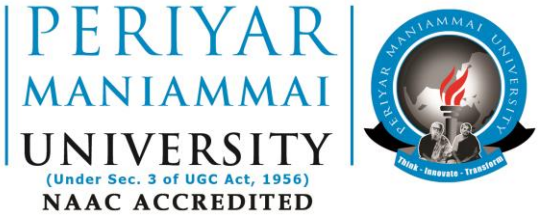
B.TECH. MECHANICAL ENGINEERING

(4 Years Full time Degree Programme)

CURRICULUM AND SYLLABUS

Regulation 2016 (Revision I)

The total credits required for completing the
B.Tech. Programme in Mechanical Engineering is 176.



DEPARTMENT OF MECHANICAL ENGINEERING

Periyar Maniammai University

Vallam, Thanjavur - 613 403

MAY 2017

Department of Mechanical Engineering

University Vision

- To be a University of global dynamism with excellence in knowledge and innovation ensuring social responsibility for creating an egalitarian society.

University Mission

- **UM1:** Offering well balanced programmes with scholarly faculty and state-of-art facilities to impart high level of knowledge.
- **UM2:** Providing student - centered education and foster their growth in critical thinking, creativity, entrepreneurship, problem solving and collaborative work.
- **UM3:** Involving progressive and meaningful research with concern for sustainable development.
- **UM4:** Enabling the students to acquire the skills for global competencies.
- **UM5:** Inculcating Universal values, Self respect, Gender equality, Dignity and Ethics.

Department Vision

To be recognized globally for outstanding education and research in all fields of mechanical engineering leading to well qualified engineers, who are innovative, entrepreneurial and successful in studies.

Department Mission

- **DM 1:** To inculcate basic mechanical engineering knowledge to students through effective teaching– learning practices with state of art facilities.
- **DM2:** To impart quality education to enable the students for higher studies, research and Entrepreneurship.
- **DM3:** To carry out research activities to satisfy the societal and industrial needs towards sustainability.
- **DM4:** To provide our students with educational experiences that gives them a sound basis for global requirements, team work and lifelong learning.
- **DM5 :** To cater the needs of society in context of mechanical engineering with human ethics values.

Mapping of University Mission with Department Mission

	DM1	DM2	DM3	DM4	DM5	Total
UM1	3	2	1	1	1	8
UM2	1	3	1	2	1	8
UM3	1	2	3	1	1	8
UM4	1	1	1	3	1	7
UM5	1	0	2	1	3	7
Total	7	8	8	8	7	

Programme Outcomes (PO's)

Graduates shall have

1. an ability to apply principles of engineering, basic science, and mathematics to model and analyze components or processes
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability
4. an ability to function on multi-disciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
12. an ability to imbibe principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes
13. an ability to work professionally in ***design and manufacturing*** systems (PSO1)
14. an ability to work professionally in ***energy*** systems (PSO2)

Programme Educational Objectives (PEO's)

1. Mechanical Engineering graduate shall have successful career with good leadership & team work abilities.
2. Graduate pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.
3. Graduate shall have ability to apply core technical competency to various engineering problems along with sense of social awareness.
4. Graduate shall engage in lifelong learning by applying contextual technological knowledge for research and value education.

PEO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Total
PEO1	1	0	2	3	1	1	3	1	2	1	1	1	1	1	19
PEO2	3	2	1	1	2	1	1	1	1	1	2	1	2	1	20
PEO3	2	2	3	0	2	3	0	2	0	2	1	1	1	1	20
PEO4	0	2	1	1	1	1	2	1	3	1	2	2	1	1	19

Guidelines for UG Engineering & Technology Curriculum 2015-16

Curriculum Structure for B.Tech. (Full time) Degree Programmes offered by PMU

S. No.	Category	AICTE Recommendation %	PMU adoption %	PMU credits	Deviation %	Number of courses
1.	Humanities and Social Sciences (HS), including Management;	5 to 10	5.11 %	9	0	6
2.	Basic Sciences(BS) including Mathematics, Physics, Chemistry, Biology;	15 to 20	15.91 %	28	0	7
3.	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical /Computer Engineering, Instrumentation;	15 to 20	13.64 %	24	Actual = - 1.36 %	6
4.	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required;)	30 to 40	39.20 %	69	0	17
5.	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch;	10 to 15	10.23 %	18	0	6
6.	Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	5 to 10	5.11 %	9	0	3
7.	Project Work, Seminar and/or Internship in Industry or elsewhere	10 to 15	10.23 %	18	0	5
8.	Mandatory Courses (MC); Non-Credit 8 units (UGC Mandatory)*	-	-	-	-	3
10.	Non Credit Course – ELS	-	-	-	-	3
11.	NCC/NSS/YRC/RRC/Sports	-	-	-	-	1
			100%	176		57

Semester I

S. No.	Code No	Course Title	Credits				Hours				
			L	T	P	Total	L	T	P	S.S.	Total
1.	XMA101	Algebra, Differential Calculus and their Applications	3	1	0	4	3	2	0	0	5
2.	XCP102	Computer Programming	3	0	1	4	3	0	2	0	5
3.	XBW103	Mechanical and Civil Engineering Systems	3	1	1	5	3	2	2	0	7
4.	XAC104	Applied Chemistry	3	1	1	5	3	2	2	0	7
5.	XGS105	Study Skills and Language Laboratory	1	0	0	1	1	0	0	2*	3
6.	XUM106	Human Ethics, Values, Rights and Gender Equality	1	0	0	1	1	0	0	2*	3
		Total	**14**	**4**	**2**	**20**	**14**	**8**	**6**	**2**	**30**

* Non-credit

Semester II

S. No.	Code No	Course Title	Credits				Hours			
			L	T	P	Total	L	T	P	Total
1.	XMA201	Calculus and Laplace Transforms	3	1	0	4	3	2	0	5
2.	XEM202	Engineering Mechanics	3	1	0	4	3	2	0	5
3.	XBE203	Electrical and Electronics Engineering Systems	3	1	1	5	3	2	2	7
4.	XAP204	Applied Physics	3	1	1	5	3	2	2	7
5.	XEG205	Engineering Graphics	2	0	1	3	2	0	2	4
6.	XGS206	Speech Communication	1	0	0	1	1	0	2*	3
		Total	**15**	**4**	**3**	**22**	**15**	**8**	**8**	**31**

* Non-credit

Semester III

S. No.	Code No	Course Title	Credits				Hours				
			L	T	P	Total	L	T	P	S.S.	Total
1.	XMA301	Transforms and Partial Differential Equations	3	1	0	4	3	2	0	0	5
2.	XME302	Engineering Thermodynamics	3	1	0	4	3	2	0	0	5
3.	XME303	Manufacturing Technology	3	0	1	4	3	0	2	0	5
4.	XME304	Strength of Materials	3	1	1	5	3	2	2	0	7
5.	XES305	Engineering Materials	3	0	0	3	3	0	0	0	3
6.	XEP306	Entrepreneurship Development	2	0	0	2	2	0	0	1*	3
7.	XGS307	Interpersonal Communication	0	0	0	0	0	0	2*	0	2
8.	XME308	In-plant Training - I	-	-	-	1	-	-	-		-
		Total	**17**	**3**	**2**	**23**	**17**	**6**	**6**	**1**	**30**

* Non-credit

Semester IV

S. No.	Code No	Course Title	Credits				Hours			
			L	T	P	Total	L	T	P	Total
1.	XOR 401	Operations Research	3	0	0	3	3	0	0	3
2.	XME402	Machine Drawing, Computer Graphics and Computer Aided Design	2	0	1	3	2	0	2	4
3.	XME403	Electrical Technology & Industrial Electronics	3	0	1	4	3	0	2	5
4.	XME404	Mechanics of Machines	3	1	1	5	3	2	2	7
5.	XME405	Design of Machine Elements	3	1	0	4	3	2	0	5
6.	XEE406	Economics for Engineers	3	0	0	3	3	0	0	3
7.	XGS407	Technical Communication	1	0	0	1	1	0	2*	3
8.	XEC408	Extracurricular activities - NCC/NSS/YRC/RRC/Sports	-	-	-	-	-	-	-	-
		Total	**18**	**2**	**3**	**23**	**18**	**4**	**8**	**30**

* Non-credit

Semester V

S. No.	Code No	Course Title	Credits				Hours			
			L	T	P	Total	L	T	P	Total
1.	XMA501	Numerical Methods	2	1	0	3	2	2	0	4
2.	XME502	Design of Transmission Systems	2	1	0	3	2	2	0	4
3.	XME503	Machine Tool Operations and Metrology	3	0	1	4	3	0	2	5
4.	XME504	Fluid Mechanics and Machinery	3	1	1	5	3	2	2	7
5.	XME505	Professional Elective - I	2	1	0	3	2	2	0	4
6.	XTQ506	Total Quality Management	3	0	0	3	3	0	0	3
7.	XGS507	Business Communication	1	0	0	1	1	0	2*	3
8.	XME508	In-plant Training - II	-	-	-	1	-	-	-	-
		Total	**16**	**4**	**2**	**23**	**16**	**8**	**6**	**30**

* Non-credit

Semester VI

S. No.	Code No	Course Title	Credits				Hours			
			L	T	P	Total	L	T	P	Total
1.		Open Elective - I	3	0	0	3	3	0	0	3
2.	XME602	Industrial Engineering and Management	3	0	0	3	3	0	0	3
3.	XME603	Automobile Engineering	3	0	1	4	3	0	2	5
4.	XME604	Thermal Engineering	3	1	1	5	3	2	2	7
5.	XME605	Power Plant Engineering	3	1	0	4	3	2	0	5
6.	XME606	Professional Elective - II	3	0	0	3	3	0	0	3
7.	XUM607	Environmental Studies	0	0	0	0	3*	0	0	3
8.	XGS608	Academic Writing	0	0	0	0	0	0	2*	2
		Total	**18**	**2**	**2**	**22**	**21**	**4**	**6**	**31**

* Non-credit

Semester VII

S. No.	Code No	Course Title	Credits				Hours			
			L	T	P	Total	L	T	P	Total
1.		Open Elective - II	3	0	0	3	3	0	0	3
2.	XME702	Fluid Power Engineering and Mechatronics	3	0	1	4	3	0	2	5
3.	XME703	Heat and Mass Transfer	3	1	1	5	3	2	2	7
4.	XME704	Professional Elective - III	3	0	0	3	3	0	0	3
5.	XME705	Professional Elective - IV	3	0	0	3	3	0	0	3
6.	XUM706	Cyber Security	0	0	0	0	3*	0	0	3
7.	XME707	Project Phase - I	0	0	2	2	0	0	4	4
8.	XGS708	Career Development Skills	0	0	0	0	0	0	1*	1
9.	XME709	In-plant Training - III	-	-	-	2	-	-	-	-
		Total	**15**	**1**	**4**	**22**	**18**	**2**	**9**	**29**

* Non-credit

Semester VIII

S. No.	Code No	Course Title	Credits				Hours			
			L	T	P	Total	L	T	P	Total
1.		Open Elective - III	3	0	0	3	3	0	0	3
2.	XME802	Professional Elective - V	3	0	0	3	3	0	0	3
3.	XME803	Professional Elective - VI	3	0	0	3	3	0	0	3
4.	XME804	Project Phase - II	0	0	12	12	0	0	24	24
		Total	**9**	**0**	**12**	**21**	**9**	**0**	**24**	**33**

PROFESSIONAL ELECTIVES

Code No	Course Title	Credits			
		L	T	P	C
Professional Elective - I					
XME505A	Finite Element Analysis	2	1	0	3
XME505B	Mechanical Vibrations	2	1	0	3
XME505C	Reliability Engineering	2	1	0	3
XME505D	Gas Dynamics and Shock Waves	2	1	0	3
Professional Elective - II					
XME606A	CAD/CAM	3	0	0	3
XME606B	Product Design and Development	3	0	0	3
XME606C	Mathematical Modeling and Simulation	3	0	0	3
XME606D	Refrigeration and Air conditioning	3	0	0	3
Professional Elective - III					
XME704A	Advanced I.C Engines	3	0	0	3
XME704B	Tool Engineering	3	0	0	3
XME704C	Renewable Energy Sources	3	0	0	3
Professional Elective - IV					
XME705A	Computer Integrated Manufacturing	3	0	0	3
XME705B	Disaster Management	3	0	0	3
XME705C	Instrumentation and Control Engineering	3	0	0	3
Professional Elective - V					
XME802A	Computational Fluid Dynamics	3	0	0	3
XME802B	Industrial Automation and Control	3	0	0	3
XME802C	Unconventional Manufacturing Technology	3	0	0	3
Professional Elective - VI					
XME803A	Automotive Electronics	3	0	0	3
XME803B	Microelectromechanical Systems	3	0	0	3
XME803C	Industrial Safety	3	0	0	3

OPEN ELECTIVES

Code No	Course Title	Credits			
		L	T	P	C
XMEOE1	Product Design and Development	3	0	0	3
XMEOE2	Renewable Energy Sources	3	0	0	3

Summary of the credits and hours

Semester	Total Credits	Total Hours / Week	No. of courses
I	20	30	6
II	22	31	6
III	23	30	8
IV	23	30	8
V	23	30	8
VI	22	31	8
VII	22	29	9
VIII	21	33	4
I - VIII	**176 Credits**	-	57

Credit structure

Course type	Credits				Contact Hours			
	L	T	P	Total	L	T	P	Total
Lecture course	3	0	0	3	3	0	0	3
Lecture + Practical course	3	0	1	4	3	0	2	5
	2	0	1	3	2	0	2	4
Lecture + Tutorial course	3	1	0	4	3	2	0	5
	2	1	0	3	2	2	0	4
Lecture + Tutorial + Practical course	3	1	1	5	3	2	2	7

XMA 101 ALGEBRA, DIFFERENTIAL CALCULUS AND THEIR APPLICATIONS 3 1 0 4

CO1. Cog: U,A_p ***Explain*** the Properties of eigen values and eigen vectors of the matrices, ***Make Use of*** orthogonal and similarity transformation and ***Construct*** the quadratic form to Canonical form.

CO2. Cog: R,U ***Define*** and ***Find*** the radius and circle of curvature in cartesian and polar coordinates and to ***Explain*** evolutes and envelopes.

CO3.Cog: U ***Explain*** the convergence of series of positive terms, alternating series, and power series using tests of convergence .

CO4. Cog: R ***Find*** total and partial derivatives , Taylor serie expansions of functions and the extremum of functions and their applications.

CO5. Cog: A_p ***Solve*** the linear equations of second and higher order with constant and variable coefficients and simultaneous first order differential equations and to ***Apply*** Method of variation of parameters to ***Solve*** the differential equation.

SUBCODE	SUB NAME	L	T	P	C
XMA 101	ALGEBRA,DIFFERENTIAL CALCULUS AND THEIR APPLICATIONS	3	1	0	4
C:P:A = 3:0:0					
		L	T	P	H
		3	2	0	5

UNIT I MATRICES **15**

Eigen values and Eigenvectors of a real matrix –Properties of Eigen values and Eigen vectors – Cayley-Hamilton theorem (excluding proof) - Similarity transformation (Concept only) – Orthogonal matrix - Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to Canonical form by Orthogonal transformation.

UNIT II GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS **15**

Curvature – Cartesian and polar co-ordinates – Centre and radius of curvature – Circle of curvature – Involutes and evolutes – Envelopes – Properties of envelopes and evolutes.

UNIT III INFINITE SERIES **15**

Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test – Statement of theorems and problems only) – Alternating series – Series of positive and negative terms – Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series (Simple problems only)

UNIT IV FUNCTIONS OF SEVERAL VARIABLES **15**

Functions of two variables – Partial derivatives – Total differentiation – Taylor's expansion – Maxima and Minima – Constrained maxima and minima – Lagrange's Multiplier method – Jacobian Determinants.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS AND APPLICATIONS **15**

Linear equations of second and higher order with constant and variable coefficients (Euler's and Legendre's equations) – Simultaneous first order linear equations with constant coefficients – Method of variation of parameters - Applications to electrical circuit problems.

	LECTURE	TUTORIAL	TOTAL

	45	**30**	**75**

TEXT

1. Grewal, B.S. Higher Engineering Mathematics, 40th Edition, Khanna Publication, Delhi, 2007.
2. Kreyszig, E, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Son(Asia) Ltd, Singapore, 2001.

REFERENCES

1. Bali N.P and Narayana lyengar, Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi, 2003.
2. Veerarajan T, Engineering Mathematics Fourth Edition, Tata – McGraw Hill Publishing Company Ltd, New Delhi, 2005.
3. Kandasamy P., Thilagavathy K, and Gunavathy K, Engineering Mathematics Volume I, II and III, S. Chand & Co, New Delhi, 2005.
4. Venkataraman M. K, Engineering Mathematics, Volume I and II Revised enlarge Fourth Edition, The National Publishing Company, Chennai, 2004.

E REFERENCES

www.nptel.ac.in

Advanced Engineering Mathematics Prof. Pratima Panigrahi

Department of Mathematics Indian Institute of Technology, Kharagpur.

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3									1		1
CO 2	3									1		1
CO 3	3	2								1	1	2
CO 4	3	2			1					1	1	1
CO 5	3	2			1					1	1	1
	15	6	0	0	2	0	0	0	0	5	3	6

1 - Low , 2 – Medium , 3- high

XCP 102 **Computer Programming** **3 0 1 4**

SUBCODE	**SUB NAME**	**L**	**T**	**P**	**C**
XCP 102	**COMPUTER PROGRAMMING**	**3**	**0**	**1**	**4**
C:P:A = 3:1:0					
		L	**T**	**P**	**H**
		3	**0**	**2**	**5**

	Course Outcomes	**Domain**	**Level**
CO1	***Define*** programming fundamentals and ***Solve*** simple programs using I/O statements.	Cognitive Psychomotor	Remember Guided Response
CO2	***Define*** syntax and ***write simple programs*** using control structures and arrays	Cognitive Psychomotor	Remember Guided Response
CO3	***Explain*** and ***write simple programs*** using functions and pointers	Cognitive Psychomotor	Understand Guided Response
CO4	***Explain*** and ***write simple programs*** using structures and unions	Cognitive Psychomotor	Understand Guided Response
CO5	***Explain*** and ***write simple programs*** using files and ***Build*** simple projects	Cognitive Psychomotor	Understand Guided Response

UNIT I	PROGRAMMING FUNDAMENTALS AND INPUT /OUTPUT STATEMENTS	9 + 6

Theory

Program – Flowchart – Pseudo code – Software – Introduction to C language – Character set – Tokens: Identifiers, Keywords, Constants, and Operators – sample program structure -Header files – Data Types - Output statements – Input statements.

Practical

1. Program to display a simple picture using dots.
2. Program for addition of two numbers
3. Program to swap two numbers
4. Program to solve any mathematical formula.

UNIT II	CONTROL STRUCTURE AND ARRAYS	9 + 6

Theory

Control Structures – Conditional Control statements: Branching, Looping - Unconditional control structures: switch, break, continue, goto statements – Arrays: One Dimensional Array – Declaration – Initialization – Accessing Array Elements – Searching – Sorting – Two Dimensional arrays - Declaration – Initialization – Matrix Operations – Multi Dimensional Arrays - Declaration – Initialization. Storage classes: auto – extern – static. Strings: Basic operations on strings.

Practical

1. Program to find greatest of 3 numbers using Branching Statements
2. Program to display divisible numbers between n1 and n2 using Looping Statement
3. Program to remove duplicate element in an array.
4. Program to perform string operations.

UNIT III	FUNCTIONS AND POINTERS	9 + 6

Theory

Functions: Built in functions – User Defined Functions - Parameter passing methods - Passing arrays to functions – Recursion - Programs using arrays and functions. Pointers - Pointer declaration - Address operator - Pointer expressions & pointer arithmetic - Pointers and function - Call by value - Call by Reference - Pointer to arrays - Pointers and structures - Pointers on pointer.

Practical

1. Program to find factorial of a given number using four function types.
2. Programs using Recursion
3. Programs using Pointers

UNIT IV	STRUCTURES AND UNIONS	9 + 6

Theory

Structures and Unions - Giving values to members - Initializing structure - Functions and structures - Passing structure to elements to functions - Passing entire function to functions - Arrays of structure - Structure within a structure and Union.

Practical

1. Program to read and display student mark sheet Structures with variables
2. Program to read and display student marks of a class using Structures with arrays
3. Program to create linked list using Structures with pointers

UNIT V	FILES	9 + 6

Theory

File management in C - File operation functions in C - Defining and opening a file - Closing a file - The getw and putw functions - The fprintf & fscanf functions - fseek function – Files and Structures.

Practical

1. Program for copying contents of one file to another file.
2. Program using files using structure with pointer

	LECTURE	PRACTICAL	TOTAL
	45	30	75

TEXT BOOKS

1. Byron Gottfried, "Programming with C", III Edition, (Indian Adapted Edition), TMH

publications, 2010

2. Yeshwant Kanethker, “Let us C”, BPB Publications, 2008

REFERENCES

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education Inc. (2005).
2. Behrouz A. Forouzan and Richard. F. Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks–Cole Thomson Learning Publications, 2001.
3. Johnsonbaugh R. and Kalin M., “Applications Programming in ANSI C”, III Edition, Pearson Education India, 2003.
4. https://iitbombayx.in/courses/IITBombayX/BMWCS101.1x/2015_T1/courseware

Mapping of COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	2			2							2
CO2	3	2			2							2
CO3	3	2	1	2	2							2
CO4	3	2	1	2	2							2
CO5	3	2	1		2			1			2	2

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
Original	15	10	3	4	10			1			2	10
Scaled to 0,1,2,3 scale	3	2	1	1	2			1			1	2

XBW 103 Mechanical and Civil Engineering Systems 3 1 1 5

Semester	SEMESTER II	
Subject Name	Mechanical and Civil Engineering Systems	
Subject Code	XBW 103/XBW 203	
Prerequisite	Nil	
L –T –P –C 3- 1 - 1- 5	C:P:A 3:1:0	L –T –P –H 3- 2-2-7

Course Outcome:		Domain (C or P or A)	LEVEL
CO1	***Define and visualize*** the working principles of the various boilers, turbines and engines	Cognitive Psychomotor	Knowledge Perception
CO2	***Differentiate and auscultate*** the measurements by using various metrology instruments	Cognitive Psychomotor	Comprehension Guided response
CO3	***Categorise and illustrate*** the various metal forming, joining and cutting processes	Cognitive Psychomotor	Synthesis Mechanism
CO4	***Characterize and determine*** the quality of the good Building materials; and measure linear and angular dimensions	Cognitive Psychomotor	Knowledge Guided response
CO5	***Summarize and palpate*** the components of a substructures and super structures.	Cognitive Psychomotor	Evaluation Guided response

COURSE CONTENT	
UNIT-I	**Basics of Thermal and Energy Systems 9+6+6 hrs**
	Introduction to Mechanical Engineering – Streams – Thermal, Design, and Manufacturing Conventional and non conventional sources of energy – Heat energy – Modes of heat transfer – Working principles of Boilers and Turbines – Classification of IC Engines – 4 stroke and 2 stroke engines – Petrol and diesel engines – Performance of stationary diesel engines and automotive (diesel and petrol) IC engines – Working principles of hydel, steam and nuclear power plants. **Practical:** Diesel engine performance – BHP Demonstration of refrigeration and air conditioning units
UNIT –II	**Fundamentals of Machine Elements and Measurements 9+6+6 hrs**
	Engineering materials – Machine elements – fasteners and support systems – Belt drives – Types – Velocity ratio and Length of belt – Gear drives – Types – Velocity ratio. Principle of measurements – Accuracy – Precision – Errors – Measuring instruments – Scale – Vernier Caliper – Micrometer – Slip gauges – Spirit level. **Practical:** Measurements using Vernier Caliper, Micrometer. Demonstration of transmission system in machines and suspension system in automobiles.
UNIT-III	**Elements of Manufacturing 9+6+6 hrs**
	Manufacturing processes – Classification – Principles of metal forming – forging, moulding, casting – Principles of metal joining – welding, soldering and brazing. Machining – turning, drilling, milling and grinding – Machining time and

	material removal rate. **Practical:** Exposure to workshop tools Fitting exercises: Square and triangle Simple turning and drilling Demonstration of welding and mould preparation
UNIT -IV	**Surveying and Construction Materials 9+6+6 hrs**
	Surveying: Definition – Survey Instruments – Classification of Survey – Linear and Angular Measurements – Measurement of area – Illustrative Examples. Construction Materials: Bricks – Stones – Timber – Steel – Cement – Sand – Aggregates – Concrete **Practical:** Surveying
UNIT V	**Components and of Construction of Civil Structures 9+6+6 hrs**
	Substructure: Bearing capacity **-** Types of Foundation – Application – Requirement of good foundations. Superstructure: Brick masonry – Types of bond – Flooring – Beams – Columns – Lintels – Roofing – Doors and windows fittings – Introduction to bridges and dams – Building drawing **Practical:** Building drawing, Carpentry, Plumbing.
	Total Contact hrs (L-45 hrs & P-30&T-30 hrs)

Text books

1. Dr. P.K. Srividhya, P. Pandiyaraj, S. Balamurugan, "Basic Civil and Mechanical Engineering", PMU Publications, Vallam, 2013.
2. Dr. B.C.Punmia, Ashok Kumar Jain, "Basic Civil Engineering", Laxmi Publications, New Delhi, 2003.
3. Dr. B.C.Punmia, "Surveying – Volume I", Laxmi Publications, New Delhi, 2005

References

1. Venugopal K., Basic Mechanical Engineering, Anuradha Publications, Kumbakonam, 2007.
2. Shanmugam G. and Palanichamy M. S.,"Basic Civil and Mechanical Engineering", Tata Mc Graw Hill Publishing Co., New Delhi, 3rd Edition, 2009.

Mapping of CO's with GA's:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12

CO1	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**2**			**2**		**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO3		**2**			**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4		**3**		**1**		**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**1**	**1**			**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Total	**5**	**6**	**-**	**5**	**5**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
Scale	**2**	**3**		**2**	**2**	**1**						

Scale : 1 - Low Relation
2 - Medium Relation
3 – High Relation

XAC 104 Applied Chemistry 3 1 1 5

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XAC104/XAC204	**APPLIED CHEMISTRY**	**3**	**1**	**1**	**5**
C:P:A = 2.8:0.8 :0.4					
		L	**T**	**P**	**H**
		3	**2**	**2**	**7**

COURSE OUTCOMES

CO1. Cog (R) and Psy (Perception): ***Identify*** and ***describe*** the various water quality parameters and methods to purify water in contest with boilers and domestics usage.

CO2. Cog (U) and Psy (Set) : ***Explain*** the fundamental principles of electrochemical reactions, its applications in redox reactions and calculate the different electrochemical processes.

CO3. Cog (Apply) ,Affec (Rece) and Psy (Mech): ***Interpret*** the types of corrosion, ***use*** *and* ***measure*** its control by various methods including protective techniques.

CO4. Cog (R &Analy) and Affec (Resp) ; ***Describe***, ***Illustrate*** and ***Discuss*** the generation of energy in batteries, nuclear reactors, solar cells, fuel cells and anaerobic digestion.

CO5. Cog (R &Apply) and Psy(Mech) ; ***Apply*** and ***measure*** the different types of spectral techniques for quantitative chemical analysis and ***list*** nanomaterials for various engineering processes.

Theory Part

UNIT - I WATER TECHNOLOGY	**7 + 8 +9**

Sources and types of water – water quality parameters – BIS and ISO specifications- hardness: types and estimation of hardness (problems) - alkalinity: types and estimation (problems) – boiler feed water – requirements – disadvantages of using hard water in boilers – internal treatment, external treatment – demineralization process – desalination using reverse osmosis – domestic water treatment - Effluent treatment processes in industries

UNIT - II ELECTROCHEMISTRY	**8+5 +15**

Basic concepts of conductance – Kohlraush's law and conductometric titrations –electrode potentials– Nernst equation: derivation and problems - reversible and irreversible cells – electrolytic and electrochemical cells – emf and its measurements - types of electrodes-reference electrodes - primary and secondary - glass electrode - determination of pH using quinhydrone and glass electrodes - electrochemical series and its applications - Galvanic cells and concentration cells - potentiometric titrations - redox titrations.

UNIT – III CORROSION AND PROTECTIVE COATINGS	**9 + 4 +3**

Corrosion- causes- types-chemical, electrochemical corrosion (galvanic, differential aeration), corrosion in electronic devices, corrosion control - material selection and design aspects -

electrochemical protection – sacrificial anode method and impressed current cathodic method.

Protective coatings: paints- constituents and functions - electroplating of copper and gold, Electroless plating - Distinction between electroplating and electroless plating,
advantages of electroless plating, electroless plating of nickel and copper on PCB.

UNIT –IV ENERGY STORAGE DEVICES AND NUCLEAR ENERGY | **12 + 7**

Energy storage devices – Batteries: Types – primary (dry cell, alkaline cells) and secondary (lead acid, Ni-Cd and Lithium ion batteries) - Supercapacitors – Fuel cells-Hydrogen-Oxygen fuel cell- Solar cells .

Nuclear energy: nuclear fission and fusion –chain reaction and its characteristics – nuclear energy and calculations (problems) – atom bomb –Nuclear reactor- light water nuclear power plant – breeder reactor- Weapon of mass destruction- nuclear, radiological, chemical and biological weapons. Disarmament - National and International Cooperation- Chemical Weapon Convention (CWC), Peaceful Uses of Chemistry. Bio fuels: biomethanation- anaerobic digestion process, biomass: sources and harness of energy.

UNIT –V SPECTROSCOPY AND NANOCHEMISTRY | **9 +6 +3**

Electromagnetic spectrum - Lambert law and Beer-Lambert's law (derivation and problems) – molecular spectroscopy -UV- visible spectroscopy: electronic transitions - chromophores and auxochromes – instrumentation (block diagram) - applications – IR spectroscopy: principle – fundamental modes of vibrations – calculations of vibrational frequency – IR spectrophotometer instrumentation (block diagram) – applications of IR spectroscopy.

Nanochemistry - Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis ; properties and applications of nano materials-Buckminister fullerenes, CNT‟S(Single walled carbon nano tubes and Multi-walled carbon tubes)-Graphene- advantages and applications.

TEXT BOOKS

1. Jain and Jain , "A Text book of Engineering Chemistry", Dhanapatrai Publications,New Delhi, 2011.
2. Gadag and NityanandaShetty , "Engineering Chemistry", I.K International publishing House Pvt. Ltd, 2010.
3. P. Atkins, J.D. Paula , "Physical Chemistry" , Oxford University Press, 2009.
4. S. S. Dara, S. S. Umare, "A Text Book of Engineering Chemistry", S. Chand Publishing, 2011
5. C.P. Poole and F.J. Owens, " Introduction to Nanotechnology", , Wiley, New Delhi ,2007.

REFERENCE BOOKS

1. Puri B R Sharma L R and Madan S Pathania, " Principles of Physical Chemistry", Vishal publishing Co., Edition 2004
2. Kuriocose, J C and Rajaram, J, "Engineering Chemistry", Volume I/II, Tata McGraw-Hill Publishing Co. Ltd. New Delhi, 2000

E Resources - MOOCs:

1. http://www.mooc-list.com/course/chemistry-minor-saylororg
2. https://www.canvas.net/courses/exploring-chemistry
3. http://freevideolectures.com/Course/2263/Engineering-Chemistry-I
4. http://freevideolectures.com/Course/3001/Chemistry-I
5. http://freevideolectures.com/Course/3167/Chemistry-II
6. http://ocw.mit.edu/courses/chemistry/

Laboratory Part **30 hrs**

1. Determination of total hardness, temporary and permanent hardness of water by EDTA method.

2. Determination of alkalinity of water sample.
3. Determination of chloride content of water sample by Argentometric method.
4. Conductometric titration of a strong acid with a strong base.
5. Determination of strength of hydrochloric acid by pH metric method.
6. Conductometric precipitation titration using barium chloride and sodiumsulphate.
7. Determination of strength of iron by potentiometric method using dichromate.
8. Potentiometric acid-base titration using quinhydrone electrode.
9. Corrosion inhibition efficiency by weight loss method.
10. Estimation of iron by colorimetric method.

REFERENCE BOOKS

1. Mendham, Denney R.C,. Barnes J.D and Thomas N.J.K., "Vogel's Textbook of Quantitative Chemical Analysis", 6th Edition, Pearson Education, 2004.
2. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P. "Experiments in Physical Chemistry", 8th Ed.; McGraw-Hill: New York, 2003.
3. Sirajunnisa.A., Sundaranayagi.S.,Krishna.,Rajangam.R.,Gomathi.S., "Applied Chemistry Lab Manual", Department of Chemistry, PMU Press, Thanjavur, 2016.

E Resources - MOOCs:

1.http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques
2. http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011
3.http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
	45	**30**	**30**	**105**

Table:1 Mapping of CO's with GA's:

	GA 1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	3	3			1	2	1	1	1		2
CO2	2	1	0			1		1	1			1
CO3	3	3	3	2	2	1	2		1	1		1
CO4	3	3	2	2	2	1	2		1	1		1
CO5	2	2	1	1	1	1	1	1	1			1
Total	13	12	9	5	5	5	7	3	5	3		6
Scaled to 0,1,2,3 scale	3	3	2	1	1	1	2	1	1	1		2

Scale: 1-5=1; 6-10=2; 11-15=3

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**1**	**1**		**2**

0-No relation 1 – Low relation, 2 – Medium relation, 3 – High relation

XGS 105 Study Skills and Language Laboratories 1 0 1 1

			STUDY SKILLS AND LANGUAGE LAB	**L**	**T**	**P**	**C**
				1	**0**	**1**	**1**
C	**P**	**A**		**L**	**T**	**P**	**H**
1	**1**	**0**		**1**	**0**	**2**	**3**

Course Outcome:

CO1: Cog (Rem), *Identify* different strategies of reading and writing skills.

CO2: Cog (Rem), Make use of library skills in their learning process.

CO3: Cog (Apply), Apply different techniques to various types of material such as a novel, newspaper, poem, drama and other reading papers.

CO4: Cog(Understanding), Ability to use visual aids to support verbal matters into language discourse.

CO5: Cog (Understand), Psy (Guided Response) Prepares to face the written exam with confidence and without any fear or tension.

SYLLABUS

UNITS		**Hrs**
I	Introduction to study skills; Learning Skills and Strategies of Learning; Cognitive Study skills and physical study skills, Library skills (How to use Library), familiarization of library facilities by the librarian; familiarization of basic cataloguing techniques, how to ransack the library etc.	5
II	Reference Skills, how to use the library facilities for research and to write assignments; how to find out reference books, articles, journals and other e-learning materials; how to use a dictionary and thesaurus.	5
III	Reading related study skills, Process of reading, various types of reading materials and varied reading techniques; familiarization to materials written by various authors; features of scientific writing and familiarization to scientific writing by renowned authors; note making skills	5
IV	Writing related study skills; process of writing, characteristics of writing, discourse analysis, use of visual aids, and note making and note taking skills	5
V	Exam preparation skills; anxiety reduction skills; familiarization with various types of exam/evaluation techniques etc.	5
	LANGUAGE LAB (Practical)	
	Sounds of English Language; vowels, consonants, diphthongs, word stress, sentence stress, intonation patterns, connected speech etc	5
	Vocabulary building – grammar, synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, idioms and phrases.	5
	Reading comprehension – reading for facts, meanings from context, scanning, skimming, inferring meaning, and critical reading. Active listening, listening for comprehension etc.	10
	L=15 hrs P -25 hrs Library – 5 Total:45 Hrs	

Text books

Appropriate Chapters/Units from the following textbooks

1. V.R. Narayanaswamy ,Strengthen Your Writing by (Orient Longman), 2000
2. Ghosh, R N; Inthira, S R [Author],A Course in written English: New Delhi, 1978
3. Jaya Sasikumar, Champa Tickoo, Writing With A Purpose, Published by Oxford University Press, 2000
4. Freeman, Sarah: Study Strategies. New Delhi: Oxford University Press, 1979
5. Paul Gunashekar M.L. Tickoo, Reading for Meaning, Published by S. Chand & Company

Ltd. Sultan Chand & Company, 2000
6. Bernard Hartley (Author), Peter Viney (Author**)** Streamline English: Departures (Oxford English) Paperback ,1990.
7. Bernard Hartley (Author), Peter Viney (Author), Streamline English: Destinations, by , Oxford : Oxford University Press, 1992.
8. Bernard Hartley (Author), Peter Viney (Author),Streamline English Directions, (Oxford University Press 1982).

References

1. Jaya Sasikumar, Champa Tickoo, Writing With A Purpose, Oxford University Press | Paper Back | Language – English.
Freeman, Sarah*:* Study Strategies. *New Delhi: Oxford University Press*, 1979.
2. Reading for Meaning, Paul Gunashekar M.L. Tickoo, Published by S. Chand & Company Ltd. Sultan Chand & Company**,** 2000
3. Susan Fawcett (Author)Evergreen: A Guide to Writing with Readings Paperback – January 4, 2013.

Mapping of COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1										2		
CO2										**2**		
CO3				2						**1**		
CO4												1
CO5										**1**	2	

C:P:A = 3:1:2

XMA 201 CALCULUS AND LAPLACE TRANSFORMS 3 1 0 4

CO1. Cog: R, A_p ***Make Use of*** standard results to ***Find*** the Laplace transforms of derivatives and integrals and to ***solve*** differential equations.

CO2. Cog: R, A_p ***Apply*** *multiple integral concepts to* ***Find*** the area, volume and to understand the order of integration.

CO3.Cog: R, A_p ***Define*** the gradient, divergent curl of vectors. ***Find*** directional derivative, unit vector normal to the surface. ***Apply*** corresponding theorems to ***Find*** the line, surface and Volume integrals.

CO4. Cog: U,A_p ***Construct*** and examine the analytic functions, and their the complex Conjugate and to ***Explain*** the concept of conformal mapping and to ***Construct*** the bilinear transformation.

CO5. Cog: U,A_p ***Explain*** the poles , singularities and residues of functions and to ***solve*** the problems using contour integration.

SUBCODE	SUB NAME	L	T	P	C
XMA 201	CALCULUS AND LAPLACE	3	1	0	4

	TRANSFORMS				
C:P:A = 3:0:0					
		L	**T**	**P**	**H**
		3	**2**	**0**	**5**

UNIT I LAPLACE TRANSFORMS **15**

Transforms of elementary functions – properties – derivatives and integrals of transforms- Transforms of derivatives and integrals - Transforms of unit step function and impulse function - Transform of periodic functions – Convolution Theorem – Inverse transforms – Solutions of differential and integral equations.

UNIT II MULTIPLE INTEGRALS **15**

Double integration – Cartesian and polar coordinates – change of order of integration - area as a double integral – change of variables between Cartesian and polar coordinates - triple integration-– Simple applications (Finding area & volume of a certain region).

UNIT III VECTOR CALCULUS **15**

Gradient, divergence and curl - directional derivative – normal and tangent to a given surface – angle between two surfaces – irrotational and solenoidal vector fields - Line, Surface and Volume Integral – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proof).

UNIT IV ANALYTIC FUNCTIONS **15**

Function of a complex variable – analytic function – necessary and sufficient condition (excluding proof) – Cauchy Riemann equations – properties of analytic functions - harmonic conjugate - construction of an analytic function – Conformal mapping: w= z + c, cz, $\frac{1}{z}$, sinz, coshz, $z+\frac{k^2}{z}$ - Bilinear transformation.

UNIT V COMPLEX INTEGRATION **15**

Statement and application of Cauchy's integral theorem and integral formula - Taylor's and Laurent's expansion - Residues – Cauchy's Residue Theorem - Contour integration over unit circle.

LECTURE	**TUTORIAL**	**TOTAL**
45	**30**	**75**

TEXT

3. Grewal, B.S. Higher Engineering Mathematics, 41st Edition, Khanna Publication, Delhi, 2011.
4. Kreyszig, E, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Son(Asia) Ltd, Singapore, 2001.

REFERENCES

5. Bali N.P and Narayana lyengar, Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi, 2003.
6. Veerarajan T, Engineering Mathematics Fourth Edition, Tata – McGraw Hill Publishing Company Ltd, New Delhi, 2005.
7. Kandasamy P., Thilagavathy K, and Gunavathy K, Engineering Mathematics Volume I, II and III, S. Chand & Co, New Delhi, 2005.
8. Venkataraman M. K, Engineering Mathematics, Volume I and II Revised enlarge Fourth Edition, The National Publishing Company, Chennai, 2004.

E REFERENCES

www.nptel.ac.in

1. Advanced Engineering Mathematics Prof. Jitendra Kumar

   Department of Mathematics Indian Institute of Technology, Kharagpur

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3											1
CO 2	3											1
CO 3	3	2								1	1	2
CO 4	3	2			1					1	1	1
CO 5	3	2			1					1	1	1
	15	6	0	0	2	0	0	0	0	3	3	6

1 - Low, 2 – Medium, 3- high

XEM 202 **Engineering Mechanics** **3 1 0 4**

Semester	SEMESTER II	
Subject Name	Engineering Mechanics (Common to all Branches)	
Subject Code	**XEM 202**	
Prerequisite	Applied Physics	
L –T –P –C 3- 1 – 0- 4	C: P: A 2.6: 02: 0.2	L –T -P- H 3- 2 - 0 -5

Course Outcome:		**Domain**
CO1	***Identify*** and choose various types of loading and support conditions that act on structural and dynamic systems.	C(Understand)
CO2	***Apply*** pertinent mathematical, physical and engineering mechanics principles to the system to predict the problem.	C(Application)
CO3	***Display and Apply*** knowledge on the concepts of centroid and moment of inertia of various sections and solids.	C & A (Application) (Develop)
CO4	***Analyze and Model*** the problem using free-body diagrams and accurate equilibrium equations and finding the solution.	C(Analyze) , P (Model)
CO5	***Develop*** concepts of friction, rigid body kinematics and dynamics with an emphasis on the modeling and analysis and solving simple dynamic problems involving kinematics and momentum.	C(Create)

COURSE CONTENT

` **UNIT-I**	**BASICS AND STATICS OF PARTICLES** **15 hrs**
	Introduction - Units and Dimensions - Laws of Mechanics –Coplanar and Non coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Equivalent systems of forces - Principle of transmissibility – single equivalent force.
UNIT –II	**EQUILIBRIUM OF RIGID BODIES** **15 hrs**
	Free body diagram - Types of supports and their reactions - requirements of stable equilibrium – Equilibrium of Rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.
UNIT-III	**PROPERTIES OF SURFACES AND SOLIDS** **15 hrs**
	Determination of Areas and Volumes - First moment of area and the centroid - second and product moments of plane area - Parallel axis theorem and Perpendicular axis theorem - Polar moment of inertia – Mass moment of inertia - relation to area moment of inertia.
UNIT -IV	**DYNAMICS OF PARTICLES** **15 hrs**
	Displacement, Velocity and Acceleration - their relationships - Relative motion - Curvilinear motion - Newton's Law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.
UNIT V	**ELEMENTS OF RIGID BODY DYNAMICS AND FRICTION** **15 hrs**
	Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid Body - Work energy equation. Frictional Force - Laws of Coulomb friction - Simple Contact friction - Rolling Resistance - Belt Friction.
	L=45 hrs T -30 hrs

Text books

1. D.S.Kumar "A text book of Engineering Mechanics" Publishers S.K.Kataria and Sons , 2012
2. R.S.Khurmi "A Textbook of Engineering Mechanics" , S. Chand Publishers, 2011
3. Engineering Mechanics: Statics (14th Edition) by Russell C. Hibbeler , Best Sellers, 2015
4. Engineering Mechanics: Dynamics (14th Edition) by Russell C. Hibbeler , Best Sellers, 2015
5. Velusami.M.A. "Engineering Mechanics with Vector Approach": S.Chand Publishers, 2012
6. J. L. Meriam, L. G. Kraige "Engineering Mechanics: Dynamics",Sixth Edition 2012

References

1. Beer F.P and Johnson E.R., "Vector Mechanics for Engineers – Statics and Dynamics", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2001.
2. K.V.Natarajan, "Engineering Mechanics", Dhanalakshmi Publishers, Chennai, 2006.
3. Chandramouli, Engineering Mechanics, PHI Learning Pvt Ltd, 2011
4. Jayakumar and Kumar , Engineering Mechanics, PHI Learning Pvt Ltd, 2013

Mapping of COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1										2		
CO2										2		
CO3				2						1		
CO4												1
CO5										1	2	

XBE 203 Electrical and Electronics Engineering 3 1 1 5

CO1: Cog (Rem), Psy (Mechanism, Set): ***Describe*** AC and DC circuits and measuring devices. ***Construct*** and ***test*** AC, DC circuits and measuring devices.

CO2: Cog (Understand): ***Explain*** different types of Electrical machines.

CO3: Cog (Rem), Psy (Set): Describe semiconductor devices and ***show*** the input output characteristics of basic semiconductor devices.

CO4: Cog (Understand), Psy (COR, Set): ***Explain*** logic gates and their applications and ***construc***t ***and verify*** the logic gates and construct simple adders and subtractors using logic gates.

CO5: Cog (Rem): ***Describe*** microprocessors in detail.

SUB CODE	**SUB NAME**	**L**	**T**	**P**	**C**
XBW 203	**Electrical and Electronics Engineering Systems**	3	1	1	5
C:P:A		**L**	**T**	**P**	**H**
3:1:0		3	2	2	7

Unit- 1	**FUNDAMENTAL OF DC AND AC CIRCUITS, MEASUREMENTS**	**10 + 9 + 20**

Fundamentals of DC– Ohm's Law – Kirchoff's Laws - Sources - Voltage and Current relations – Star/Delta Transformation - Fundamentals of AC – Average Value, RMS Value, Form Factor - AC power and Power Factor, Phasor Representation of sinusoidal quantities - Simple Series, Parallel, Series Parallel Circuit - Operating Principles of Moving coil and Moving Iron Instruments (Ammeter, Voltmeter) and Dynamometer type meters (Watt meter and Energy meter).

Unit- 2	**ELECTRICAL MACHINES**	**8 + 9**

Construction, Principle of Operation, Basic Equations, Types and Application of DC Generators, DC motors - Basics of Single Phase Induction Motor and Three Phase Induction Motor - Construction, Principle of Operation of Single Phase Transformer, Three phase transformers, Auto transformer.

Unit- 3	**SEMICONDUCTOR DEVICES**	**9 + 3 + 5**

Classification of Semiconductors, Construction, Operation and Characteristics: PN Junction Diode – Zener Diode, PNP, NPN Transistors, Field Effect Transistors and Silicon Controlled Rectifier – Applications.

Unit- 4	**DIGITAL ELECTRONICS**	**9 + 6 + 5**

Basic of Concepts of Number Systems, Logic Gates, Boolean Algebra, Adders, Subractors, multiplexer, demultiplexer, encoder, decoder, Flipflops, Up/Down counters, Shift Registers.

Unit- 5	MICROPROCESSORS	9 + 3

Architecture, 8085, 8086 - Interfacing Basics: Data transfer concepts - Simple Programming concepts.

1. Study of Electrical Symbols, Tools and Safety Precautions, Signal Generators, Power Supplies and Voltage Regulators.
2. Study of Active and Passive Elements - Resistors, Inductors and Capacitors, Bread Board and Printed Circuit Board.
3. Verification of AC Voltage, Current and Power in Series connection and Parallel connection.
4. Fluorescent lamp connection with choke.
5. Staircase Wiring.
6. Calibration of Ammeter, Voltmeter, Wattmeter, Energy meter, Multimeter and Lux meter.
7. Testing of DC Voltage and Current in series and parallel resistors which are connected in breadboard by using Voltmeter, Ammeter and Multimeter.
8. Measuring input signal magnitude and frequency by using Cathode Ray Oscilloscope.
9. Forward and Reverse bias characteristics of PN junction diode and Zener diode.
10. Input and Output Characteristics of NPN transistor.
11. Verification of Truth Tables of Logic Gates.
12. Construction and verification of simple adders and subtractors.

Lecture = 45; Tutorial = 30; Lab = 30; Total = 105 Hours

TEXT BOOKS:

1.	Mittle, V. N., 2007. Basic Electrical and Electronics Engineering. 1st ed. New Delhi: Tata McGraw-Hill.
2.	Malvino, A. P., 2006. Electronics Principles. 7th ed. New Delhi: Tata McGraw-Hill.
3.	Rajakamal, 2007. Digital System-Principle & Design. 2nd ed. Pearson education.
4.	Moris Mano, 1999. Digital Design. Prentice Hall of India.
5.	Ramesh, S. Gaonkar, 2013. Microprocessor Architecture, Programming and its Applications with the 8085. 6th ed. India: Penram International Publications.

REFERENCE BOOKS:

1.	Corton,H., 2004. Electrical Technology. CBS Publishers & Distributors.
2.	Syed, A. Nasar, 1988. Electrical Circuits. Schaum Outline Series, McGraw-Hill.
3.	Jacob Millman and Christos, C. Halkias, 2010. Electronics Devices and Circuits. 3rd ed. New Delhi: McGraw-Hill.
4.	Millman, J. and Halkias, C. C., 2011. Integrated Electronics: Analog and Digital Circuits and Systems. 2nd ed. New Delhi: McGraw-Hill.
5.	Mohammed Rafiquzzaman, 1992. Microprocessors - Theory and Applications: Intel and Motorola. Prentice Hall International.

E-REFERENCES:

1.	NTPEL, Basic Electrical Technology (Web Course), Prof. N. K. De, Prof. T. K. Bhattacharya and Prof. G. D. Roy, IIT Kharagpur.

2.	http://freevideolectures.com/Course/2335/Basic-Electrical-Technology#, Prof. L. Umanand , IISc Bangalore.
3.	http://nptel.ac.in/Onlinecourses/Nagendra/, Dr. Nagendra Krishnapura , IIT Madras.
4.	http://www.nptelvideos.in/2012/11/basic-electrical-technology.html, Dr. L. Umanand, IISC Bangalore.

Table: COs versus GAs mapping

CO/GA	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	2	2	2	1	-	-	-	1	-	-	1
CO2	3	2	-	2	1	-	-	-	-	-	-	1
CO3	3	-	-	-	1	-	-	-	1	-	-	1
CO4	3	2	2	2	1	-	-	-	1	-	-	1
CO5	3	-	-	-	1	-	-	-	-	-	-	1
Total	15	6	4	6	5				3			5
Scaling	3	1	1	1	1				1			1

XAP 204 Applied Physics 3 1 1 5

COURSE CODE	COURSE NAME	L	T	P	C
XAP104 / XAP204	APPLIED PHYSICS	3	1	1	5
C:P:A = 2.8:0.8:0.4					
		L	T	P	H
		3	2	2	7

COURSE OUTCOMES

CO1. Cog: R, U, Psy: (M); ***Identify*** the basics of mechanics, ***explain*** the principles of elasticity, viscosity and ***determine*** its significance in engineering systems and technological advances.

CO2.Cog: R, Ana, Aff: Rec; ***Describe*** the production, propagation, perception & ***analysis*** of acoustical wave and ***locate*** basic acoustical problem encountered in constructed buildings.

CO3. Cog: U, App, Psy: (M), Aff: Rec; ***Understand*** the fundamental phenomena in optics by ***measurement*** and ***describe*** the working principle and ***application*** of various lasers and fibre optics.

CO4. Cog: U, Ana, Psy: (M), Aff: Rec; ***Analyse*** different crystal structures, ***discuss*** and ***use*** physics principles of latest technology by ***visualizing.***

CO5. Cog: U, App; ***Develop Knowledge*** on engineering materials, its properties and ***application.***

THEORY

UNIT - I MECHANICS AND PROPERTIES OF MATTER **9+6+12**

Mechanics: Force - Newton's laws of motion - work and energy - impulse and momentum - torque - law of conservation of energy and momentum - Friction.

Elasticity: Stress - Strain - Hooke's law - Stress strain diagram - Classification of elastic modulus - Moment, couple and torque - Torsion pendulum - Applications of torsion pendulum - Bending of beams - Experimental determination of Young's modulus: Uniform bending and non-uniform bending - I shape girders.

Viscosity: Coefficient of viscosity - Laminar flow - streamline flow - turbulent flow - Reynold's number

- Poiseuille's method.

UNIT - II ACOUSTICS, ULTRASONICS AND SHOCK WAVES	**9+6**

Acoustics: Classification of sound - Characteristics of musical sound - Loudness - Weber Fechner law - Decibel - Absorption coefficient - Reverberation - Reverberation time - Sabin's formula (growth and decay) - Factors affecting acoustics of buildings (reverberation time, loudness, focusing, echo, echelon effect - resonance and noise) and their remedies.

Ultrasonics: Production: Magnetostriction and Piezoelectric methods - NDT: Ultrasonic flaw detector.

Shock waves: Definition of Mach number - Description of a shock wave - Characteristics - Methods of creating shock waves.

UNIT – III OPTICS, LASERS AND FIBRE OPTICS	**9+6+12**

Optics: Dispersion - Optical instrument: Spectrometer - Determination of refractive index and dispersive power of a prism - Interference of light in thin films: air wedge - Diffraction: grating.

LASER: Introduction - Population inversion -Pumping - Laser action - Nd-YAG laser - CO_2 laser - Semiconductor Laser (homojunction) - Applications

Fibre Optics: Principle and propagation of light in optical fibre - Numerical aperture and acceptance angle - Types of optical fibre - Fibre optic communication system

UNIT –IV SOLID STATE PHYSICS	**9+6+6**

Crystal Physics: Lattice - Unit cell - Lattice planes - Bravais lattice - Miller indices - Sketching a plane in a cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing density for SC, BCC, FCC and HCP structures.

Semiconductors: Semiconductor properties - Types of semiconductor - Intrinsic - Extrinsic: P-type and N-type semiconductor - PN junction diode - Biasing - Junction diode characteristics.

UNIT –V NOVEL ENGINEERING MATERIALS AND BIOMETRICS	**9+6**

Novel Engineering Materials: Introduction - Metallic glasses: Melt spinning technique, properties, applications - Shape Memory Alloys: Transformation temperature, working of SMA, characteristics - Biomaterials: Properties, interaction of biomaterials with tissues, applications - Nano phase materials: Production, properties and applications.

Biometrics: Introduction - definition - instrumentation - devices -advantages

TEXT BOOKS

1. Avadhanulu M. N. and Kshirsagar P. G., "A Text Book of Engineering Physics", 7th Enlarged Revised Edition., S. Chand & Company Ltd., New Delhi, 2005.
2. Senthil Kumar G., " Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2003.
3. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2005.
4. Prabu P. and Gayathri P., " Applied Physics", PMU Press, Thanjavur, 2013

REFERENCE BOOKS

1. Gaur R.K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2001.
2. Pillai S.O., "Solid State Physics", 5th Edition, New Age International Publication, New Delhi,2003.

E RESOURCES

NPTEL , Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

LABORATORY

1.	Torsional Pendulum - determination of moment of inertia and rigidity modulus of the given material of the wire.
2.	Uniform Bending - Determination of the Young's Modulus of the material of the beam.

3.	Non-Uniform Bending - Determination of the Young's Modulus of the material of the beam.
4.	Poiseuille's flow - Determination of coefficient of viscosity of the given liquid.
5.	Spectrometer - Determination of dispersive power of the give prism.
6.	Spectrometer - Determination of wavelength of various colours in Hg source using grating.
7.	Air wedge - Determination of thickness of a given thin wire.
8.	Laser - Determination of wavelength of given laser source and size of the given micro particle using Laser grating.
9.	Post office Box - Determination of band gap of a given semiconductor.
10.	PN Junction Diode - Determination of V-I characteristics of the given diode.

REFERENCE BOOKS

1. Srinivasan M. & others, "A text book of Practical Physics", Sultan Chand & Sons, 2001.
2. Shukla R.K., "Practical Physics", New Age International Publication, New Delhi, 2011.
3. Umayal Sundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
	45	**30**	**30**	**105**

Table: Mapping of CO's with GA's:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	2	2	2	1	-	-	-	1	-	-	1
CO2	3		1		1	-	-	-		-	-	1
CO3	3	2	2	2	1	-	-	-	1	-	-	1
CO4	3	2	2	2	1	-	-	-	1	-	-	1
CO5	3		2			-	-	-		-	-	1
Total	15	6	9	6	4				3			5
Scaled to 0,1,2,3 scale	3	2	2	2	1				1			1

1 - Low, 2 – Medium, 3 – High

XEG 205 Engineering Graphics 2 1 0 3

Subject Name	Engineering Graphics	L	T	P	C
Subject Code	XEG 203	2	1	0	3
Prerequisite	Nil	L	T	P	H
C:P:A	0.66 : 0.66 : 0.66	2	2	0	4

Course Outcome		**Domain** (C or P or A)
CO1	***Apply*** the national and international standards, ***construct*** and ***practice*** various curves	C(Ap), P(GR) and A(Res)

CO2	***Interpret***, ***construct*** and ***practice*** orthographic projections of points, st. lines and planes.	C(Under),P(Mech) and A(Res)
CO3	***Construct Sketch*** and ***Practice*** projection of solids in various positions and true shape of sectioned solids.	C(Apply) ,P(CoR) and A(Res)
CO4	***Interpret***, ***Sketch*** and ***Practice*** the development of lateral surfaces of simple and truncated solids, intersection of solids.	C(Under) ,P(CoR) and A(Res)
CO5	***Construct***,***sketch*** and ***practice*** isometric and perspective views of simple and truncated solids.	C(Apply) ,P(CoR) and A(Res)

COURSE CONTENT		
` UNIT-I	**INTRODUCTION, FREE HAND SKETCHING OF ENGG OBJECTS AND CONSTRUCTION OF PLANE CURVE**	**6+6**
	Importance of graphics in engineering applications – use of drafting instruments – BIS specifications and conventions as per SP 46-2003. Pictorial representation of engineering objects – representation of three dimensional objects in two dimensional media – need for multiple views – developing visualization skills through free hand sketching of three dimensional objects. Polygons & curves used in engineering practice – methods of construction – construction of ellipse, parabola and hyperbola by eccentricity method – cycloidal and involute curves – construction – drawing of tangents to the above curves.	
UNIT–II	**PROJECTION OF POINTS, LINES AND PLANE SURFACES**	**6+6**
	General principles of orthographic projection – first angle projection – layout of views – projections of points, straight lines located in the first quadrant – determination of true lengths of lines and their inclinations to the planes of projection – traces – projection of polygonal surfaces and circular lamina inclined to both the planes of projection.	
UNIT-III	**PROJECTION OF SOLIDS AND SECTIONS OF SOLIDS**	**6+6**
	Projection of simple solids like prism, pyramid, cylinder and cone when the axis is inclined to one plane of projection – change of position & auxiliary projection methods – sectioning of above solids in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other and above solids in inclined position with cutting planes parallel to one reference plane – true shapes of sections.	
UNIT-IV	**DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS**	**6+6**
	Need for development of surfaces – development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones – development of lateral surfaces of the above solids with square and circular cutouts perpendicular to their axes – intersection of solids and curves of intersection – prism with cylinder, cylinder & cylinder, cone & cylinder with normal intersection of axes and with no offset.	
UNIT V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+6**
	Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones – principles of perspective projections – projection of prisms, pyramids and cylinders by visual ray and vanishing point methods.	
	LECTURE: 30	**TUTORIAL: 30** **TOTAL :60**
TEXT BOOKS		

1. Bhatt,N.D, “Engineering Drawing”, Charotar Publishing House, 46th Edition-2003.
2. Natarajan,K.V, “ A Textbook of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2006 .
3. Dr. P.K. Srividhya, P. Pandiyaraj, “Engineering Graphics”, PMU Publications, Vallam, 2013

REFERENCES

1. Luzadder and Duff, “Fundamentals of Engineering Drawing” Prentice Hall of India PvtLtd, XI Edition - 2001.
2. Venugopal,K. and Prabhu Raja, V., “Engineering Graphics”, New Age International(P) Ltd., 2008.
3. Gopalakrishnan.K.R,. “Engineering Drawing I & II”, Subhas Publications, 1998.
4. Shah,M.B and Rana,B.C.,”Engineering Drawing”, Pearson Education,2005.

E RESOURCES

1. http://periyarnet/Econtent
2. http://nptel.ac.in/courses/112103019/

Mapping of CO’s with GA:

	GA 1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	2	3	1	1							1
CO2	3	2	1	1	1							1
CO3	3	2	1	1	1							1
CO4	3	2	1	1	1							1
CO5	3	2	1	1	1							1
Total	15	10	7	5	5							5
Scaled	3	2	2	1	1							1

1 – Low Relation, 2 – Medium Relation, 3 – High Relation

XGS 206 Speech Communication 2 0 1 3

COURSE OUTCOMES (COs)

CO1: Cog: Choose and ***identify*** different styles to various forms of public speaking skills and presentation skills.

CO2:Cog: U: ***Understand*** and identify the proper tone of language required in writing and speaking.

CO3: Psy: A: ***Adapting*** the speech structures and developing the speech outline.

CO4: Aff: R: Ability to ***communicate*** and develop presentation skills.

CO5: Psy: R: **Calibrates** the speaker to face the audience without any anxiety.

SEMESTER I					
COURSE CODE	**SUBJECT NAME**	**Category**			
		L	**T**	**P**	**Credits**
	Speech Communication	**2**	**0**	**1**	**3**
C:P:A		**L**	**T**	**P**	**Hour**
1.8:0.8:0.4		**2**	**0**	**1**	**3**

SYLLABUS

UNIT	**Content**	**Hours**

		Allotted
I	Introduction to public speaking; functions of oral communication; skills and competencies needed for successful speech making; importance of public speaking skills in everyday life and in the area of business, social, political and all other places of group work	**5**
II	Manuscript, impromptu, rememorized and extemporaneous speeches; analyzing the audience and occasion; developing ideas; finding and using supporting materials.	**5**
III	Organization of Speech; introduction, development and conclusion; language used in various types of speeches; Adapting the speech structures to the Audience; paralinguistic features	**5**
IV	Basic tips; how to present a paper/assignment etc; using visual aids to the speeches; using body language to communicate.	**5**
V	Public speaking and speech anxiety, public speaking and critical listening Speech practice (4-6 speeches per student)	**25**

Lecture	**Practical**	**Total**
20 Hours	**25 Hours**	**45 Hours**

TEXT

1. Gordon H. Mills Technical Writing –Oxford Press, 1978
2. Barun K. Mitra, Effective Technical Communication: A guide for scientists and Engineers. Author, Publication: Oxford University press. 2007

Mapping COs with POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		1					2		3
CO2				1			3		3
CO3							2		3
CO4							3		3
CO5								2	3
Total		1		1			10	2	15
Scaled									

0 – No relation 1- Low relation 2- Medium relation 3 – High relation

XMA 301 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS 3 1 0 4

CO1. Cog: R ***Explain*** and ***Demonstrate*** the basic concepts in partial differential equations and to ***solve*** linear, nonlinear, homogeneous and nonhomogeneous partial Differential equations.

CO2. Cog: R,U ***Demonstrate*** the basic concept and properties of Fourier series and to ***state*** Parseval's identity and Diritchlet's condition.

CO3.Cog: A_p ***Solve*** the standard Partial Differential Equations, arising in engineering Problems, like Wave equation and Heat flow equation by Fourier series method.

CO4. Cog: U,A_p ***Explain*** and ***Apply*** the concept of Fourier transform and its properties.

CO5. Cog: R,A_p ***State*** and ***Apply*** the properties of Z transform and to ***Find*** the Z transform

and inverse Z transform .

SUBCODE	SUB NAME	L	T	P	C
XMA 301	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	3	1	0	4
C:P:A = 3:0:0					
		L	T	P	H
		3	2	0	5

UNIT I Partial Differential Equations **15**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution 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.

UNIT II Fourier Series **15**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Parseval's identity – Harmonic Analysis.

UNIT III Applications of Boundary Value Problems **15**

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT IV Fourier Transform **15**

Fourier integral theorem (without proof) – Fourier transform pairs – Fourier Sine and Cosine transforms – properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z – Transform and Difference Equations **15**

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

	LECTURE	TUTORIAL	TOTAL
	45	30	75

TEXT

1. Grewal, B.S., "Higher Engineering Mathematics", 40th Edition Khanna Publishers, New Delhi, (2007).
2. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S.Viswanathan (Printers and Publishers)Pvt. Ltd. Chennai, (2002).

REFERENCES

1. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw Hill Book Co., Singapore, (1987).
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., " Engineering Mathematics Volume III", S. Chand & Company Ltd., New Delhi, (1996).
3. Bali N.P. and Manish Goyal, "A Text Book of Engineering Mathematics" 7th Edition Lakshmi Publications (P) Limited, New Delhi, (2007)

E REFERENCES

www.nptel.ac.in

2. Advanced Engineering Mathematics, Prof. Jitendra Kumar ,

Department of Mathematics, Indian Institute of Technology, Kharagpur.

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3									1		1
CO 2	3									1		1
CO 3	3	2								1	1	2
CO 4	3	2			1					1	1	1
CO 5	3	2			1					1	1	1
	15	6	0	0	2	0	0	0	0	5	3	6

1 - Low , 2 – Medium , 3- high

XME 302 Engineering Thermodynamics 3 1 0 4

CO 1: Cognitive (knowledge, application,) Psychomotor (perception,set) : Describe the thermodynamic properties, process and cycle. Moreover, formulating various thermodynamics laws.

CO 2 : Cognitive (knowledge, analysis) Psychomotor (perception, set, mechanism) Describe Carnot cycle, Perpetual motion machine and Kelvin's Plank statement, Clausius statement. It also explains refrigeration and heat pump.

CO 3 : Cognitive (knowledge, comprehension and applications) Psychomotor (perception, set, mechanism) Describe the properties of solid, liquid and vapour. Moreover explains the Rankine cycle, Reheat cycle and Regenerative cycle.

CO 4 : **Cognitive (knowledge, application) Psychomotor (perception, set , mechanism)** Describe the properties of ideal and real gases and Avagadro's law. It also describe Dalton's law partial pressure.

CO 5 : Cognitive (knowledge, application , analysis) Psychomotor (perception, set, mechanism) Describe the Psychrometry property and chart. Moreover, it also describe various psychrometric process such as sensible, latent heat exchange process and adiabatic mixing , evaporative cooling process.

C**OURSE CODE**	**COURSE NAME**	**L**	**T**	**P**	**C**
XME 302	**ENGINEERING THERMODYNAMICS**	**3**	**1**	**0**	**4**
C:P:A		**L**	**T**	**P**	**H**
4:0:0		**3**	**2**	**0**	**5**
Unit -1	**BASIC CONCEPTS AND LAWS OF THERMODYNAMICS**	9+3			

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. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal

equipments.		
Unit -2	**ENTROPY AND AVAILABILITY**	9+3
Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – Carnot theorem, absolute entropy, availability – Basics of energy in non-flow processes.		
Unit-3	**PROPERTIES OF SUBSTANCES AND STEAM CYCLES**	9+3
Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes. Standard Rankine cycle, Reheat and regenerative cycle.		
Unit-4	**GASES AND THERMO DYNAMIC RELATIONS**	9+3
Gas mixtures – Properties of ideal and real gases, equation of state, Avagadro's law, Vander Waal's equation of states, compressibility, compressibility chart. Dalton's law of partial pressure, Exact differentials, T-D, relations, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.		
Unit-5	**PSYCHROMETRYAND PSYCHROMETRIC CHART**	9+3
Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing and evaporative cooling. Refrigeration – Carnot cycle and air refrigeration.		
Lecture = 45 : Tutorial = 15 : Total = 60 Hours		
TEXT BOOKS:		
1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2008. 2. Lynn D Russell, George A, Adebiyi "Engineering Thermodynamics" Indian Edition, Oxford University Press, New Delhi, 2007.		
REFERENCE BOOKS :		
1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003. 2. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 2003. 3. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2005. 4. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum's		

Outline Series, Tata McGraw-Hill, New Delhi, 2004.
E- REFERENCES
1. http://nptel.iitm.ac.in/courses 2. http://www.intechopen.com

XME 303 Manufacturing Technology 3 0 1 4

Subject Name	MANUFACTURING TECHNOLOGY	L	T	P	C
Subject Code	XME 303	3		1	4
Prerequisite	MECHANICAL AND CIVIL ENGINEERING SYSTEMS	L	T	P	H
C:P:A	2:1:0	3	0	2	5

Course Outcome		**Domain** (C or P or A)
CO1	***Defining*** the basic process of casting and ***identifying*** the key decisions to be made in metal casting facilities.	C (Knowledge) and P(Perception)
CO2	***Compare*** the traditional metal joining processes and ***relates*** with respect to the advantages, applications.	C(Analysis) and P(Perception)
CO3	***Describe*** the basic mechanisms of bulk deformation processes and ***differentiate between*** forging, extrusion, rolling and drawing	C (Comprehension) And P (Perception)
CO4	***Discuss*** and ***differentiate*** the different process for the various sheet metal components	C (Comprehension) And P (Perception)
CO5	***Explain*** the principles of metal cutting process and describe the different operations of lathe.	C (Comprehension) And P (Perception)

COURSE CONTENT		
` UNIT-I	**METAL CASTING PROCESSES**	**9+6**
Moulding sands - types and properties - patterns – types, selection of patterns, pattern allowances - design of patterns - classifications of castings according to mould materials and moulding methods – solidification and cooling – riser and gating design – design considerations - special casting techniques - fettling and finishing of castings - defects in castings. Practical: Exercises on metal casting		
UNIT –II	**WELDING**	**9+6**
Classification of welding process - principle of gas welding - arc welding - resistance welding - solid state welding - thermo-chemical welding - radiant energy welding – Friction welding-weld defects Practical: Exercises on arc welding processes (lap, butt and T joints) Exercises on gas welding processes		
UNIT-III	**BULK DEFORMATION PROCESSES**	**9+6**
Forging - classification of forging processes, forging defects and inspection - rolling - classification of rolling processes, rolling mill, rolling of bars and shapes - extrusion - classification of extrusion processes, extrusion equipments.		

Practical: Exercise on hot forging		
UNIT-IV	**FORMING PROCESS**	**9+6**
Sheet metal forming - High velocity forming - explosive forming, electro hydraulic forming - magnetic pulse forming - pneumatic - mechanical high velocity forming. **Plastic forming** - Plastics - types of plastics - plastic moulding processes, defects in plastics. Practical: Exercise on sheet metal works		
UNIT V	**MACHINING PROCESS**	**9+6**
Mechanics of machining, single and multipoint cutting tool, tool - geometry, life and wear - Lathe - Capstan and Turret lathe - Drilling and Boring machine classification, principles of working - work holding and tool holding devices. Practical: Lathe operations		

THEORY 45	**PRACTICAL 30**	**TOTAL HRS 75**

TEXT BOOKS

1. Kalpakjian, S., "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006.
2. Hajra Choudhury S.K and Hajra Choudhury. A.K., Elements of Workshop Technology,Volume I and II, Media Promoters and Publishers Private Limited,Mumbai, 2008.

REFERENCES

1. Paul Degarma E, Black J.T. and Ronald A. Kosher, Elighth Edition, Materials and Processes, in Manufacturing Prentice – Hall of India, 2003.
2. Sharma, P.C., A Text book of Production Technology, S. Chand and Co. Ltd., 2004.
3. P.N. Rao, Manufacturing Technology- Foundry, Forming and Welding, TMH-2003; 2nd Edition, 2003
4. Roy. A. Lindberg, Processes and Materials of Manufacture, PHI / Pearson Education, 2006.

E RESOURCES

1. http://nptel.iitm.ac.in/courses
2. http://www.intechopen.com/books

Mapping of CO's with PO'S:

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}	PSO_{13}	PSO_{14}	
CO_1	2	3	3	1	-	-	-	-	-	1	3	3	3	1	20
CO_2	2	1	3	-	2	-	-	1	-	2	1	2	3	1	18
CO_3	3	3	3	1	3	3	-	1	-	2	3	3	3	1	29
CO_4	3	3	3	1	3	3	-	1	-	2	3	3	3	1	29
CO_5	3	3	3	1	3	3	-	1	-	2	3	3	3	1	29
	13	13	15	4	11	9	-	4	-	9	13	14	15	5	

1 – Low Relation, 2 – Medium Relation, 3 – High Relation

XME 304 Strength of Materials 3 1 1 5

CO_1 **Cog(Understand, Rem), Psy (Mechanism, Set):** ***Describe*** the relationship between the loads applied to a non-rigid body and the internal stresses and deformations induced in the body by understanding the mechanical properties of materials

CO_2 **Cog(Understand),** ***Explain*** the general state of shear force and bending moment of various types of beams

CO_3 **Cog(Rem, Applying), Psy (Set) Describe** the torsional deformation of various types of shafts and failure of columns

CO_4 **Cog(Understand), Psy (Set)** ***Explain*** the different approaches to calculate slope and deflection for various types of beams.

CO_5 **Cog(Rem, analyzing),** ***Describe*** the Failure criteria and analysis of cylinder and spheres

COURSE CODE	COURSE NAME	L	T	P	CREDITS
XME404	STRENGTH OF MATERIALS	3	1	1	5
C:P:A		L	T	P	CREDITS
3:1:0		3	2	2	7

UNIT I	**STRESS, STRAIN AND DEFORMATION OF SOLIDS** Mechanical properties of materials, concept of stress and strain – Hooks law -Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy – Factor of Safety- Normal and Shear stress	**9+6+6**
UNIT II	**BEAMS - LOADS AND STRESSES** Types of beams- Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.	**9+6+6**
UNIT III	**TORSION AND COLUMNS** Torsional deformation of circular shafts – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Torque, Twist and torsion stiffness – Compound shafts – Design of Shafts-Theory of columns – Long column and short column - Euler's formula – Rankine's formula - Secant formula - beam column	**9+6+6**
UNIT IV	**DEFLECTION OF BEAMS** Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope- Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column-Conjugate beam method	**9+6+6**
UNIT V	**ANALYSIS OF STRESSES IN TWO DIMENSIONS** Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses –Theories of Failure - Maximum shear stress - Strain energy in bending and torsion.	**9+6+6**

	Total Contact hrs (L-45 hrs T-30 hrs P-30 hrs)	105 hrs

1. Tensile test on mild steel using Universal Testing Machine.
2. Compression test on brick/wooden specimen using Universal Testing Machine.
3. Hardness test on Brinell and Rockwell hardness testing machines
4. Deflection tests on Simply supported and cantilever beams
5. Torsion test on mild steel rod.
6. Fatigue test on steel
7. Deflection test on beams.
8. Exercises on Mohr's circle

Lecture = 45; Tutorial = 30; Lab = 30; Total = 105 Hours

TEXT BOOKS:

1. S. Ramamrutham and R. Narayanan, (2003), Strength of Materials, Dhanpat Rai Publications.

REFERENCE BOOKS:

1. Rowland Richards, (2000), Principles of Solid Mechanics, CRC Press.
2. Timoshenko, S.P. and Young, D.H., (2000), Strength of Materials, East West Press Ltd
3. R.K. Bansal, (2000), Strength of Materials, Laxmi Publications

E-REFERENCES

http://nptel.ac.in/courses/112107146/

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}	PSO_{13}	PSO_{14}
CO_1	1	3	1	2	3	-	-	-	1	1	1	2	3	-
CO_2	2	3	3	2	3	-	-	-	-	1	2	3	3	-
CO_3	2	2	3	-	3	-	-	-	-	3	2	2	3	-
CO_4	3	3	3	2	3	-	-	-	-	2	3	3	3	-
CO_5	3	3	3	2	3	-	-	-	-	3	3	3	3	-
Total	11	14	13	8	15	-	-	-	1	10	11	13	15	-

1-Slightly relative: 2- Supportive: 3-Highly relative

Semester	SEMESTER III	
Subject Name	Engineering Materials	
Subject Code	XES 305	
Prerequisite	Nil	
L –T –P –C 3- 0 – 0- 3	C:P:A 3:0:0	L – T –P – H 45 - 0 – 0 - 45

Course Objective:

- To understand the Basic Properties of Engineering Materials.
- To identify the applications of magnetic, super conducting and dielectric materials
- To identify the heat treatment process and mechanical applications.
- To study about modern engineering materials,
- To study Nanomaterials and their properties

Course Outcome:		**Domain** (C or P or A)
CO1	Study the Basic Properties of Engineering Materials.	C
CO2	Analyze the heat treatment process and its applications.	C
CO3	Analyze of nonmetallic materials and application.	C
CO4	Inspection of engineering materials (mechanical and metallurgical)	C
CO5	List the properties and applications of modern engineering materials.	C

Course Content

` UNIT-I	**PROPERTIES OF METALLIC MATERIALS**	**9 hrs**
	Basic Crystallography- 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. Frank Reed source of dislocation Elastic & plastic modes of deformation, slip & twinning, strain hardening, seasons cracking. Fracture mechanism and types.	
UNIT-II	**IRON AND STEEL**	
	Solid solutions – Binary alloys, ternary alloys. Iron carbide equilibrium diagram - Phase transformations. Classification of steel and cast iron - microstructure, properties and application effect, yield point phenomenon, cold/hot working, recovery, re-crystallization and grain growth, strengthening of metals.	
UNIT-III	**HEAT TREATMENT OF MATERIALS**	**9 hrs**
	Heat Treatment- Definition – Full annealing, stress relief, recrystallisation – normalising, 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. Ferrous and Non Ferrous Metals- Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA. Gray, White malleable, spheroidal -Graphite - alloy cast-iron. Copper and Copper alloys – Brass, Bronze and Cupronickel. Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys..		
UNIT -IV	**NON METALLIC MATERIALS**		**9 hrs**
	Non-Metallic Materials- 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. Fibre and particulate reinforced composites and resin plastics. Powder metallurgy, Manufacturing Process, Compacting, Sintering, Vacuum processing. Properties of Powder processed materials, high energy compaction. Metal matrix composites, preparation properties and uses.		
UNIT V	**MODERN ENGINEERING MATERIALS**		**9 hrs**
	Metallic glasses- preparation of metallic glasses- properties – applications of the metallic glasses - Shape Memory Alloys (SMA) - Characteristics, properties of NiTi alloy - applications of the Shape memory alloys - advantages and disadvantages of SMA - Nanomaterials-synthesis –chemical vapour deposition – Sol Gels – ball Milling – properties of nanoparticles and applications of nanoparticles - Carbon Nanotubes(CNT)–structure–properties–applications of the CNTs.		
	LECTURE: 45	**TUTORIAL: 0**	**TOTAL :45**

Text books

1. Engineering Materials: Properties and selection/ Kenneth G. Budinski, Michael K. Budinski/ Prentice Hall
2. Engineering materials / R K Rajput / S Chand and company Ltd.
3. Deformation and Fracture Mechanics of Engineering Materials/R. W. Hertzberg/ John Wiley & Sons.
4. Powder Metallurgy: An Advanced Technique Of Processing Engineering Materials/ B. K. DATTA/ PHI Learning Pvt. Ltd.
5. Materials Science and Engineering /Raghavan/ Prentice-Hall of India.

References

1. Koch, C. C. Nanostructured materials: processing and applications: William Andrew Pub.
2. James F Shackelford, S "Introduction to materials Science for Engineers", 6 th Macmillan Publishing Company, New York, 2004
3. William D CallisterJr, "Materials Science and Engineering – An Introduction", John Wiley and Sons Inc., 6 th edition, New York, 2003
4. Jayakumar S, "Materials Science", RK Publishers, Coimbatore, 2004
5. Bolton, W., Engineering materials technology: Butterworth-Heinemann.

E RESOURCES

1. NPTEL courses, http://www.nptel.iitm.ac.in/courses.php?disciplineId=112: related web and video resources under Mechanical Engineering &Metallurgy and Material Science categories
2. http://www.intechopen.com/books

Mapping of CO's with GA:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	1	1		2	2	3	3	1	3		1
CO2	3	1	1		1	2	3	2	1	2		1
CO3	3	1	1		1	2	3	2	1	2		1
CO4	3	1	1		2	2	3	3	1	3		2
CO5	3	1	1		1	3	3	1	1	2		2
total	15	5	5		7	11	15	10	5	12		7
Scaled	3	1	1		2	3	3	2	1	2		2

1 - Low, 2 – Medium, 3 – High

XEP 306 Entrepreneurship Development 3 0 0 3

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
	ENTREPRENEURSHIP DEVELOPMENT	**3**	**0**	**0**	**3**
C:P:A = 3:0:1					
		L	**T**	**P**	**H**
		3	**0**	**0**	**3**

Course Outcome:		**Domain**
On the successful completion of the course, students will be able to		
CO1	***Recognise*** and ***describe*** the personal traits of an entrepreneur.	A(Receiving) C(Understand)
CO2	***Determine*** the new venture ideas and ***analyse*** the feasibility report.	C(Understand and Analyse)
CO3	***Develop*** the business plan and ***analyse*** the plan as an individual or in team.	Affective (Receiving) and C (Analyze)
CO4	***Describe*** various parameters to be taken into consideration for launching and managing small business.	C(Understand)
CO5	***Describe*** Technological management and Intellectual Property Rights	C(understand)

There are 6 Cs and 2 As for 3:0:1

UNIT I ENTREPRENEURIAL TRAITS AND FUNCTIONS **9**

Definition of Entrepreneurship; competencies and traits of an entrepreneur; factors affecting Entrepreneurship Development; Role of Family and Society ; Achievement Motivation; Entrepreneurship as a career and national development;

UNIT -II NEW PRODUCT DEVELOPMENT AND VENTURE CREATION **9**

Ideation to Concept development; Sources and Criteria for Selection of Product; market assessment ; Feasibility Report ;Project Profile; processes involved in starting a new venture; legal formalities; Ownership; Case Study.

UNIT –III ENTREPRENEURIAL FINANCE **9**

Financial forecasting for a new venture; Finance mobilization; Business plan preparation; Sources of Financing, Angel Investors and Venture Capital; Government support in startup promotion.

UNIT –IV LAUNCHING OF SMALL BUSINESS AND ITS MANGEMENT **9**

Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units.

UNIT –V TECHNOLOGY MANAGEMENT, IPR PORTFOLIO FOR NEW PRODUCT VENTURE	9

Technology management; Impact of technology on society and business; Role of Government in supporting Technology Development and IPR protection; Entrepreneurship Development Training and Other Support Services.

	LECTURE	TUTORIAL	TOTAL
	45	0	45

TEXT BOOKS

- Hisrich, 2016, *Entrepreneurship*, Tata McGraw Hill, New Delhi.
- S.S.Khanka, 2013, *Entrepreneurial Development*, S.Chand and Company Limited, New Delhi.

REFERENCE BOOKS

- Mathew Manimala, 2005, *Entrepreneurship Theory at the Crossroads, Paradigms & Praxis*, Biztrantra ,2nd Edition.
- Prasanna Chandra, 2009, *Projects – Planning, Analysis, Selection, Implementation and Reviews*, Tata McGraw-Hill.
- P.Saravanavel, 1997, *Entrepreneurial Development*, Ess Pee kay Publishing House, Chennai.
- Arya Kumar,2012, *Entrepreneurship: Creating and Leading an Entrepreneurial Organisation*, Pearson Education India.
- Donald F Kuratko, T.V Rao, 2012, *Entrepreneurship: A South Asian perspective*, Cengage Learning India.
- Dinesh Awasthi, Raman Jaggi, V.Padmanand, *Suggested Reading / Reference Material for Entrepreneurship Development Programmes* (EDP/WEDP/TEDP), EDI Publication, Entrepreneurship Development Institute of India, Ahmedabad. Available from: http://www.ediindia.org/doc/EDP-TEDP.pdf

E RESOURCES

- Jeff Hawkins, " Characteristics of a successful entrepreneur", ALISON Online entrepreneurship courses, "https://alison.com/learn/entrepreneurial-skills
- Jeff Cornwall, "Entrepreneurship -- From Idea to Launch", Udemy online Education, https://www.udemy.com/entrepreneurship-from-idea-to-launch/

MAPPING COURSE OUTCOME WITH GRADUATE ATTRIBUTES:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1									3	3	3	1
CO2			1	2	3	2	1	1	1	2	3	
CO3						1		2	3	3		2
CO4						1	1	2	3		3	3
CO5						1	1	3				3
			1	2	3	5	3	8	10	8	9	9
			1	1	1	2	1	2	3	2	2	2

0 -0 , 1-5 - 1 , 6-10 - 2, 11-15 - 3

XGS 307 Interpersonal Communications 1 0 1 0

C	P	A	INTERPERSONAL COMMUNICATION	L	T	P	C
				1	0	1	0
				L	T	P	H
1	1	0		1	0	2	3

COURSE OUTCOMES:

CO1: C: *Recognize* culture and a need for interpersonal communication.
CO2: C:U: *Demonstrate* on the need for effective communication between two people.
CO3:C:U: *Explain* on family and social relationships and need for socialization.
CO4:P:GR: *Practice* the IP principles as to how to reduce and repair conflict in interpersonal relationships.
CO5: C: *Make use* to use effective and appropriate language at various interpersonal situations to avoid conflict.

SYLLABUS

Units	.	Hours
I	Universals of interpersonal communications; Axioms of interpersonal Communication; culture in interpersonal communication and the self in interpersonal communication	9
II	Apprehension and assertiveness; aggressiveness and assertiveness; perception in interpersonal communication; listening in interpersonal communication**.**	9
III	Verbal and non verbal messages; relationship and involvement; relationship maintenance and repair.	9
IV	Power in interpersonal relationship; conflict in interpersonal relationship; friends and relatives; primary and family relationships.	9
V	Socialization, need for socialization and benefits of socialization among students.	9

Lecture (L) : 30 Hrs
Interactive Session (IS) : 15 Hrs
Total : 45 Hrs

TEXT BOOKS

1. DeVito, Joseph, *The* Interpersonal Communication *Book, 13th Edition* - , *Published by* Longman *Pub Group, Updated in its* 13th edition,*2000*
2. Kathleen S. Verderber, Inter-Act: Interpersonal Communication Concepts, Skills and Contexts, Rudolph F. Verderber, 2000
3. Clifford Whitcomb, Effective Interpersonal and Task Communication Skills for Engineers, Atlantic Publishers. 2010.

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1										2		
CO2										**2**		
CO3				2						**1**		
CO4												1
CO5										**1**	2	

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

XME 308 In plant Training 2 2 1

CO1: Cog(U) ***Relate*** classroom theory with workplace practice
CO2: Affective(Respond) ***Comply with*** Factory discipline, management and business practices.
CO3: Affective (Value) ***demonstrates*** teamwork and time management.
CO4: Psychomotor(Perception , Set) ***Describe*** and ***Display*** hands-on experience on practical skills obtained during the programme.
CO5: Cog(E) ***Summarize*** the tasks and activities done by technical documents and oral presentations.
All COs are equally weighted
Note:
Revised Bloom Taxonomy of the Cognitive Domain
Simpson's Taxonomy of the Psychomotor Domain
Krathwohl's Taxonomy of the Affective Domain

Table 1: Mapping COs with B.Tech GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	2											
CO2							1	3			1	
CO3									3	1	3	1
CO4		1	2	1	3							3
CO5				3						3		1
Total	2	1	2	4	3	0	1	3	3	4	4	5
Scaled	1	1	2	1	1	0	1	1	1	1	1	1

XOR 401 OPERATIONS RESEARCH 3 0 0 3

CO1. Cog: U,A_p ***Explain*** the basic concepts of optimization and to formulate and ***Solve*** Linear programming problems.

CO2. Cog:U,A_p ***Explain*** and ***Apply*** the concepts of Transportation problem , Assignment Problem and Travelling Salesman problem.

CO3. Cog: U ***Explain*** and ***Demonstrate*** the basic concepts of PERT-CPM and their applications in product planning control.

CO4. Cog: A_p ***Solve*** the Minimal Spanning Tree Problem, Shortest Route Problem, Maximal Flow Problem and Minimal Cost Capacitated Flow Problem.

CO5. Cog: U,A_p ***Apply*** the concepts of Game theory to ***Find*** the solution and saddle point.

SUBCODE	**SUB NAME**	**L**	**T**	**P**	**C**
XOR 401	**OPERATIONS RESEARCH**	**3**	**0**	**0**	**3**
C:P:A = 3:0:0					
		L	**T**	**P**	**H**
		3	**0**	**0**	**3**
UNIT I Linear Models					**9**
Basics of OR, Linear programming problems (L.P.P), Mathematical Formulation of L.P.P, Graphical method, Simplex algorithm, Duality.					

UNIT II Transportation Models	**9**
Transportation problem, Assignment problem, Travelling Salesman problem.	
UNIT III Project Scheduling by PERT-CPM	**9**
PERT-CPM, product planning control with PERT-CPM.	
UNIT IV Network Models:	**9**
Network definition, Minimal Spanning Tree Problem, Shortest Route Problem, Maximal Flow Problem, Minimal Cost Capacitated Flow Problem.	
UNIT V Game Theory	**9**
Introduction - competitive game - finite and infinite game - two person zero sum game - rectangular game - solution of game- saddle point, solution of a rectangular game with saddle point.	

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**0**	**45**

TEXT

1. Hamdy A. Taha, "Operations Research" An Introduction, Eighth Edition, by Pearson Education, Inc.(2008).
2. Frederick.S Hillier and Gerald J. Lieberman, Introduction to Operations Research, sixth edition,Mc Graw Hill International Edition, Industrial Engineering Series, (2001).
3. Kantiswaroop,Gupta P.K and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi, (2008).

REFERENCES

1.Hadley G, Linear Programming, Narosa publishing House, (1995).

2. Hadley G, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass, (1973).

3. Gupta R. K. "Linear Programming",Krishna Prakashan Media(P) Ltd. ,(2009).

E REFERENCES

www.nptel.ac.in

Fundamentals of Operations Research , Advanced Operation Research
Prof.G.Srinivasan, Department of Management Studies, Indian Institute of Technology, Madras.

	GA1	**GA2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**	**GA12**
CO 1	3									1		1
CO 2	3									1		1
CO 3	3	2								1	1	2
CO 4	3	2			1					1	1	1
CO 5	3	2			1					1	1	1
	15	6	0	0	2	0	0	0	0	5	3	6

1 - Low, 2 – Medium, 3- high

XME 402 Machine Drawing, Computer Graphics and CAD 2 0 1 3

CO1: Cog & Psy, An Ability to understand and apply the knowledge of machine drawing as a system of Communication in which ideas are expressed clearly and all information fully conveyed.
CO2: Cog, Generate and interpret engineering technical drawings of parts and assemblies according to engineering design standards.
CO3: Cog & Psy, Recognize to use modern engineering tools, software and equipment to analyze different drawings for Design & manufacturing.
CO4: Cog & Psy, Integrate the role of graphic communication in the engineering design process
CO5: Cog, An ability to draw the machine component model by CAD software packages.

COURSE CODE	COURSE	L	T	P	C
XME402	MACHINE DRAWING, COMPUTER GRAPHICS AND CAD	2	0	1	3
C:P:A		L	T	P	H
3:1:0		2	0	2	4

Unit- 1	**CODES AND TOLERANCES**	9+0
Conventional representations of threaded parts, springs, gear and common features. Abbreviations and symbols for use in technical drawings, Conventions for sectioning and dimensioning. Tolerances, fits and allowances-types		
Unit- 2	**WORKING DRAWINGS OF FASTENERS AND MACHINE COMPONENTS**	3+12
Preparation of working drawings of Fasteners and Machine components- Nuts, bolts, joints –cotter joint and knuckle joint. screw jack, Plummer block and machine vice		
Unit- 3	**BASICS OF CAD**	7+2
The design process Morphology of design - Product cycle - Sequential and concurrent engineering - Role of computers - Computer Aided Engineering - Computer Aided Design - Design for Manufacturability – Computer Aided Manufacturing - Benefits of CAD.		
Unit- 4	**INTERACTIVE COMPUTER GRAPHICS**	8+4
Creation of Graphic Primitives - Graphical input techniques - Display transformation in 2D and 3D – Viewing transformation - Clipping - hidden line elimination - Mathematical formulation for graphics - Curve generation techniques- Representation of curves – Bezier curves – cubic spline curve– Surface Modelling techniques – surface patch – Coons patch – Bezier and B-spline surfaces – Volume modelling – Boundary models		
Unit- 5	**CAD MODELLING OF MACHINE COMPONENTS**	3+12
Preparation of CAD modelling of Flange coupling and Universal coupling, cotter joint and knuckle joint. screw jack, Plummer block and machine vice		

Lecture = 30; Tutorial = 0; Lab = 30; Total = 60 Hours

TEXT BOOKS:

1. Machine drawing by Gopalakrishnan, Subash Publishers,2002
2. Ibrahim Zeid, " CAD - CAM Theory and Practice ", Tata McGraw-Hill Publishing Co.Ltd., 1998.
3. Sadhu Singh, " Computer Aided Design and Manufacturing ", Khanna Publishers, New Delhi, 1998.
4. Chris McMohan and Jimmi Browne, “CAD/CAM principles, practice and manufacturing management”, Pearson Education Ltd., 2000.

REFERENCE BOOKS:

1. Machine drawing , N.D. Bhatt, Charotar Publishing House, Anand
2. Machine drawing, N.Siddeswar, P.Kanniah, and V.V.S. Satry TataMcGraw Hill, 1980
3. Groover and Zimmers, " CAD / CAM : Computer Aided Design and Manufacturing Prentice Hall of India, New Delhi, 1994.
4. Donald Hearn and M. Pauline Baker, “Computer Graphics”, Prentice Hall, 1992.

E-REFERENCES

1. NPTEL courses http//nptel.iitm.ac.in/courses.php- web and video resources on Computer Aided Design and Manufacturing

COURSE CODE	XME 403	L	T	P	C
COURSE NAME	ELECTRICAL TECHNOLOGY & INDUSTRIAL ELECTRONICS	3	0	1	4
PREREQUISITES	Electrical and Electronics Engineering systems	L	T	P	T
C:P:A	3.2:0.4:0.4	3	0	2	5

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Define and Explain*** the operation of DC and AC machines.	Cognitive	Remember Understand
CO2	***Define and Explain*** the operation of Transformer and Induction machines.	Cognitive	Remember Understand
CO3	***Understand, calculate, design, constructs*** and ***justify*** transistor biasing and various types of amplifiers.	Cognitive Psychomotor Affective	Understand Apply Mechanism Value
CO4	***Understand, predict, show*** **and** ***report*** field effect transistors characteristics and power control devices	Cognitive Psychomotor Affective	Understand Apply Set Respond
CO5	***Label, Outline*** microprocessors and their applications.	Cognitive	Remember Understand

UNIT I D.C AND A.C MACHINES **9+6+6**

Constructional details and operating Principles of D.C generators – e.m.f equation – type of generators – Principles and Operation of D.C motors – back e.m.f – types of motors – speed and torque equation. Construction and operation of synchronous generators – types of synchronous machines – e.m.f equation – principle of operation of synchronous motors.

UNIT II TRANSFORMERS AND INDUCTION MACHINES **9+6+6**

Introduction to the transformer – e.m.f equation – regulation – losses and efficiency – introduction to three phase transformers. Constructional details and principle of operation of three phase induction motor – types of three phase induction motors – e.m.f equation – losses and efficiency.

UNIT III TRANSISTORS **9+6+6**

Introduction to the Electronics Components – Rectifiers - Half Wave, Full Wave rectifier, voltage regulation, Biopolar Junction Transistor – CB, CE, CC configuration and characteristics – Biasing Circuits – Class A, B and C amplifiers – Field effect transistor.

UNIT IV INDUSTRIAL ELECTRONICS **9+6+6**

Introduction to the Amplifiers - Configuration and Characteristics of FET amplifier – SCR. Diac, Triac, UJT – Characteristics and Simple applications – Switching Transistors – Concept of Feedback – Negative Feedback – Application in Temperature and motor Speed Control.

UNIT V 8085 MICROPROCESSOR, INTERFACING AND APPLICATIONS OF MICROPROCESSOR **9+6+6**

Block diagram of microcomputer – Architecture of 8085 – Pin Configuraiton – Instruction Set – Addressing Modes – Simple Programs using arithmetic and logical operations. Basic interfacing concepts – Interfacing of Input and output devices – Application of microprocessor Temperature Control, Stepper Motor Control, Traffic Light Control.

LIST OF EXPERIMENTS

1.	Load test on D.C. shunt motor
2.	Speed control of D.C. shunt motor
3.	Load test on 3-phase induction motor
4.	No load and blocked rotor tests on 3-phase induction motor
5.	Performance characteristics of single-phase transformer
6.	Characteristics of JFET
7.	Characteristics of Uni junction transistor
8.	RC or Wein bridge oscillator
9.	Operating amplifier (Adder, subtractor, differentiator, integrator, inverting and non-inverting)
10.	Programs for 8/16 bit arithmetic operations using 8085

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	**0**	**30**	**75**

TEXT BOOKS

1. D.P.Kothari and I.J.Nagrath, Basic Electrical Engineering" Second Edition 2002, Tata McGraw-Hill Publishers.
2. V.K.Mehta and Rohit Mehta "Principles of Electrical Engineering", 2003, S.Chand and Co. Ltd.
3. Ramesh Goankar, " Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.
4. Milman and Halkais, "Integrated Electronics" Tata McGraw-Hill Publishers, 1995.

REFERENCES

1. Stephen J.Chapman, "Electrical Machinery Fundamentals" Third Edition, 1999, McGraw Hill.
2. K.Murugesh Kumar, "Basic Electrical Science and Technology", First Published 2002, Vikas Publishing House Private Limited.
3. DouglesV.Hall, "Microprocessor and Interfacing" Programming and Hardware, 1999, McGraw Hill.

E- REFERENCES

1. http://www.rtna.ac.th/departments/elect/Data/EE304/Electronic%20Devices%20and%20Circuit%20Theory.pdf
2. http://nptel.ac.in/courses/117103063/ (Prof. ChitralekhaMahanta, NPTEL, Basic Electronics, IIT-Guwahati)
3. http://nptel.ac.in/video.php?subjectId=117103063 (Prof. GautamBarua, NPTEL, Basic Electronics, IIT-Guwahati)
3. http://nptel.ac.in/courses/117101106/ (Prof. A N chandorkar, NPTEL, Analog Electronics, IIT-Bombay)
4. NTPEL, Basic Electrical Technology (Web Course), Prof. N. K. De, Prof. T. K. Bhattacharya and Prof. G.D. Roy, IIT Kharagpur.
5. Prof.L.Umanand ,http://freevideolectures.com/Course/2335/Basic-Electrical-Technology#, IISc Bangalore.
6. http://nptel.ac.in/Onlinecourses/Nagendra/, Dr. NagendraKrishnapura , IIT Madras.
7. Dr.LUmanand , http://www.nptelvideos.in/2012/11/basic-electrical-technology.html, IISC Bangalore

Table: 1 Mapping of COs with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	2	2	1	1	1			1	1		1	1		
CO 2	2	2	1	1	1			1	1		1	1		
CO 3	2	1	1	1	1			1	1		1	1		
CO 4	2	2	2	1	2			2	1		2	2		
CO 5	1	1	2	1	2			2	1		3	3		
Total	9	8	7	5	7			7	5		8	8		
Scaled value	2	2	2	1	2			2	1		2	2		

1-5 → 1, 6-10 → 2, 11-15 → 3
0 – No relation, 1 – Low relation, 2 – Medium relation, 3 – High relation

XME 404 **Mechanics of Machines** **3 1 1 5**

COURSE CODE	SUBJECT NAME	Category			
		L	**T**	**P**	**C**
XME 304	**MECHANICS OF MACHINES**	**3**	**1**	**1**	**5**
	C:P:A 3:1:0	**L**	**T**	**P**	**H**
		3	**2**	**2**	**7**

PREREQUISITES : Engineering Mechanics

COURSE OBJECTIVES

- To understand the principles in mechanisms used for governing of machines.
- To impart the knowledge about the effect of forces on the machines and the methods to control them.

COURSE OUTCOMES: After successful completion of the course, the student would be able to :

CO 1: Cog (Know,App), Psy (Guid): ***Recall*** basics of different types of mechanisms and ***Sketches*** the velocity and acceleration in planar mechanisms.

CO 2: **Cog (Syn, App), Psy (Per):** ***Construct*** cam profile for specific follower motion and ***Describes*** and ***Solve*** problems in gears and gear trains.

CO 3: Cog (Ana), Psy (Per): ***Calculate*** the inertia forces in reciprocating and rotating masses and turning moments in flywheels.

CO 4: Cog (Ana),Psy (Mechanism): Balance reciprocating and rotating masses and ***analyze*** free vibration systems and ***measure*** the frequency of damped and forced vibration systems.

CO 5: Cog (Know),Psy (Per): ***Recognize*** the gyroscopic effect in mechanical applications and ***identifying*** the equilibrium speed using governors.

Syllabus

UNIT I	**BASICS OF MECHANISMS AND KINEMATICS OF PLANE MECHANISMS**	**9+6+9**

Terminology and Definitions - Degree of Freedom - Mobility - Kutzbach criterion - Grashoff's law - Kinematic Inversions of 4-bar chain and slider crank chains -Mechanical Advantage - Transmission angle - Description of common Mechanisms - Quick return mechanisms - Straight line generators. Displacement, velocity and acceleration - Analysis of simple mechanisms by Algebraic and vector approaches - Coincident points – Coriolis acceleration.		
UNIT II	**CAMS AND GEARS**	**9+6+6**
Classification of cams and followers - Terminology and definitions – Cams with uniform acceleration and retardation, SHM, Cycloidal motion, Oscillating followers. Law of toothed gearing – Spur Gear terminology and definitions – Law of gearing - contact ratio – Interference and undercutting – Helical, Bevel, Worm, Rack and Pinion gears [Basics only] – Simple, Compound gear trains – Epicyclic gear trains.		
UNIT III	**FORCE ANALYSIS AND FLY WHEELS**	**9+6+3**
Forces on rigid body in motion – Free body diagrams – Static equilibrium conditions – Two, three & four members – Static force analysis of simple mechanisms – Dynamic force analysis – Inertia force and Inertia torque – D Alembert's principle – The principle of superposition – Dynamic Analysis in reciprocating engines – Gas forces – Equivalent masses – Bearing loads – Crank shaft torque – Turning moment diagrams – Fluctuation of energy – Fly Wheels – Engine shaking forces.		
UNIT IV	**BALANCING AND VIBRATIONS**	**9+6+6**
Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing Multi-cylinder engines – Partial balancing in locomotive engines – Balancing of linkages – Balancing machines. Basic features of vibratory systems – Degrees of freedom – Natural frequency – Free vibration and forced vibration – Damped vibration – Transmissibility ratio.		
UNIT V	**MECHANISM FOR CONTROL**	**9+6+6**
Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force – Other Governor mechanisms. Gyroscopes – Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.		

1. Drawing of some common mechanisms
2. Drawing displacement, velocity and acceleration diagrams
3. Drawing of various cam profiles and motion curves
4. Constructing simple and epicyclic gear trains
5. Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors
6. **Cam - Study of jump phenomenon**
7. Motorised Gyroscope - Determination of gyroscopic couple.
8. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
9. Balancing of reciprocating and rotating masses.
10. Transverse vibration of free Beam.
11. Determination of velocity ratios - simple, compound, Epicyclic and differential gear trains.
12. Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms
13. Determination of Mass moment of inertia of Fly wheel and Axle system.

	L=45 T=30 P=30 TOTAL: 105 HOURS
TEXT BOOKS	
1.	Ambekar A.G, "Mechanism and Machine Theory" Prentice Hall of India, New Delhi, 2007.
2.	Shigley J.E. ,Pennock G.R.and Uicker.J.J., 'Theory of Machines and Mechanisms', Oxford University Press,2003.
REFERENCES	
1.	Thomas Bevan, 'Theory of Machines', CBS Publishers and Distributors, 2008.
2.	Ghosh.A, and A.K.Mallick, 'Theory of Mechanisms and Machines', Affiliated East-West Pvt. Ltd., New Delhi, 2007.
3.	Rao.J.S. and Dukkipati.R.V. 'Mechanisms and Machine Theory', Wiley-Eastern Ltd., New Delhi, 2003.
4.	John Hannah and Stephens R.C., 'Mechanics of Machines', Viva Low-Prices Student Edition, 2003.
E REFERENCES	
1.	http://nptel.iitm.ac.in/courses
2.	http://www.intechopen.com/books

COURSE OUTCOME-PROGRAMME OUTCOME MAPPING:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PSO1	PSO 2
CO1	3	1	1	-	2	-	-	2	1	-	2	3	2	1
CO2	3	2	3	-	2	-	-	2	1	-	2	3	2	-
CO3	3	2	3	-	2	-	-	1	1	-	2	3	1	-
CO4	3	2	3	-	3	-	-	2	2	-	2	3	2	2
CO5	3	2	2	-	3	-	-	2	1	-	2	3	1	-

1-Slightly Relative 2-Supportive 3-Highly Relative

XME 405 Design of Machine Elements 3 1 0 4

1. **CO1: Cog (Remember, Understand, Apply, Analyze, Evaluate)** Analyze stresses and strains in various machine elements.
2. **CO2: Cog (Understand, Apply, Analyze, Evaluate, Create)** Design and select shafts, keyways & couplings based on standard data and manufacturer's catalogue.

3. **CO3: Cog (Understand, Apply, Analyze, Evaluate, Create)** Design and select fasteners and welded joints based on standard data and manufacturer's catalogue.
4. **CO4: Cog (Understand, Apply, Analyze, Evaluate, Create)** Design and select helical springs, leaf springs, torsional springs, belleville springs based on standard data and manufacturer's catalogue.
5. **CO5: Cog (Understand, Apply, Analyze, Evaluate, Create** Design and select contact and rolling type bearings, journal bearings based on standard data and manufacturer's catalogue.

COURSE CODE	COURSE NAME	L	T	P	C
XME 405	DESIGN OF MACHINE ELEMENTS	3	1	0	4
C:T:A		L	T	P	H
3:2:0		3	2	0	5
Unit- 1	**STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS**			**9+6**	
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- 2	**DESIGN OF SHAFTS & COUPLINGS**			**9+6**	
Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways- Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings - design of knuckle joints.					
Unit- 3	**DESIGN OF FASTNERS AND WELDED JOINTS**			**9+6**	
Threaded fasteners - Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures - theory of bonded joints.					
Unit- 4	**DESIGN OF SPRINGS AND LEVERS**			**9+6**	
Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs - Belleville springs – Design of Levers.					
Unit- 5	**DESIGN OF BEARINGS AND FLYWHEELS**			**9+6**	
Design of bearings – sliding contact and rolling contact types. – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – calculation of bearing dimensions – Design of flywheels involving stresses in rim and arm.					
Lecture = 45; Tutorial = 30; Total = 75 Hours					
TEXT BOOKS:					
1. Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Fifth Edition, 2011. 2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, Third Edition, 2011.					
REFERENCE BOOKS:					

1. Norton R.L, "Design of Machinery", Tata McGraw-Hill Book Co, 2004.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

STANDARDS

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

COs versus POs mapping

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
CO_1	3	2	2	2	1	-	-	-	1	-	-	1	2	1
CO_2	3	2	-	2	1	-	-	-	-	-	-	1	2	1
CO_3	3	-	-	-	1	-	-	-	1	-	-	1	2	-
CO_4	3	2	2	2	1	-	-	-	1	-	-	1	2	2
CO_5	3	-	-	-	1	-	-	-	-	-	-	1	2	-
	15	6	4	6	5				3			5	10	6
	3	1	1	1	1				1			1	2	1

XME 406 Economics for Engineers 3 0 0 3

CO1. Cog: C (R) ***Understand*** the concepts of economics in engineering
CO2. Cog: C (U) ***Interpret*** Break-even analysis
CO3. Cog: C (U) ***Illustrate*** value engineering procedure
CO4. Cog: C (U) ***Understand*** *and* ***analyze*** replacement problem
CO5. Cog: C (U) ***Explain*** depreciation

SUBCODE	SUB NAME	L	T	P	C
	ECONOMICS FOR ENGINEERS	**3**	**0**	**0**	**3**
C:P:A = 3:0:0					
		L	**T**	**P**	**H**
		3	**0**	**0**	**3**

UNIT I INTRODUCTION TO ECONOMICS **08**

Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- types of costing, element of costs, preparation of cost sheet and estimation, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost

UNIT II BREAK-EVEN ANALYSIS & SOCIAL COST BENEFIT ANALYSIS **12**

Margin of Safety, Profit, Cost & Quantity analysis-Product Mix decisions and CVP analysis, Profit/Volume Ratio (P/V Ratio), Application of Marginal costing, Limitations

Social Cost Benefit Analysis: compare different project alternatives, Calculate direct, indirect and external effects; Monetizing effects; Result of a social cost benefit analysis.

UNIT III VALUE ENGINEERING & COST ACCOUNTING: **10**

Value engineering – Function, aims, Value engineering procedure - Make or buy decision Business operating costs, Business overhead costs, Equipment operating costs

UNIT IV REPLACEMENT ANALYSIS **07**

Replacement analysis –Types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset.

UNIT V DEPRECIATION **08**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation, Annuity method of depreciation, service output method of depreciation.

LECTURE	TUTORIAL	TOTAL
45	**0**	**45**

TEXT

1. Sp Gupta, Ajay Sharma & Satish Ahuja, "Cost Accounting", V K Global Publications, Faridabad, Haryana, 2012
2. S.P.Jain & Narang, "Cost accounting – Principles and Practice", Kalyani Publishers, Calcutta, 2012
3. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
4. William G.Sullivan, James A.Bontadelli & Elin M.Wicks, "Engineering Economy", Prentice Hall International, New York, 2001.

REFERENCES

1. Luke M Froeb / Brian T Mccann, " Managerial Economics – A problem solving approach" Thomson learning 2007
2. Truett & Truett, "Managerial economics- Analysis, problems & cases " Wiley India 8th edition 2004.
3. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
4. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	2					1	1				1	1
CO 2	2	3		1		2					2	1
CO 3	2			2		1	1	1		2	1	1
CO 4	3	1		1		1					3	1
CO 5	2			1		2	1				1	2
	11	4	0	5	0	7	3	1	0	2	8	6

XMA501 NUMERICAL METHODS 2 1 0 3

CO1. Cog: R, A_p ***Solve*** algebraic and transcendental equations and to ***Find*** Eigen values of a matrix by Power method.

CO2. Cog: U ***Interpret*** *and* Approximate the data using Interpolation methods.

CO3. Cog: A_p ***Solve*** the Numerical Differentiation and Integration *and to* ***Apply the*** Trapezoidal and Simpson's rules.

CO4. Cog: A_p ***Solve*** the first order and second order differential equations using single step

and multistep methods.

CO5. Cog: A_p ***Apply*** Finite difference methods to ***Solve*** two-point linear boundary value problems and to ***Solve*** One dimensional heat-flow equation and wave equation.

SUBCODE	SUB NAME	L	T	P	C
XMA 501	**NUMERICAL METHODS**	**2**	**1**	**0**	**3**
C:P:A = 3:0:0					
		L	**T**	**P**	**H**
		2	**2**	**0**	**4**

UNIT I Solution of Equations and Eigenvalue Problems **12**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss Elimination method –Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method.

UNIT II Interpolation And Approximation **12**

Interpolation with equal intervals - Newton's forward and backward difference formulae- Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation

UNIT III Numerical Differentiation And Integration **12**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV Initial Value Problems for Ordinary Differential Equations **12**

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

UNIT V Boundary Value Problems in Ordinary and Partial Differential Equations **12**

Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit methods - One dimensional wave equation by explicit method.

	LECTURE	TUTORIAL	TOTAL
	30	**30**	**60**

TEXT

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, (2004).
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers', 3rd Edition, Prentice Hall of India Private Ltd., New Delhi, (2007).

REFERENCES

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, (2007).
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, (2006).
3. Brian Bradie, "A friendly introduction to Numerical analysis", Pearson Education

Asia, New Delhi, (2007)

4. Jain M.K. , Iyengar S.R.K, Jain R.K, "Numerical Methods problems and solutions", Revised Second Edition (2007).

E REFERENCES

www.nptel.ac.in

Elementary Numerical Analysis Prof. Rekha P. Kulkarni. Department of Mathematics, Indian Institute Of Technology, Bombay.

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3									1		1
CO 2	3									1		1
CO 3	3									1		1
CO 4	3	2			1					1	1	1
CO 5	3	2			1					1	1	1
	15	4	0	0	2	0	0	0	0	5	2	5

1 - Low , 2 – Medium , 3- high

XME 502 Design of Transmission System 2 1 0 3

CO1: Cog(Rem), Psy (Mechanism, Set): Ability to design and analyze Mechanical transmission systems

CO2: Cog(Understand), Ability to design and select spur and helical gears from manufacturer's catalogue.

CO3: Cog(Rem), Psy (Set) Ability to design and select worm and bevel gears from manufacturer's catalogue.

CO4: Cog(Understand), Psy (COR, Set) Generate the concept of gear motions, drive line positions

CO5: Cog(Rem), Represent a power transmission element with a free body diagram and solve for unknown reactions

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XME 502	**DESIGN OF TRANSMISSION SYSTEMS**	**2**	**1**	**0**	**3**
C:P:A		**L**	**T**	**P**	**H**
3:1:0		**2**	**2**	**0**	**5**
Unit- 1	**TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS**			**9+6**	
Selection of V belts and pulleys – selection of Flat belts and pulleys - Wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.					
Unit- 2	**SPUR GEARS AND HELICAL GEARS**			**11+8**	
Spur gears - Gear Terminology- Gear materials - Speed ratios and number of teeth-Force analysis - Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety. Helical gears – 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. Cross helical gears - terminology-helix angles-Estimating the size of the pair of cross helical gears.

Unit- 3	**BEVEL AND WORM GEARS**	**9+6**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

Unit- 4	**GEAR BOXES**	**6+4**

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

Unit- 5	**CAMS, CLUTCHES AND BRAKES**	**9+6**

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

Lecture = 45; Tutorial = 30; Total = 75 Hours

TEXT BOOKS:

1. Juvinall R. C., Marshek K.M., "Fundamentals of Machine component Design", – John Wiley & Sons Third Edition, 2002.
2. Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd., 1994.

REFERENCE BOOKS:

1. Maitra G.M., Prasad L.V., "Hand book of Mechanical Design", II Edition, Tata McGraw-Hill, 1985.
2. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", McGraw-Hill International Editions,1989.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000,
4. Norton R.L, "Design of Machinery", McGraw-Hill Book co, 2004.
5. Hamrock B.J., Jacobson B., Schmid S.R., "Fundamentals of Machine Elements", McGraw-Hill Book Co., 1999.

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, Pl 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

E- RESOURCES

http://nptel.iitm.ac.in

XME 503 Machine Tool Operations and Metrology 3 0 1 4

CO_1 **Cog(Understand, Rem), Psy (Mechanism, Set):** ***Describe*** the various components, operations, work holding devices and attachments on centre and semi automatic lathes.

CO_2 **Cog(Understand),** ***Explain*** the various machine tools with respect to the operations, advantages,

disadvantages, limitations, applications and other factors.

CO_3 **Cog(Creating, Rem, Applying), Psy (Mechanism, Set)** ***Create*** the suitable part programming for the corresponding job.

CO_4 **Cog(Understand), Psy (Set)** ***Explain*** the basic principles of measurements - Classify the various linear and angular measuring equipments and explain their principle of operation and applications.

CO_5 **Cog(Rem, analyzing),** ***Describe*** the various gauges used for form measurement.

SUB CODE	SUB NAME	L	T	P	CREDITS
XME 503	MACHINE TOOL OPERATIONS AND METROLOGY	3	0	1	4
C:P:A		L	T	P	HOURS
2:1:0		3	0	2	5

Unit – I	**RECIPROCATING MACHINE TOOLS** Cutting tool materials and Cutting fluids. Reciprocating machine tools: shaper, planer and slotter – Milling: types, milling cutters, operations –Hole making **–** Drilling ,boring– Sawing machine **–** Hack saw, band saw, circular saw **–** Broaching machines **–** Broach construction – Push, pull, surface and continuous broaching machines	**9+6**
Unit – II	**ABRASIVE PROCESSES AND GEAR CUTTING** Abrasive processes **–** Grinding wheel – Specifications and selection – Types of grinding process –Cylindrical grinding – Surface grinding – Centre less grinding – Honing, lapping, super finishing,polishing and buffing – Abrasive jet machining – Gear cutting – Forming – Generation – Shaping –Hobbing.	**9+6**
Unit – III	**CNC MACHINE TOOLS AND PART PROGRAMMING** Numerical control (NC) machine tools – CNC – Types – constructional details, special features –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 – Computer assisted part programming **–** Turing and machining centre.	**9+6**
Unit – IV	**LINEAR AND ANGULAR MEASUREMENT** General concept -linear measuring instruments: tool makers microscope - interferometery, optical flats - comparators: limit gauges, mechanical, pneumatic and electrical comparators, applications. angular measurements: -sine bar, sine center, bevel protractor and angle decker.	**9+6**
Unit – V	**FORM MEASUREMENT** Measurement of screw threads: Thread gauges, floating carriage micrometer measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.	**9+6**

1) V-Block Shaping
2) Spur gear Milling
4) Plug gauge(Cylindrical Grinding)
5) Surface grinding
6) Radial drilling
7) Angular measurement using bevel protractor
8) Taper and angular measurement using sine bar and slip gauge
9) Measurement of thread parameters using gear tooth vernier
10) plain turning and chambering (Using CNC machine tool)
11) Step turning (Using CNC machine tool)
12) Grooving (Using CNC machine tool)
13) External thread cutting (Using CNC machine tool)

Lecture = 45; Lab = 30; Total = 75 Hours

TEXT BOOKS:

1. Hajra Choudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002
2. HMT – "Production Technology", Tata McGraw-Hill, 1998.Dr. B.C.Punmia, "Surveying – Volume I", Laxmi Publications, New Delhi, 2005
3. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005
4. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997

REFERENCE BOOKS:

1. Rao, P.N. "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2003.
2. P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Co. Ltd, IV edition, 1993.
3.Milton C.Shaw, 'Metal Cutting Principles', Oxford University Press, Second edition,2005.
4. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2005
5. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education,

E-REFERENCES

http://nptel.ac.in/courses/112105126/27

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}	PSO_{13}	PSO_{14}
CO_1	2	3	2	3	1	-	-	-	1	1	1	3	3	-
CO_2	3	3	2	3	2	-	-	-	1	1	2	3	3	-
CO_3	3	3	2	3	2	-	-	-	1	1	2	3	3	-
CO_4	2	3	2	3	1	-	-	-	1	1	1	-	3	-
CO_5	2	3	2	3	1	-	-	-	1	1	1	-	3	-
Total	12	15	10	15	7	-	-	-	5	5	7	9	15	-

1-Slightly relative: 2- Supportive: 3-Highly relative

XME 504 Fluid Mechanics and Machinery 3 1 1 5

CO1: Cog(Rem), Psy (Mechanism, Set): ***What*** *are* the various types of fluid medium **Name** and construct the equation of motion ,capillarity, control volume.
CO2: Cog(Rem), Psy (*set*) *Select* the various dimensional flow analysis, and various applications of venture meter, **Relate** the pitot tube ,orifice meter .
CO3: Cog(Rem), Psy (Set) Describe the function of laminar flow and turbulent flow used pipe line and stream line and ***Recall*** *the flow* used in compressible and incompressible flow.
CO4: Cog(understand), (set) *Extend the velocity diagram* for various turbine used in fluid medium *Show the various parts.*
CO5: Cog(understand), Why its necessary of velocity triangle used in turbine and illustrate the function of pumps and applications.

Course Code	Course	L	T	P	C
XME504	FLUID MECHANICS AND MACHINERY	3	1	1	5
C:P:A		L	T	P	H
3:1:0		3	2	2	7
Unit- 1	BASIC CONCEPTS AND PROPERTIES OF FLUIDS			9 + 9+18	
Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges - Concepts of system and control volume. Application of control volume to continuity equitation, energy equation, momentum equation and moment of momentum equation.					
Unit- 2	FLUID KINEMATICS AND FLUID DYNAMICS			9 + 9	
Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net – fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube - dimensional analysis - Buckingham's π theorem- applications - similarity laws and models					
Unit- 3	IN COMPRESSIBLE FLUID FLOW			9 + 3+6	
Viscous flow - Navier-Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy -weisback's equation - pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.					
Unit- 4	HYDRAULIC TURBINES			9 + 6+6	
Construction of velocity vector diagrams - head and specific work - components of energy transfer - degree of reaction - Classification of hydraulic turbines - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies - performance curve for turbines.					
Unit- 5	HYDRAULIC PUMPS			9+ 3	
Classification of hydraulic pumps - Centrifugal pump: classifications, working principle,					

velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: classification, working principle, indicator diagram, work saved by air vessels and performance curves - cavitations in pumps - rotary pumps: working principles of gear and vane pumps.

1. Determination of the Coefficient of discharge of given orifice meter and venturi meter.
2. Determination of friction factor and losses for a given set of pipes.
3. Conducting experiments and drawing the characteristic curves of centrifugal pump / submersible pump.
4. Conducting experiments and drawing the characteristic curves of reciprocating pump.
5. Conducting experiments and drawing the characteristic curves of Gear pump.
6. Conducting experiments and drawing the characteristic curves of Pelton wheel.
7. Conducting experiments and drawing the characteristics curves of Francis turbine.
8. Conducting experiments and drawing the characteristic curves of Kaplan turbine.
9. Determination of static and dynamic pressure on pitot tube.
10. Tests on flow through notches.
11. Tests on flow through orifice and external mouthpiece.
12. Verification of Bernoulli's theorem.

Lecture = 45; Tutorial = 30; Lab = 30; Total = 105 Hours

TEXT BOOKS:

1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 2003.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 2008.
2. Som, S.K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2nd Edition, 2004.
3. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 2005.
4. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi, 2008.

E-REFERENCE

1. http://nptel.iitm.ac.in/courses

Table: COs versus POs mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	-	-	-	1	-	-	1
CO2	3	2	-	2	1	-	-	-	-	-	-	1
CO3	3	-	-	-	1	-	-	-	1	-	-	1
CO4	3	2	2	2	1	-	-	-	1	-	-	1
CO5	3	-	-	-	1	-	-	-	-	-	-	1
	15	6	4	6	5				3			5
	3	1	1	1	1				1			1

XTQ 506 TOTAL QUALITY MANAGEMENT 3 0 0 3

Course Outcomes (COs) are

CO1: Cognitive (Remembering, Understanding) ***List*** and ***Explain*** the basic concepts of total quality concepts and its limitations.

CO2: Cognitive (Analyzing, Evaluating) ***Analyze*** and ***Explain*** the Customer satisfaction, Employee involvement, supplier selection and appraise the performance by TQM principle.

CO 3: Cognitive (Understanding, Appling) ***Explain*** and ***Apply*** the Statistical Process Control Tools.

CO4: Cognitive (Remembering, Understanding) ***Select*** and ***Explain*** the different TQM tools and their significance.

CO5: Cognitive (Understanding) ***Explain*** the importance aspects of different quality systems.

SUBCODE	**SUB NAME**	**L**	**T**	**P**	**C**
XUM506	**TOTAL QUALITY MANAGEMENT**	**3**	**0**	**0**	**3**
C:P:A = 3: 0: 0		**L**	**T**	**P**	**H**
		3	**0**	**0**	**3**

UNIT I INTRODUCTION	**9**
Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of Total Quality Management – Historical review –Principles of TQM – Leadership – Concepts – Role of senior management – Quality Council –Quality statements – Strategic planning – Deming philosophy – Barriers to TQM implementation	
UNIT II TQM PRINCIPLES	**9**
Customer satisfaction – Customer perception of quality – Customer complaints – Service quality –Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.	
UNIT III STATISTICAL PROCESS CONTROL (SPC)	**9**
The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.	
UNIT IV TQM TOOLS	**9**
Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.	
UNIT V QUALITY SYSTEMS	**9**
Need for ISO 9000 and other quality systems – ISO 9000:2000 quality system – Elements – Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 –Concept, requirements and benefits.	

LECTURE	**TUTORIAL**	**TOTAL**
45	**-**	**45**

TEXT BOOKS

1. Dale H. Besterfiled, et. Al. “Total Quality Management”, New Delhi, Pearson Education, Inc.. 2007.
2. James R. Evans and William M. Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western, 2002.

REFERENCES

1. Feigenbaum, A.V., "Total Quality Management", McGraw Hill, 1991.
2. Oakland, J.S., "Total Quality Management", Butterworth Heineman, 1989.
3. Narayana V. and Sreenivasan, N.S., "Quality Management – Concepts and Tasks", New Age International, 1996.
4. Zeiri, "Total Quality Management for Engineers", Wood Head Publishers, 1991.

E- REFERENCES

http://nptel.ac.in/faq/110101010/Prof.IndrajitMukherjee,IIT,Bombay and Prof. Tapan P.Bagchi, IIT, Kharagpur.

Table 1: COs Vs GA mapping

	CO1	CO2	CO3	CO4	CO5	Total	Scaled total
GA1	2	1	2	1	1	7	2
GA4	1	1	2	2	1	7	2
GA5	1	1	2	2	1	7	2
GA6	1	1	2	1	2	7	2
GA7	1	1	1	1	1	5	1
GA8	1	1	1	2	2	7	2
GA9	1	1	1	-	1	4	1
GA10	1	1	1	2	2	7	2
GA12	1	1	-	-	2	4	1

XGS 507 Business Communication 1 0 1 0

			BUSINESS COMMUNICATION	**L**	**T**	**P**	**C**
				1	**0**	**1**	**0**
C	**P**	**A**		**L**	**T**	**P**	**H**
1	**1**	**0**		**1**	**0**	**2**	**3**

COURSE OUTCOMES:

CO1**:** C: R: To choose and apply different styles to various forms of business communication.
CO2: C: U: Identify the proper tone of language required in writing and speaking in business communication.
CO3: C: U: Display knowledge on grammar and other linguistic features in writing various forms of business communication.
CO4: C: GR: To distinguish between letters and memos and various forms of Business Communication.

CO5: P: Apply: Learn how to write business reports, minutes, proposals.

SYLLABUS

Units		Hours
I	Introduction to business communication; modern developments in the style of writing letters memos and reports: block letters, semi block letters, full block letters, simplified letters etc.,	**9**
II	The language used in memos/minutes/telephone memos/ letters/ assignments art of writing E-mail etc. Advantages of written and spoken communication.	**9**
III	The use of active and passive voice; the use of grammar, propriety, accuracy , exactness , the tone & other elements of language used in these writings.	**9**
IV	The format of various types of Reports/ projects etc.,	**9**
V	Writing Business reports, proposals and minutes.	**9**
	Lecture: 30 Hours / **Practical: 15 Hours** / **Total: 45 Hours**	

Text Books and Reference Books:

1. John Sealy, Writing and Speaking Author:, Oxford University Press, New Delhi Third Edition 2009.
2. Williams K S, Communicating in Business (8th Edition) Engage Learning India Pvt. Ltd.; 2012
3. John Sealy, Writing and Speaking, Oxford University Press, New Delhi, Third Edition 2009.

Mapping of Course :

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1										2		
CO2										**2**		
CO3				2						**1**		
CO4												1
CO5										**1**	2	

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation.

SYLLABUS:

UNIT: 1: INTRODUCTION TO POWER PLANTS & BOILERS Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles – Comparison and Selection, Load Duration Curves- Steam Boilers and Cycles – High Pressure and Super Critical Boilers – Fluidised Bed Boilers	**15**

UNIT: 2: STEAM POWER PLANT: Components of Steam Generators, Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught – different types, Condenser Types, Cooling Towers, Chimney, Feed Water Quality, Deaerator,	**15**
NUCLEAR , HYDEL AND DIESEL POWER PLANTS : Nuclear Energy – Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety. Hydel Power Plant – Essential Elements, Selection of Turbines, Governing of Turbines- Micro Hydel developments.Types of Diesel Plants, Components, Selection of Engine Type, Applications	**15**
GAS TURBINE AND OTHER POWER PLANTS: Gas Turbine Power Plant – Fuels - Gas Turbine Material – Open and Closed Cycles – Reheating – Regeneration and Intercooling – Combined Cycle. Geo thermal –OTEC – Tidel - Pumped storage - Solar thermal central receiver system	**15**
ECONOMICS OF POWER PLANTS : Cost of Electric Energy – Fixed and operating Costs – Energy Rates – Types of Tariffs – Economics of load sharing, comparison of economics of various power plants, Energy Losses.- Case Studies	**15**

Text Books:

1. Arora S.C and Domkundwar S, "A course in Power Plant Engineering", Dhanpatrai, 2001.
2. Nag P.K, "Power plant Engineering", Tata McGraw-Hill, 1998.
3. R.K.Rajput, "Power Plant Engineering", Laxmi Publications, 1995.

References:

1. EI- Wakil M.M, "Power Plant Technology", McGraw-Hill 1984.
2. G.R. Nagpal, "Power Plant Engineering", Hanna Publishers, 1998.
3. K.K.Ramalingam, "Power Plant Engineering", Scitech Publications, 2002.
4. G.D.Rai, "Introduction to Power Plant Technology", Khanna Publishers, 1995.
5. Frank D.Graham "Power Plant Engineers Guide", D.B. Taraporevala Sons & Co, New Delhi, 1993.
6. T.Morse Frederick, "Power Plant Engineering", Prentice Hall of India, 1998

MAPPING WITH PROGRAMME OUTCOMES :

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PS O1 3	PS O1 4
CO1	3	1	3	2	2			1				2		3
CO2	3	3	1	2							3	2		
CO3	1		2	2	2	2					2	2		
CO4	1	3	3	3				3			1			3
CO5	1		3		3	3		3			2	3		3
	9	7	12	9	7	5		7			8	9		9

XUM 607 Environmental Studies 3 0 0 0

COURSE OUTCOMES

CO1. Cog: R and U ; ***Describe*** the significance of natural resources and ***explain*** anthropogenic impacts.

CO2.Cog: U ; ***Illustrate*** the significance of ecosystem and biodiversity for maintaining ecological

balance

CO3. Cog: R, Aff: Rec ; ***Identify*** the facts , consequences , preventive measures of major pollution and ***Recognize*** the disaster phenomenon

CO4. Cog: U & Anal : ***Explain*** the socio- economics, policy dynamics and ***practice*** the control measures of global issues for sustainable development.

CO5. Cog: U and App: ***Recognize*** the impact of population and ***apply*** the concept to develop various welfare programs.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XUM602	**ENVIRONMENTAL STUDIES**	**3**	**0**	**0**	**0**
C:P:A = 2.5: 0 : 0.5					
		L	**T**	**P**	**H**
		3	**0**	**0**	**3**

UNIT - I INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY **9**

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT - II ECOSYSTEMS AND BIODIVERSITY **9**

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 - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III ENVIRONMENTAL POLLUTION **12**

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 – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide.

UNIT –IV SOCIAL ISSUES AND THE ENVIRONMENT **9**

Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT –V HUMAN POPULATION AND THE ENVIRONMENT **6**

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 – Case studies.

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**0**	**45**

TEXT BOOKS

5. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000.
6. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003
7. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003.
8. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, 2006.
9. Introduction to International disaster management, Butterworth Heinemann, 2006.
10. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004.

REFERENCE BOOKS

1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, 2009.
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, 2012.
4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, 2003.
5. Sundar, Disaster Management, Sarup & Sons, New Delhi, 2007.
6. G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006.

E RESOURCES

1. Bharat Raj Singh , 2015,Global Warming: Causes, Impacts and Remedies , InTech.

2. Richard C. J. Somerville , The Forgiving Air: Understanding Environmental Change , 1998, University of California Press

3.Benny Joseph, Environmental Studies, 2005,Tata McGraw Hill.

Table:1 Mapping of CO's with GA's:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3											1
CO2	2					2	1			1		1
CO3	2	1	3			3	1		2	1		1
CO4	1	1	2			3	2	3				1
CO5	2	1	1			3						1
	10	**3**	**6**			**11**	**4**	**3**	**2**	**2**		**5**
Scaled to 0,1,2,3 scale	**2**	**1**	**2**			**3**	**1**	**1**	**1**	**1**	**1**	**1**

1 - Low, 2 – Medium, 3 – High

XME 702 Fluid Power Engineering and Mechatronics 3 0 1 4

COURSE CODE	SUBJECT NAME	Category			
		L	T	P	CREDITS
XME 603	FLUID POWER ENGINEERING AND MECHATRONICS	3	0	1	4
C:P:A		L	T	P	HOURS
3:1:0		3	0	2	5

PREAMBLE: This course deals with the fundamental aspects of Hydraulics and Pneumatics, the two fields of relevance to fluid power engineering. Mechatronics has often been described as a combination of the subjects of Electrical Engineering, Mechanical Engineering, Computer Engineering and Applied Control Engineering – in the union between of these above subjects the discipline of Mechatronics emerge. Today engineering industries are mostly depends on the Industrial automation for productivity and reliability. The Real back bones of Automation and success of automation is possible only with the full depth knowledge on Fluid power Engineering and Mechatronics

PREREQUISITE: The pre-requisite knowledge required by the Students in the areas of basics in fluid mechanics, engineering mathematics, electrical and electronics.

COURSE OBJECTIVES: ***(Identify what you need to do to achieve your goals)***

1. To gain knowledge and understanding of hydraulic, pneumatic systems and fluid power generation elements, fluid power symbols.
2. To impart knowledge and understanding of hydraulic and pneumatic systems components and their purpose and energy transfer in fluid power actuators
3. To understand and gain knowledge of hydraulic and pneumatic systems circuits design and analyze them towards their application
4. To understand the important elements of a measurement system and the basic performance specifications and models of a variety of analog and digital Mechatronics sensors,the fundamentals of Microprocessor
5. To introduce the concept of control systems elements and to understand the various control modes, building blocks of Mechatronics system.

COURSE OUTCOMES: ***(Identify) On the successful completion of the course, students will be able to***

	Course outcomes	Domain and Level
CO_1	**Describe** the hydraulic and pneumatic systems and their generation elements and A**pply** suitable elements/fluids for the fluid power systems. **Use** fluid power symbols in construction of circuits. **Analyze** the generation elements performance	**C** , **A** and **P**
CO_2	**Discuss** and **Differentiate** hydraulic and pneumatic systems components and their purpose. **Choose** and **Plan** the appropriate elements in construction of circuits. **Measure** and **Evaluate** the energy transfer in fluid power actuators	**C** , **A** and **P**
CO_3	**Observing** the hydraulic and pneumatic systems circuits design,	**C** , **A** and **P**

	Construct and **Analyze** them towards their application	
CO_4	**Demonstrate** the elements of a measurement system and the basic performance specifications and models of a variety of analog and digital Mechatronics sensors and **Test** them in various circuits. **Use** the Various Microprocessors in different experiments	**C** , **A** and **P**
CO_5	**Identify** control systems elements and to understand the various control modes, **Apply** and **Anlyze** the Mechatronics control system Performance in Various processes.	**C** , **A** and **P**

SYLLABUS:

Unit – I	**INTRODUCTION TO FLUID POWER SYSTEMS AND BASIC GENERATION ELEMENTS** Introduction to fluid power system, Types, Application and Advantages of fluid power system. Types of fluids, Pascals Law, Losses in pipe, Fluid power symbols. Sources of fluid power – Pumps - Classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps – Compressors, classification.	**7+6**
Unit – II	**HYDRAULIC AND PNEUMATIC SYSTEM COMPONEN** Filter, regulator, lubricator. Fluid Power Actuators: Linear hydraulic actuators – Types of Actuators – Single acting, Double acting, Special cylinders like Tandem, Rodless, Telescopic, Cushioning mechanism, Rotary actuators – Fluid motors, Gear, Vane and Piston motors - Accumulators and Intensifiers. Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves.	**9+6**
Unit – III	**DESIGN OF HYDRAULIC AND PNEUMATIC CIRCUI** Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Accumulators circuits, Intensifier circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascade method. Hydro Mechanical servo systems - Electro hydraulic servo systems and proportional valves.	**9+6**
Unit – IV	**MECHATRONICS, SENSORS AND TRANSDUCERS** Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Microprocessor based Controllers. Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors – Selection of Sensors. Error measurement and uncertainty determination in measurement of flow / pressure / current / voltage / power / torque / electrical power / speed	**11+6**
Unit – V	**SYSTEM MODELS AND DESIGN OF MECHATRONICS**	**9+6**

	SYSTEM Building blocks of Mechanical, Electrical, Fluid and Thermal Systems. Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control. Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions Case Studies of Mechatronics Systems, Robotics-Pick and place robot – automatic Car Park Systems – Engine Management Systems.		
LAB	1) Actuation of Pneumatic single acting cylinder by 3/2 Single solenoid direction control valve and Pneumatic double acting cylinder by 5/2 Single solenoid direction control valve 2) Actuation of Pneumatic double acting cylinder by 5/2 double solenoid direction control valve 3) Actuation of Pneumatic double acting cylinder by Meter In and Meter Out speed control circuits 4)Actuation of Pneumatic double acting cylinders in Sequential circuits using PLC 5) To Run a Stepper Motor at different speed 6) To Run a Stepper Motor to the required angle 7) To Run a Stepper Motor in forward and reverse direction 8) Actuation of Pneumatic double acting cylinder to find Force Vs Pressure and Speed Vs Discharge 9) Actuation of Hydraulic double acting cylinder to find Force Vs Pressure and Speed Vs Discharge 10)Performance Study of Flow process in On-Off/P/PI/PID Controllers 11)Performance Study of Pressure process in On-Off/P/PI/PID Controllers 12) Performance Study of Temperature process in On-Off/P/PI/PID Controllers 13)To run a PMDC Motor in Open Loop and Closed Loop 14)To Study and simulation of circuits Using Automation Studio software		
	Lecture-45 hrs	Practical -30 hrs	Total 75 hrs

TEXT BOOKS

1. Anthony Esposito, “Fluid Power with Applications”, Pearson Education, Edition,2011.
2. W. Bolton, “Mechatronics”, Pearson Education, Edition, 2008.

REFERENCES

1. Majumdar S.R., “Oil Hydraulics Systems- Principles and Maintenance”, Tata McGraw-Hill, 2001.
2. Majumdar S.R., “Pneumatic systems – Principles and maintenance”, Tata McGraw Hill, 1995
3. Anthony Lal, “Oil hydraulics in the service of industry”, Allied publishers, 1982.
4. Michael B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2000.
5. Nitaigour Premchand Mahadik, “Mechatronics”, Tata McGraw-Hill publishing Company Ltd,

2003 Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2000.
6. Pneumatics and Hydraulics, Andrew Parr. Jaico Publishing Co. 2000.
7. Srinivasan.R, "Hydraulic and Pneumatic controls", Vijay Nicole, 2006.
8. Devdas shetty, Richard A. Kolk, "Mechatronics System Design", Thomson Learning Publishing Company, Vikas publishing house, 2001
9. Bishop, Robert H, Mechatronics Hand book, CRC Press, 2002.

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}	PSO_{13}
CO_1	3	2	2	1	3	3	1	2	-	1	1	3	3
CO_2	3	3	3	-	3	3	-	1	-	-	-	3	3
CO_3	3	3	3	-	3	3	-	1	1	-	-	3	3
CO_4	3	3	3	-	3	3	-	1	-	2	2	3	3
CO_5	3	3	3	-	3	3	-	1	1	2	2	3	3

1-Slightly relative: 2- Supportive: 3-Highly relative

XME 603 Automobile Engineering 3 0 1 4

CO_1 **Cog(Understand, Rem), Psy (Mechanism, Set):** ***Describe*** the structure of vehicle chassis and engines.
CO_2 **Cog (Understand),** ***Explain*** the ignition, fuel supply and emission control systems.
CO_3 **Cog (Rem, Applying), Psy (Set) Describe** the transmission systems
CO_4 **Cog(Understand), Psy (Set)** ***Explain*** the Steering, Suspension and Braking System
CO_5 **Cog (Rem, analyzing),** ***Describe*** the importance of safety devices and recent trends in automotives

SUB CODE	SUB NAME	L	T	P	CREDITS
XME 702	AUTOMOBILE ENGINEERING	3	0	1	4
C:P:A		L	T	P	CREDITS
3:1:0		3	0	2	5

Unit – I	**Introduction to Vehicle Structure and Engine components** Vehicle construction - Chassis and body - Specifications - Engine -	**9+6**

	Types - Construction -Location of engine - Cylinder arrangement - Construction details - Cylinder block -Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters - Cooling system -Types - Water pumps - Radiators - Thermostats - Anti-freezing compounds.	
Unit – II	**Ignition, Fuel Supply and Emission Control System** Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system- Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multipoint – Unit injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI-Automobile Emissions– Effects on human health and environment - Control techniques - Exhaust Gas Recirculation (EGR) - Catalytic converter- Emission tests and standards (Indian and Europe)	**9+6**
Unit – III	**Transmission System** Clutches - Function - Types - Single plate, Multiple plate and Diaphragm Clutch - Fluid coupling - Gearbox - Manual - Sliding - Constant - Synchromesh - Overdrive - Automatic transmission - Torque converter - Epicylic and Hydromatic transmission – Continuously variable transmission - Universal joint - Propeller shaft - Hotchkiss drive – Final drive -Rear axle assembly - Types - Differential - Need - Construction – Non-slip differential – Differential locks - Four wheel drive.	**9+6**
Unit – IV	**Steering, Suspension and Braking System** Principle of steering - Steering Geometry and wheel alignment - Steering linkages –Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers – Wheels and Tires - Construction - Type and specification - Tire wear and causes - Brakes - Needs –Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist –Retarders – Anti-lock Braking System(ABS)	**9+6**
Unit – V	**Automobile Electrical systems, Instrumentation and Advances in Automobile Engineering** Battery-General electrical circuits-Dash board instrumentation - Passenger comfort – Safety and security - HVAC - Seat belts - Air bags - Automotive Electronics - Electronic Control Unit (ECU) - Variable Valve Timing (VVT) - Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP) Traction Control System (TCS) - Global Positioning System (GPS) - X-by-wire - Electric - Hybrid vehicle.	**9+6**
1) Study and demonstration of Layout of an Automobile 2) Study and Demonstration of Differential 3) Study and Demonstration of Clutches 4) Study and Demonstration of Brakes 5) Study and Demonstration of Gear box 6) Study and Demonstration of Steering Mechanism 7) Study and Demonstration of Suspension System 8) Study and Demonstration of Internal Combustion Engine		

Lecture = 45; Tutorial = 0; Lab = 30; Total = 75 Hours
TEXT BOOKS:
1 Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications, latest Edition.
REFERENCE BOOKS:
1. David A. Corolla, (2009), Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd. 2. Richard Stone, Jeffrey K. Ball, (2004), Automotive Engineering Fundamentals" SAE International 3. Bosch Automotive Hand Book, (2007), 6th Edition, SAE Publications. 4. K. Newton and W. Steeds, The motor vehicle, 13th Edition, Butterworth-Heinemann Publishing Ltd.
E-REFERENCES
http://www.howacarworks.com/

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}	PSO_{13}	PSO_{14}
CO_1	3	2	2	2	3	-	-	-	1	1	1	1	3	-
CO_2	2	2	1	2	1	-	-	-	2	2	2	2	2	-
CO_3	3	2	1	1	2	-	-	-	1	3	3	3	2	-
CO_4	2	2	1	1	1	-	-	-	1	1	2	1	2	-
CO_5	2	2	1	2	-	-	-	1	-	-	2	-	-	2
Total	12	10	6	8	7	-	-	1	5	7	10	7	9	2

1-Slightly relative: 2- Supportive: 3-Highly relative

XME 604 THERMAL ENGINEERING

L	T	P	C
3	1	1	5
L	**T**	**P**	**H**
3	2	2	7

Course Outcomes

- Integrate and apply the concepts, laws and methodologies studied from the thermodynamics course into the analysis of cyclic process and thermal energy systems.
- Apply knowledge of applied thermodynamic concepts to study various thermal applictions like IC engines, Air compressors, Steam devices, Refrigeration and Air conditioning systems, etc.

UNIT I GAS POWER CYCLES AND INTERNAL COMBUSTION ENGINES AND ITS SYSTEMS **9+3=12**

Otto, Diesel, dual, Brayton cycles - calculation of mean effective pressure and air standard efficiency, actual and theoretical PV diagram of two stroke and four stroke engines.

Components and functions of IC engine - actual and theoretical valve timing diagram, port timing diagram and PV diagrams - comparison of two stroke & four stroke engines and SI and CI engines.

UNIT II INTERNAL COMBUSTION ENGINE FUELS, COMBUSTION AND PERFORMANCE **9+3=12**

Conventional and alternate fuels - comparison of petrol and diesel engine fuels - air-fuel ratio calculation - knocking and detonation - lubrication system and cooling system - I.C. Engine testing - performance calculation - engine efficiencies - heat balance - scavenging in two stroke engines - exhaust gas analysis, pollution control norms - instruments for measuring emission of NOx , CO, unburnt HC and smoke.

UNIT III AIR COMPRESSORS **9+3=12**

Reciprocating air compressors - classification and working principle, work of compression with and without clearance - effect of clearance - volumetric efficiency, isothermal efficiency and isentropic efficiency of reciprocating air compressors - multistage air compressor and inter cooling - optimum intermediate pressure for perfect inter cooling - work of multistage air compressor - compressor efficiencies and mean effective pressure - rotary and centrifugal compressors.

UNIT IV BOILERS, STEAM NOZZLE, STEAM TURBINES **9+3=12**

Modern high pressure steam boilers - Rankine cycle and its modifications - analysis - thermal calculations - heat balance - accessories - boiler code.

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ration, supersaturated flow.

Types of steam turbines - impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines.

UNIT V REFRIGERATION AND AIR – CONDITIONING **9+3=12**

Vapour compression refrigeration cycle - super heat, sub cooling, performance calculations - working principle of vapour absorption, air cycle, steam and thermoelectric refrigeration systems - refrigerants – psychrometric processes, Controls for R&AC - cooling load calculations and air circulating systems, concept of RSHF, GSHF, ESHF – air conditioning systems.

Practical

1. Valve timing diagram for single cylinder four stroke diesel engine
2. Port timing diagram for single cylinder two stroke petrol engine
3. Performance test on 4-stroke single cylinder water-cooled diesel engine

4. Heat balance test on 4-stroke twin cylinder water-cooled diesel engine
5. Morse test on four stroke multi cylinder petrol engine
6. Retardation test to find frictional power of a single cylinder diesel engine
7. Determination of viscosity – Red wood viscometer
8. Determination of flash point and fire point (open cup and closed cup)
9. Performance test on a refrigeration / air conditioning system
10. Performance test on single/two stage reciprocating air compressor
11. Exhaust gas analysis of IC engines.

TEXT BOOKS

1. Rajput, R.K., Thermal Engineering, 6th Edition, Laxmi Publications, 2007
2. Ballaney, P.L., "Thermal Engineering" , Khanna Publishers, 24th Edition, 2003.

REFERENCES

1. Rudramoorthy, R., Thermal Engineering, 4th Edition, Tata McGraw Hill, New Delhi, 2006.
2. Kothandaraman , C.P., Domkundwar .S and A.v. Domkundwar", a course in thermal Engineering", Dhanpal Rai & sons, fifth edition, 2002.
3. Arora .C.P., "Refrigeration and Air Conditioning", TMH, 1994.
4. Holman .J.P., "Thermodynamics", McGraw Hill, 1985.

XME 605 Power Plant Engineering 3 1 0 4

COURSE CODE	SUBJECT NAME	Category			
		L	T	P	CREDITS
XME605	POWER PLANT ENGINEERING	3	1	0	4

COURSE OBJECTIVE:
This course is an introduction to learn working principles of various types of power plants.
PREREQUISITE: No need of any Prerequisite
COURSE OUTCOMES:

		Level
CO_1	Basic knowledge of Different types of Power Plants, site selection criteria of each one of them.	C and A
CO_2	Understanding of Thermal Power Plant Operation, turbine governing and different types of high pressure boilers.	C and A
CO_3	Basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.	C and A
CO_4	Understanding of Power Plant Economics	C and A
CO_5	Discussing environmental and safety aspects of power plant operation	C and A

XME 703 Heat and Mass Transfer 3 1 1 5

CO1: Cognitive (understand & apply): Understand and **solve** problems involving steady and unsteady heat conduction, convection, and radiation.
CO2: Cognitive (evaluation): Evaluate diffusion and convective Mass transfers occurring in different applications

CO3: Cognitive (apply), Psy (experimentation): Design and **analyze** the performance of heat and mass transfer processes and heat exchangers

CO4: Cog (design), Psy (experimentation): Design and **conduct** experiments to solve open-ended engineering problems related to heat transfer

CO5: Cog (comprehension), Affective: Reinforce technical written and oral communication skills through a formal lab project report.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XME 703	**HEAT AND MASS TRANSFER**	**3**	**1**	**1**	**5**
C:P:A		**L**	**T**	**P**	**H**
3:1.5:0.5		**3**	**2**	**2**	**7**

Unit- 1	**CONDUCTION**	**11+ 6+8**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – 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.

Unit- 2	**CONVECTION**	**10 +6+8**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, 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- 3	**PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS**	**9 + 6+8**

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers – LMTD Method of heat Exchanger Analysis – Effectiveness – NTU method of Heat Exchanger Analysis – Overall Heat Transfer Coefficient – Fouling Factors.

Unit- 4	**RADIATION**	**8 + 6+4**

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation – Grey body radiation Shape Factor Algebra – Electrical Analogy – Radiation Shields –Introduction to Gas Radiation

Unit- 5	**MASS TRANSFER**	**9+ 6+4**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Multi-component systems and their Governing Equations. Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations

Practical:

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 Apparatus - natural convection mode
6. Heat transfer from pin-fin Apparatus - forced convection mode
7. Effectiveness of Parallel flow heat exchanger
8. Effectiveness of Counter flow heat exchanger
9. Determination of Stefan-Boltzmann constant
10. Determination of emissivity of a grey surface
11. Study of solar water heater
12. Study of solar air heater

Lecture = 45; Tutorial = 30; Practical = 30; Total = 105 Hours

TEXT BOOKS:

1. Sachdeva R C, “Fundamentals of Engineering Heat and Mass Transfer” New Age International, 2009.
2. Yadav R “Heat and Mass Transfer” Central Publishing House, 1995.
3. Holman J.P “Heat and Mass Transfer” Tata McGraw-Hill, 2000.

REFERENCE BOOKS:

1. Ozisik M.N, “Heat Transfer”, McGraw-Hill Book Co., 1994.
2. Nag P.K, “ Heat Transfer”, Tata McGraw-Hill, New Delhi, 2011
3. Kothandaraman C.P “Fundamentals of Heat and Mass Transfer” New Age International, New Delhi, 2006
4. Frank P. Incropera and David P. DeWitt, “Fundamentals of Heat and Mass Transfer”, John Wiley and Sons, 2011
5. Velraj R, “Heat & Mass Transfer”, Ane Books, New Delhi, 2011

E-REFERENCES

1. http://nptel.iitm.ac.in/courses/112101097/

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}	PO_{13}	PO_{14}
CO_1	3	-	-	-	3	-	-	1	-	1	2	1	-	3
CO_2	3	-	-	2	3	-	-	1	-	1	2	1	-	-
CO_3	2	3	3	-	1	1	1	-	1	-	1	3	1	3
CO_4	2	3	3	-	1	2	1	-	1	-	1	3	-	3
CO_5	-	-	-	-	-	2	3	2	2	1	1	-	-	1

1-Slightly relative **2- Supportive** **3-Highly relative**

XME 707 and XME 804 Project Phase -1 and Phase II
Course Outcomes (COs)
Phase 1: L:T:P:C 0:0:2 C:P:A = 1:0.5:0.5
Phase II : L:T:P:C 0:0:12 C:P:A 6:3:3

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

CO	Title	Domain	Level
1	**Identify** the Engineering Problem relevant to the domain interest.	Cog	Analyze
2	**Interpret and Infer** Literature survey for its worthiness.	Cog	Analyze, Apply
3	**Analyse** and **identify** an appropriate technique for solve the problem.	Cog	Analyze, Apply
4	**Perform** experimentation /Simulation/Programming/Fabrication, **Collect** and ***interpret*** data.	Psy, Cog	CoR, Create, Apply
5	***Record* and *Report* the** technical findings as a document.	Cog	Remember, Understand
6	***Devote*** oneself as a responsible member and ***display*** as a leader in a team to ***manage*** projects.	Aff, Cog	Value, Organization, Create
7	**Responding** of project findings among the technocrats.	Aff	Responding

Mapping of Course Outcomes (COs) with GAs)

XME 707 –Project Phase -1 and XME 804 Project Phase II

	CO1	CO2	CO3	CO4	CO5	CO6	CO7	Total	
GA1	3	2	1	2	1	-	1	10	2
GA2	3	2	1	2	1	-	1	10	2
GA3	-	-	1	3	1	-	-	5	1
GA4	-	1	2	3	1	2	2	11	3
GA5	-	-	2	3	1	-	-	6	2
GA6	1	-	1	1	-	3	3	10	2
GA7	1		1	1	-	1		4	1
GA8	1	-	1	1	-	3	-	6	2
GA9	-	-	-	-	2	3	1	6	2
GA10	-	-	-	-	3	3	3	9	2
GA11	-				2	2	2	6	2
GA12	1				3	3	1	8	2

1- Low relation 2 – Medium relation 3 – High relation

Electives

Gas Dynamics and Shock Waves **3 1 0 4**

CO1: Cog(Understand): ***Describe*** effects and characteristics of open system compressible fluid flow at Mach speed through energy equations

CO2: Cog(Analze), ***Explain*** High speed compressible fluid flow characteristics , energy transfer and energy transformation in nozzles and diffusers variable area ducts in open systems

CO3: Cog(Analyze), ***Explain*** High speed compressible fluid flow characteristics on effects due friction and heat transfer in combustion chambers, regenerators of constant area ducts in open systems..

CO4: Cog(Understand), Describe shockwave generation on Mach speed and its effects in flow characteristics.

CO5: Cog (Analyze), ***Explain*** Jet and Rocket propulsion for analysing performance of propulsion systems.

COURSE CODE	COURSE NAME	L	T	P	C
	GAS DYNAMICS AND SHOCK WAVES	**3**	**1**	**0**	**4**
C:P:A		**L**	**T**	**P**	**H**
3:1:0		**3**	**2**	**0**	**5**
Unit- 1	**COMPRESSIBLE FLOW – FUNDAMENTALS**			**9 + 6**	
Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility					
Unit- 2	FLOW THROUGH VARIABLE AREA DUCTS			**9 + 6**	
Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.					
Unit- 3	**FLOW THROUGH CONSTANT AREA DUCTS**			**9 +6**	
Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length. flow with friction in constant area ducts Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer'					
Unit- 4	**NORMAL SHOCK**			**9 + 6**	
Shock waves overview, Hypersonic, shock waves in chemistry, shock waves and materials, shock waves and biology, Industrial applications of shock wave. Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows, flow with oblique shock (elementary treatment only).					
Unit- 5	**PROPULSION**			**9+ 6**	
Aircraft propulsion – types of jet engines – energy flow through jet engines, study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines – thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engine, ram jet and pulse jet engines Rocket propulsion – rocket engines thrust equation – effective jet velocity specific impulse – rocket engine performance, solid and liquid propellants, comparison of different propulsion systems.					
Lecture = 45; Tutorial = 30; Total = 75 Hours					

TEXT BOOKS:

1. Yahya. S.M., "Fundamental of compressible flow", Third Edition, 2003New Age International (p) Ltd., New Delhi, 1996
2. Patrich.H. Oosthvizen, William E.Carscallen, "Compressible fluid flow", McGraw-Hill, 1997

REFERENCE BOOKS:

1. Cohen. H., Rogers R.E.C and Sravanamutoo, "Gas turbine theory", Addison Wesley Ltd., 1987
2. Ganesan. V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 1999.
3. Rathakrishnan.E, "Gas Dynamics", Prentice Hall of India, New Delhi, 2001

4. Shock Wave Society, IISc. CD Material Released on NSSW2,27 & 28 Feb,2012

E-REFERENCES

1. http://nptel.iitm.ac.in/

COURSE CODE	COURSE NAME	Category			
		L	T	P	CREDITS
XME 606B	PRODUCT DESIGN AND DEVELOPMENT	3	0	0	3

COURSE OBJECTIVE:

This course is an introduction to the basic concepts of engineering design and product development with focus on the front end processes.

PREREQUISITE: No need of any Prerequisite

COURSE OUTCOMES:

		Level
CO_1	To know the basic concepts of product design, product features and its architecture.	C and A
CO_2	To know the various categories of existing engineering problems and solutions to such problems through different optimization techniques and approaches.	C and A
CO_3	To acquire the knowledge about the concept development, optimization, design verification, process improvement and process control, bench marking.	C and A
CO_4	To acquire the knowledge for develop new products considering aesthetics, ergonomics, environment and other human factors	C and A
CO_5	To acquire the knowledge in Additive Manufacturing (AM) technologies, their potential to support design and manufacturing.	C and A

SYLLABUS:

UNIT I PRODUCT DEVELOPMENT Product Development process – Product development organizations - Raw data manipulation – Gathering, interpretation and organizing hierarchically based on needs. Human factors, ergonomics and other factors - product development versus design. Product cost analysis and cost models - Reverse engineering and redesign product development process - New product development.	**9**
UNIT II PRODUCT FUNCTIONAL REQUIREMENT Establishing the product specifications – Target specifications – Refining specification. Principles of design - axiomatic approach, functional decomposition, mathematical representation, and functional analysis – examples.	**9**

UNIT III PRODUCT CONCEPTS Concept generation, evaluation and selection. Product architecture – Implication and establishing - Related system level design issues. Quality function deployment, product design specification	**9**
UNIT IV INDUSTRIAL DESIGN Introduction – need and impact of industrial design – Industrial design process and its management – Assessing the quality of industrial design - design for manufacturing - cost considerations, Impact of DFM decisions on other factors. Reliability, failure identification techniques, design for maintainability, product safety and packaging.	**9**
UNIT V PROTOTYPING Principles of prototyping – Types and techniques - Planning for prototypes, economics of product development projects, Elements of economic analysis – Financial model – Sensitivity analysis – Influence of the quantitative factors – softwares in prototyping, 3D Printing and Rapid Prototyping	**9**

Text Books

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development ", 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9

2.Kevin Otto , Kristin Wood, " Product Design techniques in Reverse Engineering and New Product Development", 1rd Edition, 2006, PEARSON Publishing Ltd. ISBN-978-81-7758-821-7

References

1. S.Rosenthal, Effective Product Design and Development, Irwin, 1992.
2. Charles Gevirtz Developing New products with TQM, McGraw Hill International Editions, 1994.
3. Harry Nystrom, " Creativity and innovation", John Wiley & Sons, 1979.
4. Frank W. Liou, Rapid Prototyping & engineering applications, CRC Press, 2008.

MAPPING WITH PROGRAMME OUTCOMES :

1-Slightly relative: 2- Supportive: 3- Highly relative

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2		1			3		2		2	3	3	3	
CO2	2	3	3	2	3	2		3	2	2	3	3	3	
CO3	3	3	3	3	3	3	1	2	1	2	2	2	3	
CO4	3	2	3	3	3	3		2	2	2	3	3	3	
CO5		2	2			1		1	1	2			3	
	10	**10**	**12**	**8**	**9**	**12**	**1**	**10**	**6**	**10**	**11**	**8**	**15**	**0**

COURSE CODE	SUBJECT NAME	Category			
		L	T	P	CREDITS
XME704C	Renewable Energy Sources	3	0	0	3

COURSE OBJECTIVE:

This course is an introduction to learn the design principles & exploration of nonconventional energy resources and their effective tapping technologies.

PREREQUISITE: No need of any Prerequisite

COURSE OUTCOMES:

		Level
CO_1	To know the energy demand of world, nation and available resources to fulfill the demand	C and A
CO_2	To know about the problems associated with the conventional energy resources for sustainable development	C and A
CO_3	To know about the exploration of nonconventional energy resources and their effective tapping technologies	C and A
CO_4	To acquire the knowledge of modern energy conversion technologies	C and A
CO_5	Select appropriate energy conservation method to reduce the wastage of energy	C and A

SYLLABUS:

UNIT I ENERGY AND ENVIRONMENT Primary energy sources - world energy resources - Indian energy scenario - energy cycle of the earth –environmental aspects of energy utilization, CO_2 emissions and global warming, Carbon cycle – renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.	**10**
UNIT II BIO ENERGY Energy from bio mass & bio gas plants - various types - design principles of biogas plants - applications. Industrial, municipal and agricultural waste to Energy, Incineration - advantages and limitations – Bio fuels – types, production methods, properties and applications.	**9**
UNIT III SOLAR ENERGY Principles of solar energy collection -.solar radiation - measurements - instruments - types of collectors - characteristics and design principles of different type of collectors - performance of collectors. Solar thermal applications – water heaters and air heaters - performance and applications - simple calculations - solar cooling - solar drying - solar ponds - solar tower - solar furnace.	**10**
UNIT IV WIND, TIDAL AND GEO THERMAL ENERGY Energy from the wind - general theory of windmills - types of windmills - design aspects of horizontal axis windmills - applications. Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants - power from geothermal energy - working principle of geothermal power plants	**9**
UNIT V ENERGY CONSERVATION AND AUDIT Energy Conservation, Energy Audit and Energy Management-Principles and Techniques.	**7**

Text Books

1. Rai G.D, "Non conventional Energy sources" (1999) Khanna Publishers, New Delhi
2. Duffie and Beckmann, "Solar Energy Thermal Processes, John Wiley, 1974.

References

1. Sukhatme, S.P., Solar Energy, 2nd edition, TMH, 2003
2. Sulton, "Direct Energy Conversion", McGraw-Hill, 1966.
3. Garg. H. P and Prakash. J., "Solar Energy - Fundamentals and applications", TMH, New Delhi, 1997.
4. Ashok V Desai, "Non-conventional Energy", Wiley Eastern Ltd, New Delhi, 1990

MAPPING WITH PROGRAMME OUTCOMES :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 13	PSO 14
CO1	1		1					2		1	1	1		3
CO2			3	2		1		3	3	1				3
CO3		1	1	2	3			3			2	2		3
CO4	3	2	2	3	1			2				1		3
CO5	3	3	3	2	3	3		3	3	2	3	2		3
	7	**6**	**10**	**9**	**7**	**4**		**13**	**6**	**4**	**6**	**6**		**15**

1-Slightly relative: 2- Supportive: 3- Highly relative

XUM 706C CYBER SECURITY

Course Objective:		
CO1	COG (R)	To learn the basic concepts of networks and cyber-attacks.
CO2	COG (R)	To define the concepts of system vulnerability scanning and the scanning tools
CO3	COG (R)	To understand the network defense mechanisms and the tools used to detect and quarantine network attacks.
CO4	COG (R)	To learn the different tools for scanning.
CO5	COG (R)	To identify the types of cybercrimes, cyber laws and cyber-crime investigations.

SUB CODE	**SUB NAME**	**L**	**T**	**P**	**C**
	CYBER SECURITY	**3**	**0**	**0**	**3**
C: P: A = 3:0:0					
		L	**T**	**P**	**H**
		3	**0**	**0**	**3**

UNIT I - INTRODUCTION **9**

History of Information Systems and its Importance, Basics, Changing Nature of Information Systems, Need for Distributed Information Systems: Role of Internet and Web Services. Information System Treats and attacks, Classification of Threats and assessing Damages Security in mobile and Wireless Computing-Security Challenges in Mobile Devices, authentication service Security, Security Implication for Organizations, Laptops security Concepts in Internet and World Wide Web: Brief review of Internet Protocols TCP/IP, IPV4,

and IPV6. Functions of various networking components-routers, bridges, switches, hub, gateway and Modulation Techniques.

UNIT II - SYSTEMS VULNERABILITY SCANNING	**9**

Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet.

UNIT III - NETWORK DEFENCE TOOLS	**9**

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System, Cryptool.

UNIT IV – TOOLS FOR SCANNING	**9**

Scanning for web vulnerabilities tools: Metasploit tool, Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, THC-Hydra.

UNIT V - INTRODUCTION TO CYBER CRIME AND LAW	**9**

Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.

Introduction to Cyber Crime Investigation: Password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**0**	**45**

TEXT BOOKS

1. Nina Godbole, “Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, w/cd”, Wiley Publications, 2008, ISBN 10: 8126516925, ISBN 13 : 9788126516926
2. Thomas J. Mowbray, “Cybersecurity: Managing Systems, Conducting Testing and Investigating Intrusions”, Wiley Publications, 2013, Kindle Edition, ISBN 10: 812654919X, ISBN 13 : 9788126549191
3. D.S. Yadav, “Foundations of Information Technology”, New Age International publishers, 3rd Edition, 2006, ISBN-10: 8122417620, ISBN-13: 978-8122417623.

REFERENCES

1. Mike Shema, “Anti-Hacker Tool Kit”, McGraw Hill Education, 4th edition, 2014,
2. Nina Godbole, Sunit Belapure, “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley publilcations, 2013, ISBN 10 : 8126521791, ISBN 13 : 9788126521791.
3. Corey Schou, Daniel Shoemaker, “Information Assurance for the Enterprise: A Roadmap to Information Security (McGraw-Hill Information Assurance & Security)”, Tata McGraw Hill, 2013, ISBN-10: 0072255242, ISBN-13: 978-0072255249.
4. Vivek Sood, “Cyber Laws Simplified”, McGraw Hill Education (INDIA) Private Limited in 2001, ISBN-10: 0070435065, ISBN-13: 978-0070435063.
5. Steven M.Furnell, “Computer Insecurity”, Springer Publisher, 2005 Edition.

E - REFERENCES

1. https://www.cryptool.org/en/
2. https://www.metasploit.com/
3. http://sectools.org/tool/hydra/
4. http://www.hping.org/
5. http://www.winpcap.org/windump/install/
6. http://www.tcpdump.org/
7. https://www.wireshark.org/
8. https://ettercap.github.io/ettercap/
9. https://www.concise-courses.com/hacking-tools/top-ten/
10. https://www.cirt.net/Nikto2
11. http://sqlmap.org/

	GA 1	GA 2	GA 3	GA 4	GA 5	GA 6	GA 7	GA 8	GA 9	GA 10	GA 11	GA 12
CO1	3	3	3	2	1	1	1	1	1	0	0	1

CO2	2	1	1	1	1	1	1	1	1	0	0	1
CO3	2	2	2	1	1	1	1	1	1	0	0	1
CO4	1	1	1	1	0	0	0	0	0	0	0	1
CO5	1	1	1	2	2	1	1	2	2	0	0	1
Total	9	8	8	7	5	4	4	5	5	0	0	5

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
Original	9	8	8	7	5	4	4	5	5	0	0	5
Scaled to 0,1,2,3 scale	2	2	2	2	1	1	1	1	1	0	0	1