.
3. Paresh Shah, "Basic Financial Accounting for Management", Oxford University Press, 2007.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3								3	3	3	3		
CO.2	3	3				3					3			
CO.3	3	3			3						3		3	
CO.4	3										3			3
CO.5	3	3		3							3	3		

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME701	3	3		3	3	3			3	3	3	3	3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME702	FINITE ELEMENT ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the principles involved in discretization and finite element approach.
- To impart knowledge to calculate the stiffness matrices and force vectors for simple elements.

INTRODUCTION(Not for examination): 2

Solution to engineering problems - mathematical modeling - discrete and continuum modeling - need for numerical methods of solution - relevance and scope of finite element methods - engineering applications of FEA.

UNIT I FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS 7

Weighted residual methods - general weighted residual statement - weak formulation of the weighted residual statement - comparisons - piecewise continuous trial functions- example of a bar finite element - functional and differential forms - principle of stationary total potential -Rayleigh Ritz method - piecewise continuous trial functions – finite element method - application to bar element.

UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS 9

General form of total potential for 1-D applications - generic form of finite element equations - linear bar element - quadratic element - nodal approximation - development of shape functions - element matrices and vectors - example problems - extension to plane truss- development of element equations - assembly - element connectivity - global equations - solution methods - beam element - nodal approximation - shape functions - element matrices and vectors - assembly - solution - example problems.

UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS 9

Introduction - approximation of geometry and field variable - 3 node triangular elements - four node rectangular elements - higher order elements – generalizedcoordinates approach to nodal approximations - difficulties - natural coordinates andcoordinate transformations - triangular and quadrilateral elements -iso-parametricelements - structural mechanics applications in 2-dimensions - elasticity equations – stressstrain relations - plane problems of elasticity - element equations - assembly - need forquadrature formulae – transformations to natural coordinates - Gaussian quadrature - example problems in plane stress, plane strain and axisymmetric applications.

UNIT IV DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD 9

Introduction - vibration problems - equations of motion based on weak form - longitudinal vibration of bars - transverse vibration of beams – consistent mass matrices- element equations - solution of Eigenvalue problems - vector iteration methods - normal modes - transient vibrations - modeling of damping - mode superposition technique - direct integration methods.

UNIT V APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS 9

One dimensional heat transfer element - application to one-dimensional heat transferproblems - scalar variable problems in 2-Dimensions -Applications in heat transfer in 2DProblem- Applications in fluid mechanics in 2DProblem.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze the concept of FEM and the classical approaches to solve structural and non structural problems. (Analyze)
2. Analyze one dimensional problems using analytical method and modern tool method. (Analyze)
3. Examine the stress and displacement and related factors for the complex mechanical components and analyze, interpret the data and provide suitable design modification. (Analyze)
4. Analyze longitudinal and transverse vibrations for bars and beams with the help of Eigen values and Eigen vectors with analytical method and modern tool. (Analyze)
5. Analyze the thermal properties of the components subjected to various types of heat transfer methods, by applying the concept of finite element method. (Analyze)

TEXT BOOKS:

1. Seshu.P, “Text Book of Finite Element Analysis ”, Prentice-Hall of India Pvt. Ltd,New Delhi, 2007.
2. Reddy .J.N, “An Introduction to the Finite Element Method”, McGraw-Hill International 3rd Editions, 2017.

REFERENCE BOOKS:

1. Senthil.S.Dr, Panneerdhass.R, “Finite Element Analysis”, Lakshmi Publications,Chennai,2012.
2. Chandrupatla,Belagundu, “Introduction to Finite Elements in Engineering”, Prentice-Hall of IndiaEastern Economy 4th Editions, 2015.
3. Cook.Robert.D,Plesha.Michael.E,Witt.Robert.J, “Concepts and Applications of Finite Element Analysis ”, Wiley Student 4th Edition,2004.
4. David V., “Fundamentals of Finite Element Analysis”, Tata McGraw-Hill Edition, 2005.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3											3	
CO.2	3	3			3								3	
CO.3	3	3			3								3	
CO.4	3	3			3								3	3
CO.5	3	3			3								3	3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME702	3	3			3								3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME703	MECHATRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.
- To impart knowledge on mechanical system with pneumatic, hydraulic components integrated with sensor and actuators.

UNIT I MECHATRONICS, SENSORS AND TRANSDUCERS 9

Introduction to Mechatronics Systems - Measurement Systems - Control Systems - Microprocessor based Controllers. Sensors and Transducers ------Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Fluid Pressure, Temperature,Light Sensors Selection of Sensors.

UNIT II ACTUATION SYSTEMS 9

Pneumatic and Hydraulic Systems - Directional Control Valves - Rotary Actuators.Mechanical Actuation Systems - Cams - Gear Trains - Ratchet and pawl - Belt and Chain Drives - Bearings.

UNIT III SYSTEM MODELS AND CONTROLLERS 9

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational - Transnational Systems, Electromechanical Systems - Hydraulic - Mechanical Systems. Continuous and discrete process Controllers - Control Mode - Two - Step mode - Proportional Mode - Derivative Mode - Integral Mode - PID Controllers - Digital Controllers - Velocity Control - Adaptive Control - Digital Logic Control - Micro Processors Control.

UNIT IV PROGRAMMING LOGIC CONTROLLERS 9

Programmable Logic Controllers - Basic Structure - Input / Output Processing - Programming - Mnemonics - Timers, Internal relays and counters - Data Handling - Analogs Input / Output - Selection of a PLC.

UNIT V DESIGN OF MECHATRONICS SYSTEM 9

Stages in designing Mechatronics Systems - Traditional and Mechatronic Design - Possible DesignSolutions. Case studies of Mechatronics systems- Pick and place Robot- Engine Management system- Automatic car park barrier.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the concepts of control systems, sensors and transducers in mechatronic systems.(Apply)
2. Design a pneumatic and hydraulic system and discuss the various types of actuation systems. (Create)
3. Apply the concept of various system models and controllers for mechatronics systems. (Apply)
4. Design the mechatronic system using Programmable Logic Controllers. (Create)
5. Design a mechatronics system for industrial applications. (Create)

TEXT BOOKS:

1. Bolton. W, “Mechatronics”, Pearson education, second edition, fifth Indian Reprint, 2014.
2. Rajput. R.K, “A textbook of mechatronics”, S. Chand & Co, 2007

REFERENCE BOOKS:

1. Godfrey C. Onwubolu, “MechatronicsPrinciples and Applications” Elsevier, 2005
2. Sabricetinkunt, “Mechatronics”, Wiley, 2006
3. Smaili.A, Mrad.F, “Mechatronics integrated technologies for intelligent machines”, Oxford university press, 2008
4. HMT Ltd., “Mechatronics”, Tata McGraw Hill Publishing Co. Ltd., 2000.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3												3	
CO.2	3	3	3										3	
CO.3	3												3	
CO.4	3	3	3										3	
CO.5	3	3	3										3	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME703	3	3	3										3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME706	COMPUTER AIDED ANALYSIS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To train the student to interpret drawings of components and analyze using analyzing packages.

LIST OF EXPERIMENTS : **30**

ANALYSIS (SIMPLE TREATMENT ONLY)

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket.
3. Stress analysis of an axi-symmetric component.
4. Stress analysis of cantilever beam.
5. Stress analysis of simply supported beam.
6. Stress analysis of fixed ends beam.
7. Mode frequency analysis of a 2 D component.
8. Mode frequency analysis of cantilever beams
9. Mode frequency analysis of simply supported beam.
10. Harmonic analysis of a 2D component.
11. Thermal stress analysis of a 2D component.
12. Conductive heat transfer analysis of a 2D component.
13. Convective heat transfer analysis of a 2D component.

A minimum of nine experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Analyze deflection and stresses for different components. (Analyze)
2. Design a component and compute deflection, bending moment and stresses. (Create)
3. Analyze axisymmetrical components to calculate stresses. (Apply)
4. Design a component and beams to calculate mode frequency and analyze mode shapes using modal analysis. (Analyze)
5. Apply the concept of heat transfer to compute thermal stress and plot temperature distribution. (Apply)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the equipment	Quantity required
1.	Computer System	30
2.	Color Desk Jet Printer	01
3.	Suitable analysis software	30

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	3		2	3				2	2		3		
CO.2	3	3	3	3	3				3	2		3	3	
CO.3	3	3			2				2					
CO.4	3	3	3		2				2					
CO.5	3	2		3	3				2	2		3		3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME706	3	3	3	3	3				3	2		3	3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME707	MECHATRONICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To demonstrate the operation of the Microcontroller and PLC.
- To train the students to create a continuous-time control design using software on a microprocessor for the Manipulation, Transmission, and Recording of Data.

LIST OF EXPERIMENTS : 30

1. Design and testing of fluid power circuits to control velocity, direction and force of double acting cylinder.
2. Design and simulation of a hydraulic circuit by using single solenoid 4/2 way valve to actuate two double acting cylinders.
3. Design and simulation of a hydraulic circuit by using one hand operated 4/2 way valve to actuate one double acting cylinder.
4. Design and simulation of a pneumatic circuit by using one hand operated 5/2 way valve to actuate one double acting cylinder.
5. Design and simulation of a pneumatic circuit by using two 3/2 way valve operated 4/2 way valve to actuate one double acting cylinder.
6. Design a circuit of extend/ retract of single acting cylinder using push button and 3/2 solenoid valve by using electro pneumatic trainer kit.
7. Design a circuit of extends and retraction of double acting cylinder using two push buttons and 5/2 double solenoid valve by using electro pneumatic trainer kit.
8. Servo Controller Interfacing For Closed Loop System.
9. Servo Controller Interfacing For Open Loop System.
10. Stepper motor interfacing with 8051 micro controller Full step / Half step revolutions
11. Design of a circuit to extend and retract the cylinder with the help of the two sensors to control with PLC.
12. Design of a circuit for synchronization of two cylinders to control with PLC.
13. Computerized data logging system with control for process variable - Flow in Multi process station (VMPA-62).
14. Computerized data logging system with control for process variable -Pressure in Multi Process Station (VMPA-62).
15. Computerized data logging system with control for process variable -Temperature in Multi process station (VMPA-62).

A minimum of nine experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Design of a circuit for synchronization of two cylinders to control with PLC. (Analyze)
2. Apply the knowledge of hydraulics and pneumatics to design and simulation of different circuits using FLUIDSIM software. (Apply)
3. Analyze the different circuits by Stepper motor interfacing with 8051 Micro controller. (Analyze)
4. Determine the basic electrical, hydraulic and pneumatic systems using LAB VIEW. (Evaluate)
5. Compile the computerized data logging system with control for process variables like pressure, flow and temperature. (Create)

EQUIPMENT REQUIREMENT

Sl. No.	Name of the requirement	Quantity required
1.	SYSCO simulation of speed control in hydraulic system kit	1 NO
2.	Hydraulic and Pneumatic system simulation software – FLUID SIM	10 NOS
3.	Basic Electro Pneumatic Trainer kit (VMT-05) with Electrical control Trainer (VMT – 07)	1 NO
4.	Servo controller using closed / Open loop system and drive circuit set (VPAT-22) using WINPRO LADDER software	1 NO
5.	8051 – Micro controller with Stepper motor and drive circuit sets	1 No
6.	Basic Electro Pneumatic Trainer kit (VMT-04) with PLC control Trainer (VPLCT-02) using VERSA PRO software	1 No
7.	Multi process station (VMPA – 620 with Data Acquisition card set using Process Control (Win 98)	1 No

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2	3			3				2					
CO.2	3				3				3	2		3		3
CO.3	3	3							2					
CO.4	3		3	3	3				3	2		3	3	
CO.5	3			3	3				2			2		

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME707	3	3	3	3	3				3	2		3	3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

SEMESTER VIII

Semester – VIII

Sl.No	Course Category	Course Code	Course Name	L	T	P	C
1.	HS	15UME801	Professional Ethics (Common to all branches)	2	0	0	2
2.	PE	E 6	Professional Elective - VI	3	0	0	3
3.	PE	OE 3	Open Elective - III	3	0	0	3
4.	P	15UME804	Project Work	0	0	24	12
Total Credits : 20				**8**	**0**	**24**	**20**

15UME801	PROFESSIONAL ETHICS (Common to ALL Branches)	L 2	T 0	P 0	C 2

OBJECTIVES :

- To impart knowledge on a values-based approach and provide a method of thinking about and dealing with ethical issues in the work place.
- To explain what a profession is and what it means to act professionally.

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 10

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Assessment of safety and risk – RiskBenefit analysis – ProfessionalRights – Employeerights – IntellectualProperty Rights

UNIT III GLOBAL ISSUES 11

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development- Engineers as Managers – Consulting Engineers – Honesty – Moral Leadership – Sample Code of Conduct.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Illustrate the basic perception of profession, professional ethics and various moral issues.(Understand)
2. Describe the code of ethics and role of professional ethics in engineering field. (Understand)
3. Apply ethical principles to resolve global and cross cultural issues that arise in professional career.(Apply)

TEXT BOOKS:

1. Subramanian. R , "Professional Ethics", Oxford University press India, New Delhi First edition, 2013.
2. DhineshBabu.S, "Professional Ethics and Human Values", Laxmi Publications, New Delhi, Reprint, 2016.

REFERENCE BOOKS:

1. Jayakumar.V, "Professional Ethics in Engineering", Lakshmi Publications, Chennai.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
3. Edmund G Seebauer, Robert L Barry "Fundamentals of Ethics for Scientists and Engineers", OxfordUniversity Press, 2001.
4. David Ermann, Michele S Shauf "Computers, Ethics and Society", OxfordUniversity Press,2003.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1						3	2	3			2	3		
CO.2						3	3	3			2	3		
CO.3	2					3	3	3			3	3		

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME801	2					3	3	3			3	3		

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME804	PROJECT WORK	L	T	P	C
		0	0	24	12

OBJECTIVES :

- To demonstrate the comprehension of principles by applying them to a new problem wh may be the design and manufacture of a device, a research investigation, a comp based project or management project.

PROJECT DESCRIPTION:

1. The project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.
2. Every project work shall have a guide who is the member of the faculty of the institution.
3. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
4. 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 manufacture of a device, a research investigation, a computer or management project or a design problem.
5. The progress of the project is evaluated based on a minimum of three reviews.

TOTAL : 180 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.
2. Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion.
3. Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice.
4. Test and Evaluate the performance of the developed solution using appropriate techniques and tools.
5. Apply management principles to function effectively in the project team for project execution.
6. Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.
7. Write effective reports and make clear presentation to the engineering community and society.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3		3				3						3	3
CO.2		3		3									3	3
CO.3					3			3					3	3
CO.4		3			3								3	3
CO.5									3		3		3	3
CO.6						3	3					3	3	3
CO.7										3			3	3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME804	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE:

Sl. No	Course Category	Course Code	Course Name	L	T	P	C
1.	PE	15UME901	Industrial and Quality Management	3	0	0	3
2.	PE	15UME902	Gas Dynamics and Jet Propulsion	3	0	0	3
3.	PE	15UME903	Automobile Engineering	3	0	0	3
4.	PE	15UME904	Applied Hydraulics and pneumatics	3	0	0	3
5.	PE	15UME905	Design of Jigs, Fixtures & Press Tools	3	0	0	3
6.	PE	15UME906	Computational Fluid Dynamics	3	0	0	3
7.	PE	15UME907	Quality Control and Reliability Engineering	3	0	0	3
8.	PE	15UME908	Renewable Sources of Energy	3	0	0	3
9.	PE	15UME909	Industrial Tribology	3	0	0	3
10.	PE	15UME910	Power Plant Technology	3	0	0	3
11.	PE	15UME911	Unconventional Machining Processes	3	0	0	3
12.	PE	15UME912	Composite Materials	3	0	0	3
13.	PE	15UME913	Process Planning and Cost Estimation	3	0	0	3
14.	PE	15UME914	Nano Science and Technology	3	0	0	3
15.	PE	15UME915	Vibration and Noise Control	3	0	0	3
16.	PE	15UME916	Refrigeration and Air conditioning	3	0	0	3
17.	PE	15UME917	Nuclear Engineering	3	0	0	3
18.	PE	15UME918	Entrepreneurship Development	3	0	0	3
19.	PE	15UME919	Maintenance Engineering	3	0	0	3
20.	PE	15UME920	Production Planning and Control	3	0	0	3
21.	PE	15UME921	Design of Heat Exchangers	3	0	0	3
22.	PE	15UME922	Advanced I.C. Engines	3	0	0	3
23.	PE	15UME923	Failure Analysis and Design	3	0	0	3
24.	PE	15UME924	Computer Integrated Manufacturing	3	0	0	3
25.	PE	15UME925	Cryogenics	3	0	0	3
26.	PE	15UME926	Industrial Robotics	3	0	0	3
27.	PE	15UME927	Introduction to aircraft industry and aircraft systems	3	0	0	3
28.	PE	15UME928	Design of aircraft structures	3	0	0	3

15UME901	INDUSTRIAL AND QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart the knowledge on quality management.
- To familiarize the TQM techniques and ISO system

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INTRODUCTION TO OVERVIEW OF MANAGEMENT (Not for examination):

Organization – Management – Role of managers.

UNIT I PLANNING AND ORGANISING 9

Nature and Purpose planning- Planning process - Types of plans - Objectives - Managing byobjective (MBO) Strategies - Types of strategies - Policies - Decision Making –Typesof decision - Decision Making Process - Nature and purpose of organizing - Organization structure - Line and Staff authority -Departmentation- Span of Control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment.

UNIT II DIRECTING AND CONTROLLING 9

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories Leadership - Leadership theories - Communication - Hurdles to effective communication - Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

UNIT III INTRODUCTION AND TQM PRINCIPLES 9

Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM. Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement -Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle,5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating

UNIT IV TQM TOOLS & TECHNIQUES 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA Stages, Types. Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function - TPM – Concepts

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of planning, decision making processes for different organizational structure. (Apply)
2. Apply the knowledge of leadership qualities and motivation theories in various organizations. (Apply)
3. Apply the TQM concepts for continuous improvement in industries. (Apply)
4. Investigate the performance of industries by using TQM tools and techniques and Design of Experiments, analyze and interpret the performance and provide valid solution for improved performance. (Evaluate)
5. Apply the knowledge of quality and environmental management system in organisation. (Apply)

TEXT BOOKS:

1. Harold Koontz, Heinz Weihrich, mark V Cannice "Management – A global & Entrepreneurial Perspective ", Tata Mcgraw Hill, 12th Edition, New Delhi, 2012.
2. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education Asia, III Edition,Indian Reprint, 2006.

REFERENCE BOOKS:

1. Hellriegel, Slocum & Jackson, "Management – A Competency Based Approach", Thomson South Western, 10th Edition, 2007.
2. Andrew J. Dubrin, "Essentials of Management", Thomson Southwestern, 7th Edition, 2007.
3. Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd, 2006.
4. Oakland. J.S, "TQM – Text with Cases", Butterworth – Heinemann Ltd,Oxford, 3rd Edition, 2003.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3							3	3	3	3	3	2	
CO.2	2							3	3	3	3	3	2	
CO.3	3							3	3	3	3	3	3	
CO.4	3	3	3	3	2			2		3	3	3	3	
CO.5						3	3	3		3	2	3	3	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME901	3	3	3	3	2	3	3	3	3	3	3	3	3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME902	GAS DYNAMICS AND JET PROPULSION	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the basic difference between incompressible and compressible flow.
- To impart knowledge in the phenomenon of shock waves and its effect on flow

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 9

Governing equations for compressible flows - static and stagnation properties - speed of sound and Mach number. Effect of Mach number on compressibility, isentropic flow through variable area passage ducts – Nozzle and Diffusers, Chocking of flow.

UNIT II RAYLEIGH FLOW AND FANNO FLOW 9

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties – Use of tables and charts – Generalized gas dynamics.

UNIT III NORMAL AND OBLIQUE SHOCKS 9

Governing equations – Variation of flow parameters across the normal and oblique shocks- Prandtl – Meyer relations – Use of table and charts – Applications.

UNIT IV JET PROPULSION 9

Fundamentals of jet propulsion –Propulsion cycle - Power and efficiency calculations. Working of turbojet, turbofan and turbo prop engines.

UNIT V ROCKET PROPULSION 9

Fundamentals of rocket propulsion, Types of rocket engines, Applications, Space flights.

TOTAL : 45 PERIODS

Note: Use of Gas table is permitted in End Semester Examination

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of Isentropic Flow concept to identify the various properties of gas. (Apply)
2. Determine the properties of gas flows by applying the knowledge of Rayleigh and Fanno Flows. (Apply)
3. Make use of Gas Tables for the wave concepts to conduct investigations on the various properties of gas.(Analyze)
4. Identify the power and efficiency of jets by applying the jet propulsion concepts. (Apply)
5. Explain the rocket propulsion concept and its applications in the context of society and environments. (Understand)

TEXT BOOKS:

1. Anderson, J.D, “Modern Compressible flow ”, McGraw Hill,Third Edition,2003.
2. S.M. Yahya, “Fundamentals of Compressible Flow ”, New Age International (P) Limited,New Delhi, 1996.

REFERENCE BOOKS:

1. Senthil, “Gas Dynamics and Jet Propulsion”, A.R.S Publications, Chennai, 2012.
2. Zucrow.N.J, “Principles of Jet Propulsion and Gas Turbines”, John Wiley, New York, 1970.
3. Sutton.G.P, “Rocket Propulsion Elements ”, John wiley, New York,1986
4. Shapiro.A.H, “Dynamics and Thermodynamics of Compressible fluid Flow”, John wiley, New York, 1953.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3	2						2						
CO.2	3	2	2					3					3	
CO.3	3	3						3					2	
CO.4	3	2											2	
CO.5	2						3							

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UEN101	3	3	2				3	3					3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME903	AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the construction and working principle of various parts of an automobile.
- To impart knowledge for assembling and dismantling of engine parts and transmission system.

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles, vehicle construction and different layouts,chassis, frame and body, resistances to vehicle motion, vehicle aerodynamic resistance, components of I.C engine-their forms,functions and materials, Sensors and actuators for various engine applications.

UNIT II ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines., Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system) Electronic ignition system ,Turbo chargers, Engine emission control by three way catalytic converter system –Battery and its function.

UNIT III TRANSMISSION SYSTEM 9

Clutch-types and construction, need for a gearbox -gear boxes-constant mesh, sliding mesh, synchromesh and automatic gear box, gear shift mechanisms, Over drive, transfer box, propeller shaft, slip joints, universal joints,Differential, and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING,BRAKES AND SUSPENSION SYSTEM 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System and Traction Control, airbag.

UNIT V ALTERNATIVE ENERGY SOURCES 9

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required - Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell.

TOTAL : 45 PERIODS

Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of Automobile engineering to construct the vehicle structure. (Apply)
2. Apply the knowledge of carburetor and fuel injection systems to improve the performance of Engine with environmental concern. (Apply)
3. Identify, assemble and disassemble the transmission system of the vehicles. (Apply)
4. Apply the safety principles in the design of steering, brakes, suspension system and also outline the latest technologies as air bag, ABS and Traction control. (Apply)
5. Apply knowledge of emissions norms to identify the suitable alternate fuels for IC engines. (Apply)

TEXT BOOKS:

1. Kirpal Singh, "Automobile Engineering Vol 1 &2", Standard Publishers, VII Edition, New Delhi, 1997.
2. Jain .K.K, Asthana .R.B, "Automobile Engineering", Tata McGraw Hill Publishers, New Delhi 2002.

REFERENCE BOOKS:

1. Newton, Steeds, Garet, "Motor Vehicles", Butterworth Publishers, 1989.
2. Joseph Heitner , "Automotive Mechanics", East-West Press, 2nd Edition,1999.
3. Heinz Heisler, "Advanced Engine Technology", Prentice Hall (India) Pvt. Ltd, 2006.
4. Bechtold, "Understanding Automotive Electronics", SAE 2010.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3											3		3
CO.2	3						3							3
CO.3	3								3			3		3
CO.4	3					3								3
CO.5	3					2	3	3						3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME903	3					3	3	3	3			3		3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME904	APPLIED HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart knowledge on the applications of fluid power engineering and power transmission system.
- To familiarize the fluid power system in automation of machine tools and others equipment's.

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids - General types of fluids - Fluid power symbols. Basics of Hydraulics-Applications of Pascal's Law- Laminar and Turbulent flow - Reynold's number - Darcy's equation - Losses in pipe, valves and fittings.

UNIT II HYDRAULIC SYSTEM AND COMPONENTS 9

Sources of Hydraulic Power: Pumping theory - Pump classification - Gear pump, Vane Pump, piston pump, construction and working of pumps - pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators - Types of hydraulic cylinders - Single acting, Double acting special cylinders like tandem, Rod less, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators - Fluid motors, Gear, Vane and Piston motors.

UNIT III DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components : Directional control valve - 3/2 way valve - 4/2way valve - Shuttle valve - check valve - pressure control valve - pressure reducing valve, sequence valve, Flow control valve - Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators - Accumulators circuits, sizing of accumulators, intensifier - Applications of Intensifier - Intensifier circuit

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS 9

Pneumatic Components: Properties of air - Compressors - Filter, Regulator, and Lubricator Unit - Air control valves, Quick exhaust valves, and pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit,
Sequential circuit design for simple applications using cascade method.

UNIT V DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems - Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuit, failure and troubleshooting.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the fundamental laws of fluids for various fluid power systems. (Apply)
2. Analyze and select suitable pumps and actuators for various applications in Hydraulic power systems. (Analyze)
3. Develop the Hydraulic Circuit by using control components and Accumulators. (Apply)
4. Apply the knowledge of pneumatic circuit to design the pneumatic system by Cascade method. (Apply)
5. Apply the knowledge to design the servo and PLC system for Industrial Automation system. (Apply)

TEXT BOOKS:

1. Anthony Esposito, “Fluid Power with Applications”, Pearson Education, 2005.
2. Majumdar S.R, “ Oil Hydraulics Systems- Principles and Maintenance ”,Tata McGraw-Hill ,2001.

REFERENCE BOOKS:

1. Srinivasan.R, “Hydraulic and Pneumatic controls”, Vijay Nicole, 2006.
2. Shanmugasundaram. K, “Hydraulic and Pneumatic controls”, Chand & Co, 2006.
3. Majumdar S.R, “Pneumatic systems – Principles and maintenance”, Tata McGraw Hill, 1995.
4. AnthonyLal, “Oil hydraulics in the service of industry”, Allied publishers, 1982.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3													
CO.2	3	2												
CO.3	3	2												
CO.4			3										3	
CO.5	3				2								3	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME904	3	2	3		2								3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME905	DESIGN OF JIGS, FIXTURES AND PRESS TOOLS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart the knowledge on the functions and design principles of Jigs, fixtures and press tools
- To expose the students proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES 9

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT II JIGS AND FIXTURES 9

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTSOF CUTTING DIES 9

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV BENDING FORMING AND DRAWING DIES 9

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing reverse re-drawing and combination dies – Blank development for ax- symmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V MISCELLANEOUS TOPICS 9

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries.

TOTAL : 45 PERIODS

Note :Use of Approved design Data Book permitted

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the objectives of tool design.
2. Design the jigs and fixtures for given component.
3. Summarize the press working terminologies, Types of presses and its operations.
4. Explain the blank development operations for bending, forming and drawing.
5. Illustrate the recent trends in tool design.

TEXT BOOKS:

1. Joshi.P.H, “Jigs and Fixtures”, Tata Mcgraw Hill, II Edition, New Delhi, 2004.
2. Donaldson, Lecain,Goold “Tool Design ”, Tata McGraw Hill, 3rd Edition, 2000.

REFERENCE BOOKS:

1. Venkataraman.K, “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005.
2. Kempster, “Jigs and Fixture Design ”, Hoddes and Stoughton, 3rd Edition,1974.
3. Joshi. P.H, “Press Tools-Design and Construction ”, Wheels publishing, 1996.
4. Hoffman, “Jigs and Fixture Design ”, Thomson Delmar Learning,Singapore,2004.

15UME906	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the various discretization methods, solution procedures and turbulence modeling.
- To impart knowledge to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

PREREQUISITE:

Fundamental Knowledge of partial differential equations, Heat Transfer and Fluid Mechanics.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent-Kinetic Energy Equations – Mathematical behavior of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE METHOD 9

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – solution methods for finite difference equations – Elliptic equations – Iterative solution Methods – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations.

UNIT III FINITE VOLUME METHOD (FVM) FOR DIFFUSION 9

Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems.One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

UNIT IV FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 9

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Bounded, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT V CALCULATION FLOW FIELD BY FVM 9

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants. Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the Governing equations of fluid dynamics.
2. Outline the solution methods for finite difference equations.
3. Solve the steady state One, Two and Three -dimensional diffusion problems using Finite volume method.
4. Solve the steady one-dimensional convection diffusion problems.
5. Analyze a flow field to determine flow rates, heat fluxes, pressure drops, losses, etc., using flow visualization and analysis tools.

TEXT BOOKS:

1. Chung.T.J, “Computational Fluid Dynamics”, CambridgeUniversity, 2002.
2. Versteeg.H.K, Malalasekera.W, “An Introduction to Computational Fluid Dynamics: The finite volume Method”, Longman, 1998.

REFERENCE BOOKS:

1. Ghoshdastidar. P.S, “Computer Simulation of flow and heat transfer”, Tata McGraw Hill Publishing Company Ltd, 1998.
2. Ghoshdastidar. P.S, “Heat Transfer”, OxfordUniversity Press, 2005.
3. ProdipNiyogi, Chakrabarty .S.K,Laha .M.K, “Introduction to Computational Fluid Dynamics ”, Pearson Education, 2005.
4. Patankar, S.V, “Numerical Heat Transfer and Fluid Flow”, Hemisphere Publishing Corporation, 2004.

15UME907	QUALITY CONTROL AND RELIABILITY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the students toapply process control and acceptance sampling procedure to their application.
- To impart the knowledge on the concept of quality and reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 9

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance,Quality control: Quality cost-Variation in process-causesof variation –Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and chart -process capability – process capability studies and simple problems.Six sigma concepts.

UNIT II PROCESS CONTROL FOR ATTRIBUTES 9

Control chart for attributes –control chart for non-conforming- p chart and np chart – control chart for nonconformities- C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING 9

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING – RELIABILITY 9

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT V QUALITY AND RELIABLITY 9

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

TOTAL : 45 PERIODS

Note: Use of approved statistical table permitted in the examination.

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain various process control techniques to improve quality.
2. Apply process control attributes to attain quality in industries.
3. Compare various sampling methods for selecting samples.
4. Illustrate various failure testing methods for reliability.
5. Apply various quality improvement techniques for product development in industries.

TEXT BOOKS:

1. Douglas.C.Montgomery, “Introduction to Statistical quality control”, John wiley, IV Edition, 2001.
2. Srinath.L.S, “Reliability Engineering”, Affiliated East west press, 1991.

REFERENCE BOOKS:

1. John.S. Oakland, “Statistical process control”, Elsevier, 5th Edition, 2005.
2. MonoharMahaja, “Statistical Quality Control”, DhanpatRai& Sons, 2001.
3. Gupta.R.C, “Statistical Quality control”, Khanna Publishers, 1997.
4. Grant Eugene .L, “Statistical Quality Control”, McGraw-Hill, 1996.

15UME908	RENEWABLE SOURCES OF ENERGY	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the main renewable sources of energy and their primary applications in the world.
- To impart knowledge on the technological concepts of renewable energy sources.

UNIT I SOLAR ENERGY 9

Solar energy, Solar Radiation, Solar Cells, Solar Thermal energy conversion, Solar Collectors, Fundamentals of photo Voltaic Conversion.

UNIT II WIND ENERGY 9

Wind Data and Energy Estimation –Wind mills– Wind Energy Storage – Applications.

UNIT III BIO – ENERGY 9

Biomass, Biogas, Biomass gasifier, Biogas plant, Digesters, Ethanol production, Bio diesel production

UNIT IV OTEC, TODAL, GEOTHERMAL AND HYDEL ENERGY 9

Tidal energy – Wave energy – Open and closed OTEC Cycles, Geothermal energy sources.

UNIT V HYDROGEN AND FUEL CELL 9

Hydrogen generation, storage, transport and utilization, Fuel cells – technologies, types and the power generation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of solar energy systems for various applications. (Apply)
2. Apply the knowledge of wind mills and estimate the energy from wind data (Apply)
3. Analyze the production of Biogas, Ethanol and Bio diesel for the society. (Analysis)
4. Explain the function of Tidal energy; wave energy, Ocean Thermal Energy and Geothermal energy systems. (Understand)
5. Apply the knowledge of hydrogen generation and fuel cell technologies for power generation. (Apply)

TEXT BOOKS:

1. Rai.G.D, “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 1999.
2. Sukhatme .S.P, “Solar Energy”, Tata McGraw Hill Publishing Company Ltd, New Delhi 1997.

REFERENCE BOOKS:

1. Godfrey Boyle, “Renewable Energy Power for a Sustainable Future”, OxfordUniversityPress, UK, 1996.
2. Twidell. J.W, Weir.A“Renewable Energy Sources”, EFN Spon Ltd, UK, 1986.
3. Tiwari.G.N , “solar Energy – Fundamentals Design Modeling and applications ”, Narosa Publishing House, New Delhi,2002.
4. Freris.L.L, “Wind Energy Conversion systems”, Prentice Hall, UK, 1990.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3					2	3						2	
CO.2	3	2				2	2					3	3	
CO.3	3	3				3	3	3					3	
CO.4						3	3							
CO.5	3					3	3	3				3		3

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME908	3	3				3	3	3				3	3	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME909	INDUSTRIAL TRIBOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the importance of friction and wear.
- To impart knowledge in surface engineering.

UNIT I SURFACES AND FRICTION 9

Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction Adhesion- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction – Stick slip motion - Measurement of Friction.

UNIT II WEAR 9

Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear – Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture - wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT III LUBRICANTS AND LUBRICATION TYPES 9

Types and properties of Lubricants - Testing methods - Hydrodynamic Lubrication – Elasto-hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication- Hydrostatic Lubrication.

UNIT IV FILM LUBRICATION THEORY 9

Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings – Reaction torque on the bearings - Virtual Co-efficient of friction - The Sommerfield diagram.

UNIT V SURFACE ENGINEERING AND MATERIALS FOR BEARINGS 9

Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes – Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the surface topography of engineering surfaces.
2. Illustrate the theory of Sliding Wear Mechanism.
3. Choose the suitable lubricant for different applications.
4. Explain the viscous flow between the plates.
5. Discuss the concept of viscous flow between very close parallel plates.
6. Choose the materials for rolling element bearings, fluid film bearings, marginally lubricated and dry bearings.

TEXT BOOKS:

1. Harnoy.A, “Bearing Design in Machinery”, Marcel Dekker Inc, New York, 2003.
2. Khonsari.M.M, Booser .E.R, “Applied Tribology”, John Willey&Sons, New York, 2001.

REFERENCE BOOKS:

1. Bowden.E.P, Tabor.D, “Friction and Lubrication”, Heinemann EducationalBooks Ltd, 1974.
2. Cameron.A, “Basic Lubrication theory”, Longman, U.K, 1981.
3. Bhushan, “Nanotribology and Nanomechanics ”, Springer, 2011.
4. Ramsey Gohar, “Fundamentals of Tribology”, Imperical college press, 2010.

15UME910	POWER PLANT TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the various components, operations and applications of power plants.
- To impart knowledge in waste disposal of nuclear power plants.

UNIT I LAYOUT OF POWER PLANTS 9

Layout of Steam, Hydel, Diesel, MHD,Combined Power cycles - comparison and selection, Load duration Curves.

UNIT II STEAM POWER PLANT 9

Fuel and ash handling, Combustion Equipment for burning coal, Mechanical Stokers. Pulverisers, Electrostatic, Precipitator, Draught- Different Types, Surface condenser types, cooling Towers.

UNIT III NUCLEAR POWER PLANTS 9

Nuclear Energy - Fission, Fusion Reaction, Layout of nuclear power plant, Types of Reactors, Pressurized water reactor, Boiling water reactor.

UNIT IV DIESEL AND GAS TURBINE POWER PLANT 9

Types of diesel plants, components,Selection of Engine type, applications-Gas turbine power plant- Fuels- Gas turbine material – open and closed cycles.

UNIT V OTHER POWER PLANTS 9

Geo thermal, OTEC, Tidal, Pumped storage,Solar central receiver system.Power plant economics and environmental hazards of all power plants.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of power plant to find the power capacity. (Apply)
2. Apply the knowledge of thermal power plant to calculate the various performance factors. (Apply)
3. Analyze the production processes of nuclear power plant for solving social problems. (Analysis)
4. Apply the knowledge of diesel and gas turbine power plants for clean power generation. (Apply)
5. Explain the function of Tidal energy; wave energy, Ocean Thermal Energy and Geothermal energy systems. (Understand)

TEXT BOOKS:

1 Arora S.C, Domkundwar S, “A Course in Power Plant Engineering”, DhanpatRai, 2001.

2 Nag P.K, “Power Plant Engineering ”, Tata McGraw- Hill, 2007

REFERENCE BOOKS:

1. El-Wakil M.M, “Power “Plant Technology”, Tata McGraw-Hill, 1984.
2. Ramalingam.K.K, “Power Plant Engineering”, Scitech Publications, 2002.
3. Nagpal.G.R, “Power Plant Engineering”, Khanna Publishers, 1998.
4. Rai.G.D, “Introduction to Power Plant technology”, Khanna Publishers, 1995.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2					2	2					3	2	
CO.2	2	2				2	2					3		
CO.3	2	2				3	3	3						
CO.4	2					3	3	3				3		3
CO.5						3	3							

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME910	2	2				3	3	3				3	2	3

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME911	UNCONVENTIONAL MACHINING PROCESSES	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the student the various unconventional machining processes, parameters and their influence on performance and their applications.
- To impart knowledge on thermal energy based processes.

UNIT I INTRODUCTION 9

Unconventional machining Process – Need – classification – Brief overview.

UNIT II MECHANICAL ENERGY BASED PROCESSES 9

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining.(AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES 9

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants- maskant-techniques of applying maskants-Process Parameters – Surface finish and MRR-Applications.Principles of ECM-equipments-Surface Roughness and MRR- Electrical circuit-Process Parameters-ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES 9

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the principles of unconventional machining processes and identify suitable unconventional machining methods for various difficult-to-cut materials. (Apply)
2. Analyze the various machining parameters to identify the suitable mechanical energy based unconventional machining processes for various applications. (Analyze)
3. Analyze the various machining parameters to identify the suitable electrical energy based unconventional machining processes for electrically conductive materials. (Analyze)
4. Select a suitable chemical and electro-chemical machining process for various metals and alloys. (Analyze)
5. Identify the suitable thermal energy based processes such as LBM, PAM and EBM for cutting different materials and precision machining. (Apply)

TEXT BOOKS:

1. Vijay.K.Jain , “Advanced Machining Processes ”, Allied Publishers Pvt.Ltd, New Delhi,2007.
2. Benedict.G.F, “Nontraditional Manufacturing Processes”, Marcel Dekker Inc, New York, 1987.

REFERENCE BOOKS:

1. Pandey P.C, Shan H.S, “Modern Machining Processes”, Tata McGraw-Hill, 2007.
2. Adithan.M, “Unconventional Machining process”, Atlantic, 2009.
3. Pandey.P.C, “Modern Machining process”, Pearson Education, 1980.
4. Senthil.K, “Unconventional Machining process”, Lakshmi Publications, 2010.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3												3	
CO.2	3	3											3	
CO.3	3	3											3	
CO.4	3	3											3	
CO.5	3												3	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME911	3	3											3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME912	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To familiarize the fundamentals of composite material strength and its mechanical behavior.
- To impart knowledge to analysis composite lamina strength, thermal and laminated flat plates.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS AND MANUFACTURING **10**

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law.Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Molding – Compression Molding – Pultrusion – Filament Winding – Other Manufacturing Processes.

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS **10**

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli.Evaluation of Lamina Properties from Laminate Tests.Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS **8**

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure.

UNIT IV THERMAL ANALYSIS **8**

Assumption of Constant C.T.E Modification of Hooke's Law.Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E -C.T.E for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates.

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 9

Equilibrium Equations of Motion. Energy Formulations.Static Bending Analysis.Buckling Analysis. Free Vibrations – Natural Frequencies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the mechanical behaviour of various laminated composites.
2. Apply constitutive equations of composite material at micro level.
3. Explain the free vibrations and natural frequencies for laminated flat plates.
4. Identify the thermal behaviours of composite materials.
5. Solve the equations of motion, bending and buckling of laminated flat plates.

TEXT BOOKS:

1. Gibson.R.F, “Principles of Composite Material Mechanics”, McGraw-Hill, II Edition, 1994.
2. Hyer. M.W, “Stress Analysis of Fiber – Reinforced Composite Materials”,McGraw- Hill, 1998.

REFERENCE BOOKS:

1. Issac M. Daniel, Orilshai, “Engineering Mechanics of Composite Materials”, Oxford University Press,-2006, First Indian edition: 2007.
2. MallicK.P.K, “Fiber Reinforced Composites Materials, Manufacturing and Design”, Maneel Dekker Inc, 1993.
3. Halpin. J.C, “Primer on Composite Materials Analysis ”, Techomic Publishing Co, 1984.
4. Mallick. P.K, Newman. S, “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish1990.

15UME913 PROCESS PLANNING AND COST ESTIMATION

L	T	P	C
3	0	0	3

OBJECTIVES :

- To impart knowledge on the detailed process planning concepts.
- To familiarize the students to estimate the cost for various products after process planning.

UNIT I WORK STUDY AND ERGONOMICS 10

Method study – Definition – Objectives-Motion economy- Principles – Tools and Techniques- Applications – Work measurements- purpose – use – procedure – tools and techniques- Standard time –Ergonomics – principles – applications.

UNIT II PROCESS PLANNING 9

Definition – Objective – Scope – approaches to process planning- Process planning activities – Finished part requirements- operating sequences- machine selection – material selection parameters- Set of documents for process planning- Developing manufacturing logic and knowledge- production time calculation – selection of cost optimal processes.

UNIT III INTRODUCTION TO COST ESTIMATION 8

Objective of cost estimation- costing – cost accounting- classification of cost- Elements of cost.

UNIT IV COST ESTIMATION 8

Types of estimates – methods of estimates – data requirements and sources- collection of cost- allowances in estimation.

UNIT V PRODUCTION COST ESTIMATION 10

Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the work study and ergonomic principles for various industrial applications. (Understand)
2. Demonstrate the manufacturing processes to select appropriate optimized sequence of operations for manufacturing a product. (Understand)
3. Explain about the cost estimation and cost accounting. (Understand)
4. Outline the method of costing and objectives of cost estimation. (Understand)
5. Analyze the material cost, labour cost and the over head cost for different manufacturing process. (Analyze)

TEXT BOOKS:

1. Sinha.B.P, "Mechanical Estimating and Costing", Tata McGraw-Hill, 1995.
2. Phillip.F, Ostwalal,JairoMunez, "Manufacturing Processes and systems ", John Wiley, 9th edition, 1998.

REFERENCE BOOKS:

1. Russell.R.S, Tailor.B.W, "Operations Management", PHI, 4th Edition, 2003.
2. Chitale.A.V, Gupta.R.C, "Product Design and Manufacturing", PHI, 2nd Edition, 2002.
3. Kesavan. R, "Process Planning & Cost Estimation", new age International, 2009.
4. Adithan.M, "Process Planning & Cost Estimation", New Age International, 2007.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2					2		3	3	3		3	3	
CO.2	2					2			2				3	
CO.3	2										3	3		
CO.4	2										3			
CO.5	2	3						2	2		3	3		

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UEN101	2	3				2		3	3	3	3	3	3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME914 NANOSCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES :

- To demonstrate a working knowledge of nanotechnology principles
- To familiarize various nano devices and their applications.

UNIT I INTRODUCTION AND CLASSIFICATION 9

Classification of nanostructures, nano scale architecture – Effects of the nanometre length scale – Changes to the system total energy, changes to the system structures, vacancies in nano crystals, dislocations in nano crystals – Effect of nano scale dimensions on various properties – Structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems.

UNIT II NANOMATERIALS AND CHARACTERIZATION 9

Fabrication methods – Top down processes – Milling, lithographic, machining process – Bottom-up process – Vapour phase deposition methods, plasma-assisted deposition process, MBE and MOVPE, liquid phase methods, colloidal and sol gel methods – Methods for templating the growth of nano materials – Ordering of nano systems, self-assembly and self-organization – Preparation, safety and storage issues.

UNIT III GENERIC METHODOLOGIES FOR NANOTECHNOLOGY 9

Characterization - General classification of characterization methods – Analytical and imaging techniques – Microscopy techniques - Electron microscopy, scanning electron microscopy, transmission electron microscopy, STM, field ion microscopy, scanning tunneling microscopy, atomic force microscopy – Diffraction techniques – Spectroscopy techniques – Raman spectroscopy – Surface analysis and depth profiling – Mechanical properties, electron transport properties, magnetic and thermal properties.

UNIT IV SELF ASSEMBLING NANOSTRUCTURED MOLECULAR MATERIALS AND DEVICES 9

Introduction – Building blocks – Principles of self-assembly, non-covalent interactions, intermolecular packing, nanomotors – Self assembly methods to prepare and pattern nanoparticles – Nanopartcles from micellar and vesicular polymerization, functionalized nano particles, colloidal nanoparticles crystals, self-organizing inorganic nano particles, bio-nanoparticles – nanoobjects.

UNIT V NANO DEVICES AND THEIR VARIOUS APPLICATIONS 9

Nanomagnetic materials – Particulate nanomagnets and geometrical nanomagnets – Magneto resistance – Probing nano magnetic materials – Nano magnetism in technology – Carbon nano tubes – fabrication- applications – Organic FET, organic LED"s – Organic photovoltaic – Injection lasers, quantum cascade lasers, optical memories, electronic applications, coulomb blockade devices.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the effects of nano scale dimensions on various properties.
2. Summarize the bottom up and top down processes and various synthesis techniques.
3. Compare the different types of characterization and their significance.
4. Apply key concepts in materials science, chemistry, physics, biology and engineering to the field of nanotechnology.
5. Explain the concept of nano magnetism Technology and CNT fabrication techniques.

TEXT BOOKS:

1. Charles P Poole, Frank J Owens “Introduction to Nanotechnology”, John Wiley and Sons, 2007.
2. Kelsall Robert W,IanHamley,MarkGeoghegan “Nanoscale Science and Technology”, Wiley Eastern, 2005.

REFERENCE BOOKS:

1. Gregory Timp, “Nanotechnology”, Springer-Verlag,2005.
2. Michael Kohler, Wolfgang,Fritzsche, “Nanotechnology: Introduction to Nanostructuring Techniques ”, 2004.
3. Bharat Bhushan, “Springer Handbook of Nanotechnology”, 2004.
4. Muralidharan.V.S, “Nanoscience and Technology”, CRC,2008.

15UME915	VIBRATION AND NOISE CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart knowledge on the sources of vibration and noise in automobiles.
- To familiarize on control techniques for vibration and noise.

UNIT I BASICS OF VIBRATION 9

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsion vibration, determination of natural frequencies.

UNIT II BASICS OF NOISE 9

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES 9

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tire noise, brake noise.

UNIT IV CONTROL TECHNIQUES 9

Vibration isolation, tuned absorbers, unturned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL 9

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the basic principles of vibration isolation and absorption.
2. Compare the various noise characteristic in engineering environment.
3. Explain the Noise Characteristics of engines.
4. Analyze the vibration and design the vibration control system.
5. Choose the methods for control of engine noise, combustion noise and mechanical noise.

TEXT BOOKS:

1. SingiresuS.Rao, “Mechanical Vibrations”, Pearson Education, 2004.
2. KewalPujara, “Vibrations and Noise for Engineers”, DhanpatRai& Sons, 1992.

REFERENCE BOOKS:

1. Bernard Challen, RodicaBaranescu, “Diesel Engine Reference Book”, SAE International, 1999.
2. Julian Happian-Smith, “An Introduction to Modern Vehicle Design”, Butterworth-Heinemann, 2004.
3. John Fenton, “Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing”, ISBN 1-86058-073, 1998.
4. Leo L. Beranek, “Noise and Vibration Control”, McGraw Hill Higher Education; Revised edition,2000.

15UME916	REFRIGERATION AND AIR CONDITIONING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart knowledge on various refrigeration cycles, system components and refrigerants.
- To impart knowledge on Psychrometry and Air conditioning Systems.

UNIT I REFRIGERATION CYCLE 9

Thermodynamic principles of refrigeration – Vapour compression systems – Types of Vapour Compression Cycles, Use of ph charts, Cascade system, Basic air Refrigeration cycles.

UNIT II REFRIGERANTS AND SYSTEM COMPONENTS 9

Compressors – reciprocating and rotary (elementary treatment), Types of condensers, evaporators, cooling towers – Functional aspects. Refrigerants – properties – selection of refrigerants, Alternate Refrigerants, Cycling controls.

UNIT III PSYCHROMETRY 9

Psychrometric processes use of psychrometric charts – Grand and Room Sensible Heat Factors – bypass factor, requirements of comfort air conditioning, summer and Winter Air conditioning.

UNIT IV AIR CONDITIONING SYSTEMS 9

Air Conditioning Systems – Summer Air Conditioning System, Winter Air Conditioning System – Factors affecting Air Conditioning Systems – Working principles of Comfort Air Conditioning System, Centralized Air conditioning systems, SplitAir conditioning systems. Indoor Air quality concepts.

UNIT V UNCONVENTIONAL REFRIGERATION CYCLES 9

Vapour Absorption system – Ejector jet, Steam jet refrigeration, Thermo electric refrigeration. Applications – ice plant – food storage plants – milk – chilling plants.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the working principle of refrigeration systems and cycle.
2. Summarize the system components and properties of refrigerants.
3. Apply the Psychrometric principles to solve problems.
4. Explain the working principles of Air conditioning systems.
5. Summarize the applications of Unconventional refrigeration cycles.

TEXT BOOKS:

1. Arora C.P, “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 2013.
2. Er. R.K. Rajput, “Refrigeration and Air Conditioning”, S.K. Kataria& Sons, 2012.

REFERENCE BOOKS:

1. Roy. J. Dossat, “Principles of Refrigeration”, Pearson Education, 2013.
2. Khurmi RS, “Refrigeration and Air Conditioning”, McGraw Hill Higher Education, 2010.
3. Manohar Prasad, “Refrigeration and Air Conditioning”, Wiley Eastern Ltd, 2005.
4. Stoecker N.F, Jones, “Refrigeration and Air Conditioning”, TMH,New Delhi, 2001.

15UME917	NUCLEAR ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To gain some fundamental knowledge about nuclear physics, nuclear reactor, nuclear fuels, reactors and safe disposal of nuclear wastes.
- Demonstrate an understanding of nuclear processes, and the application of general natural science and engineering principles to the analysis and design of nuclear and related systems of current and/or future importance to society.
- Familiarize analytical and problem solving skills, with special emphasis on design of nuclear reactors.
- Demonstrate an understanding of the broad social, ethical, safety and environmental context within which nuclear engineering is practiced.

UNIT I NUCLEARPHYSICS 9

Nuclear model of an atom- Equivalence of mass and energy- binding- radioactivity-half life-neutron inter actions-cross sections.

UNIT II NUCLEARREACTIONSANDREACTIONMATERIALS 9

Mechanism of nuclear fission and fusion- radioactivity – chain reactions- critical mass and composition-nuclear fuel cycles and its characteristics- uranium production and purification-Zirconium, thorium, beryllium.

UNIT III REPROCESSING 9

Reprocessing: nuclear fuel cycles – spent fuel characteristics- role of solvent extraction in reprocessing- solvent extraction equipment.

UNIT IV NUCLEARREACTOR 9

Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding Reactors- heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors.

UNIT V SAFETY ANDDISPOSAL 9

Safety and disposal: Nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the basic nuclear structure, the nuclear decay process and interaction of radiation with matter.
2. Classify the fission and the fusion reaction processes.
3. Outline the nuclear reprocessing techniques.
4. Illustrate the design and construction of reactors.
5. Explain the nuclear plant safety and nuclear waste disposal methods.

TEXT BOOKS:

1. ThomasJ.Cannoly,“FundamentalsofnuclearEngineering” JohnWiley1978.
2. John.R.Lamarsh, Anthony.J.Baratta, “Introduction to nuclear engineering”, 3rd Edition.

REFERENCE BOOKS:

1. Collier J.G, HewittG.F,“IntroductiontoNuclear power”,Hemispherepublishing,NewYork. 1987
2. WakilM.M.El.,“PowerPlantTechnology” -McGraw-Hill International,1984.
3. Lipschutz R.D “Radioactive Waste-Politics, Technology and Risk”, Ballingor, Cambridge, 1980
4. ThomasJ.Cannoly, “Fundamentals of nuclear Engineering” John Wiley1978

15UME918	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To expose the students to an entrepreneur.
- To familiarize the students in financing and accounting.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrepreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Identify the concept of entrepreneurship in economic growth.
2. Demonstrate the concept of motivation and stress management in entrepreneurship development.
3. Write the project report and select good business opportunities.
4. Explain the break even and network analysis.
5. Solve the issues in entrepreneurial process of calculated risk-taking, attitudes to failure and tolerance of uncertainty in small scale industries

TEXT BOOKS:

1. Khanka.S.S, "Entrepreneurial Development ", S.Chand& Co. Ltd, New Delhi,1999.
2. Kuratko, Hodgetts "Entrepreneurship – Theory, process and practices", Thomson learning.

REFERENCE BOOKS:

1. Hisrich R D, Peters M P, "Entrepreneurship", Tata McGraw-Hill, 5th Edition, 2002.
2. Mathew J Manimala, "Entrepreneurship theory at cross roads: paradigms and praxis", Dream tech, 2nd Edition,2006.
3. ThaduriBalaraju, "Entrepreneurship Development", 2004.
4. Singal.R.K, SrutiSingal "Entrepreneurship Development", S.K.kataria&sons,2011.

15UME919	MAINTENANCE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart knowledge on the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 9

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

UNIT III CONDITION MONITORING 9

Condition Monitoring – Cost comparison with and without CM – On-load testing and off- load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 10

Repair methods for beds, sideways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 8

Repair methods for Material handling equipment - Equipment records –Job order systems –Use of computers in maintenance.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the concept of maintenance planning in industrial maintenance system (Apply)
2. Analyse the preventive maintenance concept by applying the knowledge of maintenance categories (Analyse)
3. Analyse the temperature, vibration and wear debris of machine tool condition monitoring for safety maintenance. (Analyse)
4. Analyse the various failures in machine elements and identify the suitable safety precautions and repair methods (Analyse)
5. Analyse the various failures in material handling system and identify the suitable safety precautions and repair methods (Analyse)

TEXT BOOKS:

1. Srivastava S.K, “Industrial Maintenance Management”, S. Chand and Co, 1981.
2. Bhattacharya S.N, “Installation, Servicing and Maintenance”, S. Chand and Co, 1995

REFERENCE BOOKS:

1. White E.N, “Maintenance Planning”, Gower Press, 1979.
2. Garg M.R, “Industrial Maintenance”, S. Chand & Co, 1986.
3. Higgins L.R, “Maintenance Engineering Hand book”, McGraw Hill, 5th Edition,1988.
4. Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1996.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	3								2	2	2		3	
CO.2	3	3									2	2	3	
CO.3	3	3					3				2	2	3	
CO.4	3	3					3				2	2	3	
CO.5	3	3					3				3	2	3	

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UME919	3	3					3		2	2	3	2	3	

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME920	PRODUCTION PLANNING AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory control.
- To impart knowledge on the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION 9

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect- aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY 9

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study - work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems-Production Forecasting and anticipated production-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance - Flow production scheduling-Batch production scheduling-Product sequencing - Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of just in time systems - fundamentals of MRP II and ERP.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Make use of fundamentals of production planning and breakeven analysis in complex problems.(Apply)
2. Select the work measurement techniques for improvement and method study principles for betterment of manufacturing process. (Apply)
3. Apply the principles of product planning and process planning.(Apply)
4. Construct the different schedulingproblems to identify the optimal schedule (Apply)
5. Apply the techniques of inventory control in an industry and the knowledge of recent advancements in production systems.(Apply)

TEXT BOOKS:

1. MartandTelsang, “Industrial Engineering and Production Management”, S. Chand and Company, 1st edition, 2000.
2. James.B.Dilworth, “Operations management – Design, Planning and Control for manufacturing and services”, Mcgraw Hill International edition, 1992.

REFERENCE BOOKS:

1. Samson Eilon, “Elements of production planning and control”, Universal Book Corpn, 1984.
2. Elwood S.Buffa, RakeshK.Sarin, “Modern Production / Operations Management”, Ed. John Wiley and Sons8th Edition, 2000.
3. KanishkaBedi, “Production and Operations management”, Oxford university press, 2nd Edition2007.
4. Melynk, Denzler, “Operations management - A value driven approach”, Irwin Mcgrawhill.

COURSE ARTICULATION MATRIX:

CO/PO/PSO MAPPING

CO	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1									2	3				
CO.2									2	3				
CO.3									2	3				
CO.4									2	3				
CO.5									2	3				

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UEN101									2	3				

Ref: 3 - Strong 2 - Medium 1 - Weak

15UME921	DESIGN OF HEAT EXCHANGERS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the sizing of heat exchangers, thermal and mechanical stress analysis for various heat exchange applications.
- To familiarize the function of evaporative condenser

UNIT I CLASIFICATION OF HEAT EXCHANGERS 9

Parallel flow, Counter flow and cross flow; shell and tube and plate type; single pass and multipass - once through stream generators etc

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS 9

Heat transfer correlations, Overall heat transfer coefficient, LMTD, sizing of finned tube heat exchangers, U tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III MECHANICAL DESIGN OF SHELL AND TUBE TYPE 9

Thickness calculations, Tube sheet design using TEMA formula, Concept of equivalent plate for analyzing perforated analysis, flow induced vibration risks including acoustic issue and remedies, tube to tube sheet joint design, buckling of tubes, thermal stresses.

UNIT IV COMPACT AND PLATE HEAT EXCHANGERS 9

Types - Merits and Demerits – Design of Compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNIT V CONDENSORS AND COOLING TOWERS 9

Design of surface and evaporative condensers – cooling tower – performance characteristics.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Classify the various heat exchangers.
2. Summarize the process of a heat exchanger.
3. Explain the design concept of shell and tube type heat exchanger.
4. Outline the types and functions of compact and plate heat exchangers.
5. Explain the design procedure of condensers and cooling towers.

TEXT BOOKS:

1. Taborek.T, Hewitt.G.H,Afgan.N, “Heat Exchangers Theory and practice ”, McGraw-Hill Book Co, 1980.
2. Walkers, “Industrial Heat Exchangers – A Basic Guide”, McGraw Hill Book Co, 1980.

REFERENCE BOOKS:

1. Nicholas Cheremistoff, “Cooling Tower”, Ann Arbor Science Pub, 1981.
2. Arthur P. Frass, “Heat Exchanger Design”, John Wiley and Sons, 1988.
3. Gupta.J.P, “Fundamentals of Heat exchanger and pressure vessels technology”, Hemisphere Publishing Corporaion, 1980.
4. Donald Q Kern, Alban D. Karus “Extended surface heat transfer”, McGraw Hill Book Co, 1972.

15UME922	ADVANCED I.C. ENGINES	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart knowledge in engine exhaust emission control and alternate fuels.
- To familiarize the students to understand the recent developments in IC Engines.

UNIT I SPARK IGNITION ENGINES 9

Air-fuel ratio requirements, Design of carburetor –fuel jet size and venture size, Stages of combustion-normal and abnormal combustion, Factors affecting knock, Combustion chambers, Introduction to thermodynamic analysis of SI Engine combustion process.

UNIT II COMPRESSION IGNITION ENGINES 9

Stages of combustion-normal and abnormal combustion – Factors affecting knock, Direct and Indirect injection systems, Combustion chambers, Turbo charging, Introduction to Thermodynamic Analysis of CI Engine Combustion process.

UNIT III ENGINE EXHAUST EMISSION CONTROL 9

Formation of NOX , HC/CO mechanism , Smoke and Particulate emissions, Green House Effect , Methods of controlling emissions , Three way catalytic converter and Particulate Trap, Emission (HC,CO, NO and NOX ,) measuring equipments, Smoke and Particulate measurement, Indian Driving Cycles and emission norms.

UNIT IV ALTERNATE FUELS 9

Alcohols , Vegetable oils and bio-diesel, Bio-gas, Natural Gas , Liquefied Petroleum Gas ,Hydrogen , Properties , Suitability, Engine Modifications, Performance , Combustion and Emission Characteristics of SI and CI Engines using these alternate fuels.

UNIT V RECENT TRENDS 9

Homogeneous Charge Compression Ignition Engine, Lean Burn Engine, Stratified Charge Engine, Surface Ignition Engine, Four Valve and Overhead cam Engines, Electronic Engine Management, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine, Data Acquisition System –pressure pick up, charge amplifier PC for Combustion and Heat release analysis in Engines.

TOTAL :45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of combustion process in SI Engine to find the thermodynamic performance. (Apply)
2. Explain the combustion process in Compression Ignition Engine. (Understand)
3. Explain the Engine Exhaust emission formation and control techniques. (Understand)
4. Explain the characteristics of various alternate fuels. (Understand)
5. Identify the recent trends available in IC engine. (Apply)

TEXT BOOKS:

1. Heinz Heisler, “Advanced Engine Technology”, SAE International Publications, USA, 2005.
2. Ganesan V, “Internal Combustion Engines”, Tata Mcgraw-Hill, 4thedition, 2012.

REFERENCE BOOKS:

1. John B Heywood, “Internal Combustion Engine Fundamentals”, Tata McGraw-Hill, 1988.
2. Patterson D.J, Henein N.A, “Emissions from combustion engines and their control”, Ann Arbor Science publishers Inc, 1978.
3. Gupta H.N, “Fundamentals of Internal Combustion Engines”, Prentice Hall of India, 2013.
4. Ultrich Adler, “Automotive Electric / Electronic Systems”, Robert BoshGmbH, 2012.

15UME923	FAILURE ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart Knowledge on various multidimensional static failure criteria for different materials.
- To explain most critically stressed point in a machine component.
- To make the student Calculate reliability of the product using FEMA tools.

UNIT I MATERIALS AND DESIGN PROCESS 9

Factors affecting the behavior of materials in components, effect of component geometry and shape factors, design for static strength, stiffness, designing with high strength and low toughness materials, designing for hostile environments, material processing and design, processes and their influence on design, process attributes, systematic process selection, screening, process selection diagrams, ranking, process cost.

UNIT II FRACTURE MECHANICS 9

Ductile fracture, brittle fracture, Cleavage-fractography, ductile-brittle transition-Fracture mechanics approach to design-energy criterion, stress intensity approach, time dependent crack growth and damage -Linear Elastic Fracture Mechanics - Griffith theory, Energy release rate, instability and R-curve, stress analysis of cracks-stress intensity factor, K-threshold, crack growth instability analysis, crack tip stress analysis.

UNIT III DYNAMIC AND TIME-DEPENDENT FRACTURE 9

Dynamic fracture, rapid loading of a stationary crack, rapid crack propagation, dynamic contour integral, Creep crack growth-C Integral, Visco elastic fracture mechanics, viscoelastic J integral.

UNIT IV DETERMINATION OF FRACTURE TOUGHNESS VALUES 9

Experimental determination of plane strain fracture toughness, K- R curve testing, J measurement, CTOD testing, effect of temperature, strain rate on fracture toughness.

UNIT V FAILURE ANALYSIS TOOLS 9

Reliability concept and hazard function, life prediction, life extension, application of Poisson, exponential and Weibull distribution for reliability, bath tub curve, parallel and series system, MTBF,MTTR, FMEA definition-Design FMEA, Process FMEA , analysis causes of failure, modes, ranks of failure modes, fault tree analysis, industrial case studies/projects on FMEA.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the material properties and materials fabrication of producing a component possessing the size, shape and properties
2. Classify the various fracture mechanics, theories and fracture analysis.
3. Outline the dynamic contour integral and analyze system.
4. Explain the experimental determination of fracture toughness values.
5. Summarize the various failure analysis tools.

TEXT BOOKS:

1. John M Barsoom, Stanley T Rolte, “Fracture and Fatigue Control in Structures”, Prentice Hall, New Delhi, 1987.
2. Michael F Ashby, “Material Selection in Mechanical Design”, Butterworth – Heinemann, III Edition, 2005.

REFERENCE BOOKS:

1. Shigley and Mische , “Mechanical Engineering Design ”, McGraw Hill Inc, 1992.
2. Mahmoud M Farag, “Material Selection for Engineering Design”, Prentice Hall, 1997.
3. Faculty of Mechanical Engineering, “Design Data Book”, DPV Printers, 1993.
4. ASM Metals Handbook, “Failure Analysis and Prevention”, ASMMetalsPark, 10th Edition, 1995.

15UME924	COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the fundamentals of CAD.
- To impart knowledge on flexible manufacturing system and CAPP.

UNIT I COMPUTER AIDED DESIGN 9

Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing features in CAD - Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate, typical CAD command structure, wire frame modeling, surface modeling and solid modeling (concepts only) in relation to popular CAD packages.

UNIT II COMPONENTS OF CIM 9

CIM as a concept and a technology, CASA/SME model of CIM, CIM II, benefits of CIM, communication matrix in CIM, fundamentals of computer communication in CIM - CIM data transmission methods - serial, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex. Types of communication in CIM - point to point (PTP), star and multiplexing. Computer networking in CIM - the seven layer OSI model, LAN model, MAP model, network topologies - star, ring and bus, advantages of networks in CIM.

UNIT III GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 9

History Of Group Technology = role of G.T in CAD/CAM Integration - part families - classification and coding - DCLASS and MCLASS and OPTIZ coding systems - facility design using G.T - benefits of G.T - cellular manufacturing. Process planning - role ofprocess planning in CAD/CAM Integration - approaches to computer aided process planning - variant approach and generative approaches - CAPP and CMPP systems.

UNIT IV SHOP FLOOR CONTROL AND INTRODUCTION TO FMS 9

Shop floor control - phases - factory data collection system - automatic identification methods - Bar code technology - automated data collection system.FMS- components of FMS - types - FMS workstation - material handling and storage system - FMS layout- computer control systems - applications and benefits.

UNIT V **COMPUTER AIDED PLANNING AND CONTROL ANDCOMPUTER MONITORING** **9**

Production planning and control - cost planning and control - inventory management - material requirements planning (MRP) - shop floor control. Lean and Agile Manufacturing Types of production monitoring systems - structure model of manufacturing - process control and strategies - direct digital control.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the backend process running in CAD packages.
2. Outline CIM components and its networks.
3. Discuss GT and CAPP for manufacturing and process planning.
4. Select the appropriate data collection from shop floor and FMS.
5. Discuss Production planning and control and computer monitoring.

TEXT BOOKS:

1. Mikell. P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson Education, 2001.
2. Ranky, Paul G, “Computer Integrated Manufacturing”, Prentice hall of India Pvt. Ltd 2005.

REFERENCE BOOKS:

1. Rao.P.N, “CAD/CAM Principles and Applications”, TMH Publications, 2007.
2. Mikell. P. Groover, Emory Zimmers, “CAD/CAM”, prentice hall of India Pvt.Ltd, 1998.
3. James A. Regh,Henry W. Kreabber, “Computer Integrated Manufacturing”, Pearson Education, 2005.
4. Chris McMahon,Jimmie Browne “CAD CAM Principles,Practice and Manufacturing Management”, Pearson Education, 2005.

15UME925	CRYOGENICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the major concepts of and debates surrounding industrial and organizational psychology
- To impart knowledge on psychological research and theory to human interaction in the workplace.

UNIT I INTRODUCTION TO CRYOGENIC SYSTEMS 9

Properties of materials at low temperature, Properties of Cryogenic Fluids, Air and Gas Liquefication Systems: Thermodynamically ideal system, Production of low temperaturesLiquefication systems for gases other than Neon, Hydrogen and Helium, liquefaction systems for Neon, Hydrogen and Helium. Cryogenic Refrigeration System

UNIT II GAS SEPARATION AND GAS PURIFICATION SYSTEMS 9

The thermodynamically ideal separation system properties of mixtures, Principles of gas separation, air separation systems, Hydrogen, Argon, Helium air separation systems, Gas purification methods.

UNIT III VACUUM TECHNIQUES 9

System for production of high vacuum such as mechanical, diffusion, ion and cryopumps.Cryogenics measurement systems Temperature pressure, flow rate, liquid level measurement, Introduction to Cryocoolers.

UNIT IV CRYOGENIC FLUID STORAGE SYSTEMS 9

Introduction, Basic Storage vessels, inner vessel, outer vessel design, piping, access man ways, safetydevice. Cryogenic insulations Vacuum insulation, gas filled powders and fibrous materials, solid foam, selection and comparison of insulations. Cryogenic fluid transfer systems. Transfer through uninsulated lines, vacuum insulated lines, porous insulated linesetc.

UNIT V ADVANCES IN CRYOGENICS 9

Vortex tube and applications, Pulse tube refrigerator, Cryogenic Engine for space vehicles. Cryogenic Applications in gas industry, cryogenic fluids, space research, Cryobiology, food processing, electronics, nuclear and high energy physics, chemical processing, metal manufacturing, cryogenic power generation, medicine, analytical physics and chemistry.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Summarize the properties of cryogenics system.
2. Identify the suitable method for gas separation and purification methods.
3. Demonstrate the various vaccum techniques.
4. Explain the process of cryogenic fluid storage systems.
5. Discuss the various advance applications in cryogenics.

TEXT BOOKS:

1. Mukhopadhyay, Magmata, “Fundamentals of Cryogenic Engineering”, PHI Learning, 2012.
2. Cryogenic Engineering – R.B. Scott – D.VanNostrand Company, 1959.

REFERENCE BOOKS:

1. Cryogenic Process Engineering – K.D. Timmerhaus and T.M. Flynn, Plenum Press, New York,1989.
2. High Vacuum Technology – A. Guthree – New Age International Publication.
3. Experimental Techniques in Low Temperature Physics – G.K. White – Osford University Press,England, 1959.

15UME926 **INDUSTRIAL ROBOTICS**

L	T	P	C
3	0	0	3

OBJECTIVES :

- To familiarize the basic concepts associated with the design and functioning applications of Robots.
- To impart knowledge to analyze robot kinematics and robot programming.

UNIT I FUNDAMENTALS OF ROBOT **9**

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Payload – Robot Parts and Functions – Need for Robots – Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION **9**

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection, Segmentation Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING **9**

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 9

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Illustrate the robot anatomy and various robot applications.
2. Compare the different types of grippers and robot drive systems.
3. Discuss the role of sensors and machine vision system in robot applications.
4. Use the various programming languages for intended robot movement.
5. Explain the robot implementation in industries and its economics.

TEXT BOOKS:

1. Groover.M.P, “Industrial Robotics – Technology, Programming and Applications ”, McGraw-Hill , 2001.
2. Fu.K.S,Gonzalz.R.C, Lee C.S.G, “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co, 1987.

REFERENCE BOOKS:

1. YoramKoren, “Robotics for Engineers ”, McGraw-Hill Book Co, 1992.
2. Janakiraman.P.A, “Robotics and Image Processing,” Tata McGraw-Hill, 1995.
3. AshishDutta, “Robotic Systems - Applications, Control and Programming ”, 2012.
4. John J. Craig, “Introduction to Robotics ”, Pearson Edition, 2008.

15UME927	INTRODUCTION TO AIRCRAFT INDUSTRY AND AIRCRAFT SYSTEMS	L	T	P	C
		3	0	0	3

UNIT I AIRCRAFT INDUSTRY OVERVIEW 4

Evolution and History of Flight, Types Of Aerospace Industry, Key Players in Aerospace Industry, Aerospace Manufacturing, Industry Supply Chain, Prime contractors, Tier 1 Suppliers, Key challenges in Industry Supply Chain, OEM Supply Chain Strategies, Mergers and Acquisitions, Aerospace Industry Trends, Advances in Engineering/CAD/CAM/CAE Tools and Materials technology, Global and Indian Aircraft Scenario

UNIT II INTRODUCTION TO AIRCRAFTS 6

Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices.Types of Aircrafts - Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Configurations-Biplane, Variable Sweep, Canard Layout, Twin Boom Layouts, Span loaders, Blended Body Wing Layout, STOL and STOVL Aircraft, Stealth Aircraft. Advantages and disadvantages of these Configurations.

UNIT III INTRODUCTION TO AIRCRAFT SYSTEMS 16

Types of Aircraft Systems. Mechanical Systems. Electrical and Electronic Systems. Auxiliary systems. Mechanical Systems: Environmental control systems (ECS), Pneumatic systems, Hydraulic systems, Fuel systems, Landing gear systems, Engine Control Systems, Ice and rain protection systems, Cabin Pressurization and Air Conditioning Systems, Steering and Brakes Systems Auxiliary Power Unit, Electrical systems: Avionics, Flight controls, Autopilot and Flight Management Systems, Navigation Systems, Communication, Information systems, Radar System

UNIT IV BASIC PRINCIPLES OF FLIGHT 10

Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects.

Aerofoil Nomenclature, Types of Aerofoil, Wing Section- Aerodynamic Center, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag,

UNIT V BASICS OF FLIGHT MECHANICS **9**

Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects

Stability and Control

Degree of Stability- Lateral, Longitudinal and Directional Stability and controls of Aircraft. Effects of Flaps and Slats on Lift Coefficients, Control Tabs, Stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves

Aircraft Performance and Maneuvers

Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on aAeroplane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Get an exposure to the Aerospace Industry.
2. Understand the Basics of Aircraft Systems and Aircraft Structures.
3. Industry Practices on Design of Aircraft Structures.
4. Understand the applicability of Design aspects in Aircraft Design.
5. Relate the theoretical knowledge with the design of Aircraft Structures.

REFERENCE BOOKS:

1. Flight without Formulae by A.C Kermode, Pearson Education,10th Edition
2. Mechanics of Flight by A.C Kermode, Pearson Education,5th Edition
3. Fundamentals Of Flight, Shevell, Pearson Education, 2nd Edition
4. Introduction to Flight by Dave Anderson
5. .Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration by Ian moir, Allan Seabridge
6. Aircraft Design-A Conceptual Approach by Daniel P.Raymer, AIAA education series,6th Edition
7. Airframe Structural Design by Michael Niu, Conmilit Press, 1988,2nd Edition
8. Airframe Stress Analysis and Sizing by Michael Niu, Conmilit Press, 1999,3rd Edition
9. The Elements of Aircraft Preliminary Design – Roger D. Schaufele, Aries Publications, 2000
10. Aircraft Structural Maintenance by Dale Hurst, Avotek publishers, 2nd Edition, 2006
11. Aircraft Maintenance & Repair by Frank Delp, Michael J. Kroes&
12. William A. Watkins, Glencoe &McGraw-Hill,6th Edition, 1993
13. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio, Butterworth-Heinemann

15UME928	DESIGN OF AIRCRAFT STRUCTURES	L	T	P	C
		3	0	0	3

UNIT I OVERVIEW OF THE AIRCRAFT DESIGN PROCESS 6

Introduction

Phases of Aircraft Design, Aircraft Conceptual Design Process, Conceptual Stage, Preliminary Design, Detailed Design, Design Methodologies

Fundamentals of Structural Analysis

Review of Hooke's Law, Principal stresses, Equilibrium and Compatibility, Determinate Structures, St Venant's Principle, Conservation of Energy, Stress Transformation, Stress Strain Relations.

UNIT II AIRCRAFT STRUCTURES AND LOADS 7

Introduction to Aircraft Structures

Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longeron, Splices, Sectional Properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints

Aircraft Loads& Duration

Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, VN diagrams, Gust Loads, Ground Loads, Ground conditions, Miscellaneous Loads

UNIT III AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES 5

Material selection criteria, Aluminum Alloys, Titanium Alloys, Steel Alloys, Magnesium Alloys, copper Alloys, Nimonic Alloys, Non Metallic Materials, Composite Materials, Use of Advanced materials Smart materials, Manufacturing of A/C structural members, Overview of Types of manufacturing processes for Composites, Sheet metal Fabrication ,Machining, Welding, Superplastic Forming And Diffusion Bonding

UNIT IV STRUCTURAL ANALYSIS OF AIRCRAFT STRUCTURES 20

Theory of Plates- Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysis of stiffened panels in buckling, Rectangular plate buckling, Analysis of Stiffened panels in Post buckling, Post buckling under shear. **Sample Exercises.**

Theory of Shells-Analysis of Shell Panels for Buckling, Compression loading, Shear Loading / Shell Shear Factor, Circumferential Buckling Stress, **sample exercises**

Theory of Beams-Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Plastic Bending of beams, Shear Stresses due to Bending in Thin Walled Beams, Bending of Open Section Beams, Bending of Closed Section Beams, Shear Stresses due to Torsion in Thin Walled Beams. **Sample Exercises**.

Theory of Torsion- Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Multi Cell Sections, **Sample Exercises.**

UNIT V AIRCRAFT CERTIFICATION AND STRUCTURAL REPAIR 7

Airworthiness and Aircraft Certification

Definition, Airworthiness Regulations, Regulatory Bodies, Type certification, General Requirements, Requirements Related to Aircraft Design Covers, Performance and Flight Requirements, Airframe Requirements, Landing Requirements, Fatigue and Failsafe requirements, Emergency Provisions, Emergency Landing requirements

Aircraft Structural Repair

Types of Structural damage, Nonconformance, Rework,Repair, Allowable damage Limit, Repairable Damage Limit, Overview of ADL Analysis, Types of Repair, Repair Considerations and best practices

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Discuss the aircraft design process
2. Explain the various loads act in the aircraft structure.
3. Discuss the aircraft materials and manufacturing process.
4. Analyze the various force in aircraft structure.
5. Discuss the various airworthiness and aircraft certification
6. Illustrate the ADL analysis and aircraft repair.

REFERENCE BOOKS:

1. Flight without Formulae by A.C Kermode, Pearson Education,10th Edition
2. Mechanics of Flight by A.C Kermode, Pearson Education,5th Edition
3. Fundamentals Of Flight, Shevell, Pearson Education, 2nd Edition
4. Introduction to Flight by Dave Anderson.
5. Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration by Ian moir, Allan Seabridge
6. Aircraft Design-A Conceptual Approach by Daniel P.Raymer, AIAA education series,6th Edition
7. Airframe Structural Design by Michael Niu, Conmilit Press, 1988,2nd Edition
8. Airframe Stress Analysis and Sizing by Michael Niu, Conmilit Press, 1999,3rd Edition
9. The Elements of Aircraft Preliminary Design – Roger D. Schaufele, Aries Publications, 2000
10. Aircraft Structural Maintenance by Dale Hurst, Avotek publishers, 2nd Edition, 2006
11. Aircraft Maintenance & Repair by Frank Delp, Michael J. Kroes&
12. William A. Watkins, Glencoe &McGraw-Hill,6th Edition, 1993
13. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio, Butterworth-Heinemann

OPEN ELECTIVES

OPEN ELECTIVE (Mechanical Department offering course):

Sl. No	Course Category	Course Code	Course Name	L	T	P	C
1.	OE	15UME971	Industrial Psychology and Work Ethics	3	0	0	3
2.	OE	15UME972	Industrial Safety and Engineering	3	0	0	3
3.	OE	15UME973	Synthesis of Nano Materials	3	0	0	3
4.	OE	15UME974	Principles of Management	3	0	0	3
5.	OE	15UME975	Total Quality Management	3	0	0	3

15UME971	INDUSTRIAL PSYCHOLOGY AND WORK ETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the major concepts of and debates surrounding industrial and organizational psychology
- To impart knowledge on psychological research and theory to human interaction in the workplace.

UNIT I INTRODUCTION TO INDUSTRIAL PSYCHOLOGY 9

Definitions and Scope. Major influences on industrial Psychology. Performance Management Training and Development.

UNIT II INDIVIDUAL IN WORKPLACE 9

Motivation and Job satisfaction, stress management. Organizational culture, Leadership and group dynamics.

UNIT III ENVIRONMENT AND ENGINEERING PSYCHOLOGY-FATIGUE 9

Boredom, accidents and safety. Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests.

UNIT IV SOCIOLOGY 9

A general over view scope of industrial sociology, industry and education, industry and family, industry and social stratification. History and evolution of values and ethics in social work. Team work, communication, organizational skills and time management.

UNIT V ETHICAL PRACTICE AND SOCIETY 9

Professional values and self-awareness about ethical professional behavior, ethical decision making processes and dilemma examples. Considerations for each jurisdiction that registers, certifies or licenses social workers.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Summarize the industrial psychology and performance management.
2. Make use theories to explain and predict behavior and mental processes
3. Identify the safety and job analysis for engineering psychology.
4. Illustrate the industrial sociology and evolution the values of industrial activity.
5. Demonstrate the ethical practice in industries and social workers.

TEXT BOOKS:

1. Miner J B, “Industrial/Organizational Psychology ”, McGraw Hill Inc,1992.
2. Reamer F G, “Social Work Values and Ethics”, ColumbiaUniversity Press,2nd Edition,2003.

REFERENCE BOOKS:

1. Aamodt M G, “Industrial/Organizational Psychology : An Applied Approach ”, Belmont, 2007.
2. Aswathappa K, “Human Resource Management ”, Tata McGraw Hill, 2008.
3. Edmund G Seebauer, Robert L Barry “Fundamentals of Ethics for Scientists and Engineers ”, OxfordUniversity Press, 2001.
4. David Ermann, Michele S Shauf “Computers, Ethics and Society ”, Oxford University Press,2003.

15UME972	INDUSTRIAL SAFETY AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To enable the students to learn about various functions and activities of safety department.
- To enable students to conduct safety audit and write audit reports effectively in auditing situations.
- To have knowledge about sources of information for safety promotion and training.
- To familiarize students with evaluation of safety performance.

UNIT I CONCEPTS AND TECHNIQUES 10

History of Safety movement –Evolution of modern safety concept-general concepts of management –line and staff functions for safety-budgeting for safety-safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, 52 safety sampling, evaluation of performance of supervisors on safety.

UNIT II SAFETY AUDIT 10

Components of safety audit, types of audit, audit methodology, non-conformity reporting (NCR), audit checklist and report –review of inspection, remarks by government agencies, consultants, experts –perusal of accident and safety records, formats –implementation of audit indication -liaison with departments to ensure co-ordination –check list -identification of unsafe acts of workers and unsafe conditions in the shop floor-IS 14489 : 1998 Code of practice on occupational Safety and health audit.

UNIT III ACCIDENT INVESTIGATION AND REPORTING 10

Concept of an accident, near miss incident, reportable and non-reportable accidents, reporting to statutory authorities –principles of accident prevention –accident investigation and analysis –records for accidents, departmental accident reports, documentation of accidents – unsafe act and condition – domino sequence – supervisory role – role of safety committee – cost of accident.

UNIT IV SAFETY PERFORMANCE MONITORING 8

ANSI (Z16.1) Recommended practices for compiling and measuring work injury experience – permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate ,Total Injury illness incidence rate, Lost workday cases incidence rate (LWDI), Number of lost workdays rate –problem.

UNIT V SAFETY EDUCATION AND TRAINING 7

Importance of training -identification of training needs - training methods -programmes, seminars, conferences, competitions – method of promoting safe practice -motivation-communication - role of government agencies and private consulting agencies in safety training DGFASLI, NSC, ASSE, HSE, OSHA-NEBOSH-creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. To understand the functions and activities of safety engineering department.
2. To carry out a safety audit and prepare a report for the audit.
3. To prepare an accident investigation report.
4. To estimate the accident cost using supervisors report and data.
5. To evaluate the safety performance of an organization from accident records.
6. To identify various agencies, support institutions and government organizations involved in safety training and promotion.

TEXT BOOKS:

1. Ray Asfahl. C “Industrial Safety and Health Management” PearsonPrentice Hall, 2003.
2. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey,1973.
3. John V.Grimaldi and Rollin H. Simonds,“Safety Management”,Richard D Irwin, 1994.

REFERENCE BOOKS:

1. Lees, F.P & M. Sam Mannan , “Loss Prevention in Process Industries: Hazard Identification, Assessment and Control ”, Butterworth -Heinemann publications, London, 4th edition, 2012.
2. John Ridley, “Safety at Work”, Butterworth and Co., London, 1983.
3. Subramanian.V., “The Factories Act 1948 with Tamilnadu factories rules 1950”, Madras Book Agency, 21 st ed., Chennai, 2000.

15UME973	SYNTHESIS OF NANO MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- This course aims at imparting knowledge on synthesis of nano materials

UNIT I BULK SYNTHESIS 9

Synthesis of bulk nano-structured materials – sol gel processing – Mechanical alloying and mechanical milling- Inert gas condensation technique – Nanopolymers – Bulk and nano composite materials.

UNIT II CHEMICAL APPROACHES 9

Self-assembly, self-assembled monolayers (SAMs). Langmuir-Blodgett (LB) films, clusters, colloids, zeolites, organic block copolymers, emulsion polymerization, template synthesis, and confined nucleation and/or growth. Biomimetic Approaches: polymer matrix isolation, and surface-templated nucleation and/or crystallization. Electrochemical Approaches: anodic oxidation of alumina films, porous silicon, and pulsed electrochemical deposition.

UNIT III PHYSICAL APPROACHES 9

Vapor deposition and different types of epitaxial growth techniques- pulsed laser deposition, Magnetron sputtering - Micro lithography (photolithography, soft lithography, micromachining, e-beam writing, and scanning probe patterning).

UNIT IV NANOPOROUS MATERIALS 9

Nanoporous Materials – Silicon - Zeolites, mesoporous materials - nanomembranes and carbon nanotubes - AgX photography, smart sunglasses, and transparent conducting oxides – molecular sieves – nanosponges.

UNIT V CHARACTERIZATION OF NANOPHASE MATERIALS 9

Fundamentals of the techniques – experimental approaches and data interpretation – applications/limitations of x-ray characterization: – x-ray sources – wide angle, extended x-ray absorption technique – Electron microscopy: SEM/TEM – high resolution imaging – defects in nanomaterials – spectroscopy: – electron energy-loss mechanisms – electron filtered imaging – prospects of scanning probe microscopes – optical spectroscopy of metal/semiconductor nanoparticles.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Describe about bulk and nano composite materials.(K_2)
2. List out the self-assembled monolayers(SAMS). (K_2)
3. Discus the operation of Magnetron sputtering device. (K_2)
4. Collect the experimental approaches and data interpretation. (K_3)
5. Distinguish the nano membranes and carbon nanotubes. (K_2)

TEXT BOOKS:

1. C. N. R. Rao, A. Muller, A. K. Cheetham, "The Chemistry of Nano materials: Synthesis, Properties and Applications", Wiley-VCH, Verlag GmbH, Volume 1, Germany, 2004.
2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties &Applications ,Imperial College Press", 2004.
3. W.Gaddand, D.Brenner, S.Lysherski and G.J.Infrate, "Handbook of NanoScience, Engg. and Technology", CRC Press,2002.

REFERENCE BOOKS:

1. S.P. Gaponenko, "Optical Properties of semiconductor Nano crystals ",Cambridge University Press, 1980.
2. K. Barriham, D.D. Vvedensky, "Low dimensional semiconductor structures: fundamental and device applications", Cambridge University Press, 2001.
3. Guozhong Cao, "Nanostructures & Nanomaterials Synthesis, Properties G;Z: Applications", World Scientific Publishing Private, Ltd., Singapore, 2004.
4. Zhong Lin Wang, "Characterization Of Nanophase Materials", Wiley-VCH, Verlag GmbH, Germany, 2004.
5. Carl C. Koch, "Nanostructured Materials: Processing, Properties and Potential Applications", Noyes Publications, William Andrew Publishing Norwich,New York, U.S.A, 2002.

15UME974	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart the knowledge on the process of management in organizations and the dynamic world of managers.
- To familiarize the nature of managers contribute to the productivity and performance of their organizations.

UNIT I OVERVIEW OF MANAGEMENT 9

Organization – Management – Role of managers – Evolution of Management thought – Organization and the environmental factors – Managing globally – Strategies for International Business.

UNIT II PLANNING 9

Nature and Purpose planning – Planning process – Types of plans – Objectives – Managing by objective (MBO)- Strategies – Types of strategies – Policies – Decision Making – Types of decision – Decision Making Process - Rational Decision Making Process – Decision Making under different conditions.

UNIT III ORGANISING 9

Nature and purpose of organizing – Organization structure – Formal and informal groups / organization – Line and Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing – Selection and Recruitment – Orientation Career Development – Career stages – Training – Performance Appraisal.

UNIT IV DIRECTING 9

Creativity and Innovation – Motivation and Satisfaction – Motivation Theories- Leadership – Leadership theories – Communication – Hurdles to effective communication – Organization Culture – Elements and types of culture – Managing cultural diversity.

UNIT V CONTROLLING 9

Process of controlling – Types of control – Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control – Quality Control – Planning operations.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Summarize various management thoughts.
2. Explain planning and decision making processes.
3. Illustrate the purpose of organizing and different organizational structure.
4. Compare various motivational, leadership theories.
5. Discuss different budgetary and non-budgetary control techniques.

TEXT BOOKS:

1. Stephen P. Robbins, Mary Coulter, “Management”, Prentice Hall of India, 2006.
2. Charles W.L Hill, Steven L McShane, “Principles of Management ”, Tata McGraw-Hill Education Pvt. Ltd., 2007

REFERENCE BOOKS:

1. Hellriegel, Slocum &Jackson , “Management – A Competency Based Approach ”, Thomson South Western, 10th Edition,2007.
2. Harold Koontz, Heinz Weihrich, mark V Cannice, “Management – A global & Entrepreneurial Perspective ”, Tata Mcgraw Hill, 12th Edition,2007.
3. Parthasarathy. P, “Principle of Management”, Vrinda Publication, 2nd Edition, New Delhi,2008.
4. Andrew J. Dubrin, “Essentials of Management”, Thomson Southwestern, 2007.

15UME975	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES :

- Give knowledge on the fundamental principles of Total Quality Management;
- To give idea about choose appropriate statistical techniques for improving processes;
- To familiarize the student write reports to management describing processes and recommending ways to improve them;
- To give idea about research skills that will allow them to keep abreast of changes in the field of Total Quality Management;
- To explain the concepts and principles of total quality management.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle,5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking- Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Identify basic concepts of TQM and the role of senior management.
2. Explain the customer satisfaction, retention, employee involvement and the continuous process improvement techniques.
3. List seven tools of quality, new seven management tools and concept of six sigma.
4. Apply the concept of QFD, FMEA and total productive maintenance.
5. Demonstrate the need for ISO 9000, other quality system and auditing.

TEXT BOOKS:

1. Dale H.Besterfiled, “Total Quality Management”, Pearson Education Asia, 2006.
2. James R. Evans, William M. Lindsay “The Management and Control of Quality ”, Tata South-Western (Thomson Learning), 2005

REFERENCE BOOKS:

1. Oakland. J.S, “TQM – Text with Cases”, Butterworth – Heinemann Ltd3rd Edition, 2003.
2. Suganthi.L, Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd, 2006.
3. Janakiraman.B, Gopal. R.K “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd,2006.
4. Valarmathi .B, Srinivasa Gupta N “Total Quality Management”, Vijay Nicole.

ONE CREDIT COURSES

ONE CREDIT COURSE:

Sl. No	Course Code	Course Name	L	T	P	C
1.	15UME861	Smart Materials	1	0	0	1
2.	15UME862	CNC programming	1	0	0	1
3.	15UME863	Solar energy	1	0	0	1
4.	15UME864	Basics in Refrigeration and Air-conditioning	1	0	0	1
5.	15UME865	Jigs and Fixtures	1	0	0	1
6.	15UME866	Work Study	1	0	0	1

15UME861	SMART MATERIALS	L	T	P	C
		1	0	0	1

OBJECTIVES :

- The aim of this course is presents the latest on a variety of smart materials, smart structures, and properties and recent applications as well as the family grouping of materials.

UNIT I INTRODUCTION TO SMART MATERIALS 5

Smart materials - Definition, Concept and classifications of smart materials - Advanced composite materials, Ceramics, Pure Glass, Gallium arsenide, Superconductors and Intelligent materials.

UNIT II SMART STRUCTURES AND PROPERTIES 7

Components of a Smart Structure. Properties - Optical (optical band gap engineering, nonlinear optical effects, electrochromic, photochromic and thermochromic effects). Electrical properties (piezoelectric effect). Thermo-mechanical properties (shape memory effect, self-healing).Magnetic properties (magnetoresistance). Active surface properties (photocatalytic effect, biocompatibility).

UNIT III APPLICATIONS OF SMART MATERIALS 3

Sensors (gas, vapors, temperature, strain, stress, adaptive structures). Energy (solar cells, solar absorbers, smart windows).Environment (self-cleaning surfaces).Biomedical (artificial lungs, DNA chips, smart hydrogels).Aerospace and outer space (self-healing protective surfaces, thermal radiators). Electronics and consumer products (displays, illumination, printed electronics).

TOTAL : 15 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the definition and types of smart materials.
2. Utilize the components of smart structures and unique properties of smart materials.
3. Categorize the applications of smart materials in various engineering field.

REFERENCE BOOKS:

1. Mel Schwartz, “Smart Materials”, CRC Press, 2009.
2. A. V. Srinivasan, D. Michael McFarland, “Smart Structures, Analysis and Design”, Cambridge University Press, 2001.
3. M.V. Gandhi, B.D. Thompson, “Smart Materials and Structures”, Springer Science & Business Media, 1992.

15UME862	CNC PROGRAMMING	L	T	P	C
		1	0	0	1

OBJECTIVES :

- The objective of this course is to programming of computerized numerical control equipment with hands-on practice on operations of a CNC milling and Turning.

UNIT I INTRODUCTION TO CNC **5**

Functions of a machine tool - Concept of numerical control - Historical Development - Evolution of CNC - Limitations of CNC - Features of CNC.

UNIT II CNC MACHINING **10**

Fundamentals of CNC milling & turning - Part programming techniques - examples - Linear interpolation- Circular interpolation- simulation.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Develop part programmes for given components.

REFERENCE BOOKS:

1. S K Sinha, “CNC Programming Using Fanuc”, The McGraw-Hill Companies, Inc, 2010.
2. Ashok Kumar Singh, “CNC Programming”, Vayu Education of India; First edition (2015).
3. Hans B. Kief, Helmut A. Roschiwal, “CNC Handbook”, McGraw-Hill Education: New York, 2012.

15UME863	SOLAR ENERGY	L	T	P	C
		1	0	0	1

OBJECTIVES :

- To gain knowledge on the various sources of renewable and non-renewable energy.
- To impart various conversion technique to tap the solar energy.

UNIT I INTRODUCTION TO SOLAR ENERGY 5

Energy – Renewable, Non – renewable, Man and Energy – Energy sources – Energy Alternatives – Devices for solar energy collection – Flat Plate Collector and Concentrated Collector.

UNIT II SOLAR ENERGY CONVERSION 5

Solar air heaters – Solar bond – Solar power plant – Solar air conditioning and refrigeration – solar cooker – solar still.

UNIT III DEVELOPMENT IN SOLAR ENERGY 5

Solar energy in agriculture – Advances in solar energy – Economic analysis of solar energy – Future of solar energy – solar Ice maker.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Understand the different sources of availability of energy.
2. Apply the knowledge of thermal concepts for the extraction of solar energy.
3. Analysis the possibilities of getting improvement in the economy of solar energy.

REFERENCE BOOKS:

1. S P Sukhatme, J K Nayak, “Solar Energy: Principles of thermal Collection and Storage”, First Reprint, Tata Mcgraw – Hill, 2008.
2. Soteris A. Kalogirou, “Solar Energy Engineering: processes and Systems”, Second Edition, Academic Press, 2014.

15UME864	BASICS IN REFRIGERATION AND AIR CONDITIONING	L	T	P	C
		1	0	0	1

OBJECTIVES :

- To gain knowledge on the various sources of renewable and non-renewable energy.
- To impart various conversion technique to tap the solar energy

UNIT I INTRODUCTION 5

Definition of Refrigeration and Air Conditioning-History of Refrigeration and Air conditioning - History from compressor development point of view-History from Refrigerant development Point of View-Applications of Refrigeration and Air Conditioning

UNIT II REFRIGERATION SYSTEMS 5

Air Cycle Refrigeration Systems-Vapour Compression Refrigeration Systems-Vapour Absorption Refrigeration Systems-Lithium bromide-Water Absorption Refrigeration Systems - Aqua – Ammonia Refrigeration System-Aqua-ammonia Absorption Refrigeration Systems

UNIT III REFRIGERATION AND AIR CONDITIONING SYSTEMS 5

Refrigeration system components-Compressors Condensers Evaporators Expansion devices-Refrigerants-Properties of moist air (psychrometry)-Psychrometric Processes-Air conditioning systems for comfort-Infiltration and IAQ-Airconditioning Systems-Fan and Duct Systems-Control systems for Refrigeration and Air conditioning applications

TOTAL : 15 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Gain employment in the field of refrigeration and air conditioning;
2. Demonstrate positive work habits and attitudes; and,
3. Demonstrate knowledge and skills required for the repair and maintenance of air conditioning and refrigeration equipment according to National Standards.

REFERENCE BOOKS:

1. Refrigeration And Air Conditioning R.S.Khurmi ,J.K.Gupta.,S.Chand and Company, 2010.
2. Basic Refrigeration and Air Conditioning P.N.Ananthanarayanan.,McGraw Hill Education (India) Pvt.Ltd, 2012.

15UME865	JIGS & FIXTURES	L	T	P	C
		1	0	0	1

OBJECTIVES :

- To understand the introduction of Jigs and fixtures
- To gain proficiency in the development of required views of the final knowledge.

UNIT I PRINCIPLES JIGS & FIXTURES 5

Objectives of tool - Function and advantages of Jigs and fixtures - Basic elements – principles of location – Locating methods and devices – Mechanical actuation – pneumatic and hydraulic actuation Standard parts

UNIT II JIGS 5

Introduction of jigs - Types of Jigs – Post, Turn over, Channel, latch, box, pot, angular post jigs – Indexing jigs Drill bushes and Jig buttons – Tolerances and materials used.

UNIT III FIXTURES 5

Introduction of fixtures for given component General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Explain the jigs and fixtures.
2. Compare and development of jigs and fixtures.

REFERENCE BOOKS:

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co.,Ltd., New Delhi, 2010.
2. K. Venkataraman, “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2010.
3. Hoffman “Jigs and Fixture Design” – Thomson Delmar Learning, Singapore, 2011.

15UME866	WORKSTUDY	L	T	P	C
		1	0	0	1

OBJECTIVES :

- To impart knowledge about work study and dealing with work related issues in the work place.
- To familiarize the usage of standard time and allowances.

UNIT I WORK STUDY, MOTION STUDY & ERGONOMICS 7

Work study definition; Role of work study in improving productivity; Work study procedure: Selection of jobs; Information collection and recording; Recording techniques-charts and diagrams. Motion study; Therbligs; Cycle graph and Chrono Cycle graph; Simo chart and Principles of Motion economy. Ergonomics; Work environment and Human factors.

UNIT II WORK MEASUREMENT & FACILITIES DESIGN 8

Definition; Procedure; Performance rating; Concept of normal time; allowances. Work sampling technique. Introduction to pre - determined motion time system. Computing Standard Time.Site Selection: Factors influencing the selection of rural and urban locations of sites, Optimum decision on choice of site and analysis. Plant Layout: Types of production, Types of layouts, Advantages and Disadvantages of layout, Factors affecting layout. Design of work place layout.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Produce a model using ergonomic principles that suitable for specified work environment.
2. Design of work place plant Layout.

REFERENCE BOOKS:

1. O.P.Khanna,"Industrial Engineering and Management" Dhanpat Rai & Sons, 2010.
2. Suresh Dalela and Saurabh Dalela "Text Book of Work Study and Ergonomics" Standard Publishers Distributors, New Delhi, 2013.

INTER / MULTI

DISCIPLINARY ELECTIVE

COURSES

INTER/ MULTI DISCIPLINARY ELECTIVE COURSES:

Sl. No	Course Code	Course Name	L	T	P	C
1.	15UGM951	Smart Manufacturing (Common to Mech & IT)	3	0	0	3
2.	15UGM952	Automation in Agriculture Engineering (Common to Mech, Agri, IT)	3	0	0	3
3.	15UMG95	Electric Vehicles (Common to EEE & Mech)	3	0	0	3
4.	15UMG95	Bio Fluid Mechanics (Common to Biomedical & Mech)	3	0	0	3

15UGM951	SMART MANUFACTURING (Common to MECH and IT)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To introduce the smart connected systems using Internet of Things, Cloud in Industrial Automation
- To use devices in IoT Technology
- To familiarize the concepts of designing and developing various service models (IaaS, Paas and SaaS) and deployment models (Public, Private and Hybrid clouds).

UNIT I INDUSTRY 4.0 9

Introduction to Industrial revolutions - Industry 4.0 environment - Drivers of industry 4.0 - Digital integration in smart factory - Cyber Physical System - Internet of Things and Services - New technologies for future manufacturing - Benefits and Challenges of Industry 4.0

UNIT II ADDITIVE MANUFACTURING 9

Introduction to additive manufacturing – Classification of AM process – Generic AM process – SLS – SLA – DMLS - Reverse Engineering – Computer Aided Engineering - Powder fusion mechanism – Process parameter & Modeling – PBF commercial machine - Material Jetting – Guide line for process selection- Applications of AM – Introduction to 3D & 4D printing

UNIT III ROBOTS IN MANUFACTURING 9

Introduction about robotics in automation - Robot classification – Robot coordination system - Artificial Intelligence and Robotics - Robot applications in manufacturing – Material handling – Processing Operations – Assembly and Inspection – Future Robot Technology and tasks – Social and Labor Issues.

UNIT IV INTERNET OF THINGS 9

Internet of Things Promises – Definition – Scope – Sensors for IoT Applications – Structure of IoT – IoT Map Device - Technological Analysis - Wireless Sensor Structure – Energy Storage Module – Power Management Module – RF Module – Sensing Module IoT Development Examples

UNIT V CLOUD SERVICES AND FILE SYSTEM 9

Cloud Computing Basics - Cloud Computing definition - Types of Cloud services - Software as a Service (SaaS) - Platform as a Service (Paas) – Infrastructure as a Service (IaaS) - Database as a Service - Monitoring as a Service – Communication as a service - Service providers - Google App Engine - AmazonEC2 - Microsoft Azure - Sales force

Total: 45 Periods

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the concept of Industry 4.0 and IoT to the solution of complex engineering problems in modern industrial sector. (Apply)
2. Select appropriate additive manufacturing method for particular industrial product. (Apply)
3. Select suitable robot for the manufacturing industrial applications. (Apply)
4. Design IoT Components that meet with realistic constraints for societal and environmental considerations. (Create)
5. Apply the knowledge of virtualization techniques to provide Iaas, Saas, Paas. (Apply)

TEXT BOOKS:

1. Industry 4.0: The Industrial Internet of Things, Alasdair Gilchrist, A press, Berkeley CA, 2016, 978-1-4842-2046-7
2. The Concept Industry 4.0 : An Empirical Analysis of Technologies and Applications in Production Logistics, Bartodziej, Christoph Jan, 1st Edition, Springer Gabler, 2017. 978-3-658-16501-7
3. RajkumarBuyya, Christian Vecchiola, ThamaraiSelvi S, “Mastering Cloud Computing”,Tata McGraw Hill Education Private Limited,1st Edition, 2013.

REFERENCE BOOKS:

1. Additive Manufacturing Technologies (3D printing, Rapid prototype and Direct Digital Manufacturing, Gibson, Ian, Rosen, David, Stucker, Brent, Springer, 2015.
2. Industrial Robotics (SIE): Technology, Programming And Applications – Nicholas Odrey, Mitchell Weiss, Mikell Groover, Roger N Nagel and Ashish Dutta – Tata McGraw-Hill Publishing Company, 2012.
3. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.

COURSE ARTICULATION MATRIX

CO/PO/PSO MAPPING

CO	POs												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2			2						3	2	3	
CO 2	3	2			3							2	3	
CO 3	3	2			3							2	3	
CO 4					3							2	3	
CO 5	3				3								3	

PROGRAMME ARTICULATION MATRIX

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UGM951	3	2			3						3	2	3	

Ref: 3 - Strong 2 - Medium 3 – Weak

15UGM952	AUTOMATION IN AGRICULTURE (Common to Mech, IT, Agri)	L	T	P	C
		3	0	0	3

Objective:

- To expose the students to the concept of Agriculture Automation and Farm Mechanization
- To learn about the different types of primary and secondary tillage implements, farm equipment and ploughing methods.
- To introduce the concepts of Automatic Systems and IoT applications
- To train the students to explore and use new technologies in Agriculture

UNIT I INTRODUCTION TO FARM MECHANIZATION & AGRICULTURE AUTOMATION 8

Sources of farm power- merits& demerits of different farm power- farm mechanization-concept – scope-constraints & scope –selection factors. Mechanization in farm operations. Introduction - agriculture automation.

UNIT II TILLAGE IMPLEMENTS & AUTOMATION IN SOWING, PLANTERS 10

Tillage-objective- classification- primary tillage - mould board plough working principle –Disc plough working principle -secondary tillage –Disc harrow-single action-double action- off set-cultivator types.

Sowing &fertilizer equipment-sowing methods- Automation in sowing- seed drill-components of seed drill-seed cum fertilizer. Automation in planters-ex: potato planter, sugar cane planter.

UNIT III SYSTEMS OF AUTOMATION 8

Automated Irrigation – Pneumatic System and its applications – Portable timer system – Timer/Sensor Hybrid/SCADA – Methods of automating Irrigation layout – Machine Learning in Tank Monitoring System.

UNIT IV IoT IN AGRICULTURE 10

IoT based Automated Irrigation System – IoT based Smart Irrigation – Sensor based Automation – types – operation – Solar based Automatic Irrigation System – components – operation - Automation by sensing soil moisture-– Automation using ANN based controller – operation.

UNIT V AGRICULTURAL ROBOT 9

Introduction to Agricultural Vehicle Robot - Overview of a Robot Farming System- Agricultural Robot Vehicles - Robot Management System-Multi robot systems -Agricultural robots-types, operations.

Total :45 periods

TEXT BOOKS:

1. Jagdishwarsahay 2006, Elements of Agricultural Engineering, Standard Publishers Distributors, New Delhi.
2. Qin Zhang_ F J Pierce-(2013) Agricultural Automation_ Fundamentals and Practices-CRC Press Taylor & Francis Group.
3. H.R.Haise, E.G.Kruse. et al., 1981. "Automation of Surface Irrigation: 15 years of USDA Research and Development at Fort Collins, Colorado

REFERENCES:

1. E.L. Barger, R.A. Kepner, Roy Bainer, Principles of Farm Machinery (Third Edition), CBS Publishers & Distributors Pvt. Ltd.
2. Harris Pearson Smith and Lambert Henry Wilkes, Farm machinery and equipment's, 6thedition, Tata McGraw-Hill, New Delhi, 1997.
3 Michael and ojha 2005, Principles of Agricultural Engineering, Jain brothers, New Delhi.
4. Brian Wahlin and Darell Zimbelman, Canal Automation for Irrigation Systems, American Society of Civil Engineers, 2014.

COURSE OUTCOMES:

After completion, the student will be able to

1. The importance of Farm mechanization and concept of Agriculture Automation. (Understand)
2. Classify the various tillage implements, seed drills, automation in sowing and planters (Understand)
3. Apply the knowledge of different systems to automate irrigation. (Apply)
4. Apply the knowledge of IOT to design smart systems for automating Agriculture. (Apply)
5. Classify the various Robots for automation in Agriculture. (Understand)

Beyond the Syllabus

1. Blue River Technology – Weed Control
2. Harvest CROO Robotics – Crop Harvesting

COURSE ARTICULATION MATRIX

CO/PO/PSO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2					2	2							
CO.2	2					2	2							
CO.3	3					3	3				3	3		
CO.4	3					3	3					3		
CO.5	2					2	2							

PROGRAMME ARTICULATION MATRIX

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UGM952	**3**					**3**	**3**				**3**	**3**		

Ref: 3 - Strong 2 - Medium 3 – Weak

15UGM953 – ELECTRIC VEHICLES

(Interdisciplinary Course: EEE & MECH)

UNIT I Hybrid and Electric Vehicles (HEV): History Overview and Modern Applications 9

Ground vehicles with mechanical powertrain and reasons for HEV development - HEV configurations and ground vehicle applications - . Advantages and challenges in HEV design

UNIT II Power Flow and Power Management Strategies in HEV 9

Mechanical power: generation, storage and transmission to the wheels - Electric power: generation, storage and conversion to mechanical power - Hydraulic power: generation, storage and conversion to mechanical power - Energy storage/conversion and thermodynamic relations

UNIT III Electric Drives & Power Electronics in Hybrid Electric Vehicles 9

DC-Brushed and brushless drives: principles of design, operation, math modeling and control - Shunt Drives - Series Drives - Compound Drives - Thermal analysis of electric drives in various vehicle applications. Rectifiers - Buck convertor - Voltage source inverter - Current source inverter - DC-DC convertor

UNIT IV Vehicle Dynamics Fundamentals for HEV Modeling and Wheel-Electric Drive, Suspension System Design 9

Various strategies for improving vehicle energy/fuel efficiency - Vehicle chassis mathematical model in various operation conditions (steady motion, acceleration, regenerating braking, coasting, moving up and down a hill) Gear trains in wheel-electric drives - Mechatronic design of wheel-electric drives - Suspension design for wheel-electric drives Wheel/Tire-terrain interactive dynamics - Inverse dynamics-based control.

UNIT V Batteries and Energy Storages 9

Battery characterization, math modeling and designs-. Battery sizing for various vehicle applications - Battery monitoring and charging control - Combination of batteries and ultra capacitors - Fuel cells: principles of operation, design, modeling - Fuel cell storage system - Strategy for controlling hybrid fuel cell system- Flywheel energy storage characterization - Hydraulic accumulator characterization

REFERENCE BOOKS:

1. Chris Mi.M, Abdul Mansoor and David Wenzhong Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives” Wiley, Jul 2011.
2. Iqbal Hussain, “Electric & Hybrid Vechicles – Design Fundamentals”, Second Edition, CRC, Press, 2011.
3. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.
4. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010.
5. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2001

15UGM954	BIOFLUID MECHANICS	L	T	P	C
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Objective:

- To gain knowledge in the theory and characteristics of fluid mechanics.
- To study the characteristics of flow.
- To familiarize the concept of cardiovascular physiology.
- To understand the biomechanics of the human circulation.

UNIT I BASIC OF FLUID MECHANICS 9

Units and dimensions – Properties of fluids – mass density, specific weight, specific volume, specific gravity, viscosity, Newton law of viscosity, compressibility, vapour pressure, surface tension and capillarity, Types of fluid, Fluid Pressure.

UNIT II FLOW CHARACTERISTICS AND FLUID DYNAMICS 9

Types of flow: Laminar, Turbulent, steady, unsteady, uniform, non uniform flows , stream line, streak line, path line – continuity equation, Reynolds equation of motion, Navier stokes equation.

UNIT III FLOW THROUGH CIRCULAR CONDUITS 9

Boundary layer – Boundary layer thickness – Viscous flow – Hagen poiseuille equation – Major loss – Darcy Weisbach equation – friction factor – Moody diagram – minor losses.

UNIT IV CARDIOVASCULAR PHYSIOLOGY AND RHEOLOGY OF BLOOD 10

Cardiovascular Physiology: Introduction – Heart – Cardiac Valves – Systematic Circulation – Coronary Circular – Pulmonary Circulation and Gas Exchange in the Lungs – Cerebral and Renal circulation – IoT based Automated Irrigation System – IoT based Smart Irrigation – Sensor based Automation – types – operation – Solar based Automatic Irrigation System – components – operation - Automation by sensing soil moisture-– Automation using ANN based controller – operation.

UNIT V AGRICULTURAL ROBOT 9

Introduction to Agricultural Vehicle Robot - Overview of a Robot Farming System- Agricultural Robot Vehicles - Robot Management System-Multi robot systems -Agricultural robots-types, operations.

Total :45 periods

TEXT BOOKS:

1. Jagdishwarsahay 2006, Elements of Agricultural Engineering, Standard Publishers Distributors, New Delhi.
2. Qin Zhang_ F J Pierce-(2013) Agricultural Automation_ Fundamentals and Practices-CRC Press Taylor & Francis Group.
3. H.R.Haise, E.G.Kruse. et al., 1981. "Automation of Surface Irrigation: 15 years of USDA Research and Development at Fort Collins, Colorado

REFERENCES:

1. E.L. Barger, R.A. Kepner, Roy Bainer, Principles of Farm Machinery (Third Edition), CBS Publishers & Distributors Pvt. Ltd.
2. Harris Pearson Smith and Lambert Henry Wilkes, Farm machinery and equipment's, 6thedition, Tata McGraw-Hill, New Delhi, 1997.

3 Michael and ojha 2005, Principles of Agricultural Engineering, Jain brothers, New Delhi.
4. Brian Wahlin and Darell Zimbelman, Canal Automation for Irrigation Systems, American Society of Civil Engineers, 2014.

COURSE OUTCOMES:

After completion, the student will be able to

1. The importance of Farm mechanization and concept of Agriculture Automation. (Understand)
2. Classify the various tillage implements, seed drills, automation in sowing and planters (Understand)
3. Apply the knowledge of different systems to automate irrigation. (Apply)
4. Apply the knowledge of IOT to design smart systems for automating Agriculture. (Apply)
5. Classify the various Robots for automation in Agriculture. (Understand)

Beyond the Syllabus

1. Blue River Technology – Weed Control
2. Harvest CROO Robotics – Crop Harvesting

COURSE ARTICULATION MATRIX

CO/PO/PSO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO.1	2					2	2							
CO.2	2					2	2							
CO.3	3					3	3				3	3		
CO.4	3					3	3					3		
CO.5	2					2	2							

PROGRAMME ARTICULATION MATRIX

Subject	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
15UGM954	**3**					**3**	**3**				**3**	**3**		

Ref: 3 - Strong 2 - Medium 3 – Weak