PERIYAR MANIAMMAI
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited

think • innovate • transform

Criterion 1 – Curricular Aspects

Key Indicator	1.1	Curriculum Design and Development
Metric	1.1.3	Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the Aerospace Engineering

DEPARTMENT OF AEROSPACE ENGINEERING

SYLLABUS COPY OF THE COURSES HIGHLIGHTING THE FOCUS ON EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT

1. List of courses for the programmes in order of

S. No.	Programme Name
i.	Bachelor of Technology (Aerospace Engineering)

2. Syllabus of the courses as per the list.

Legend : Words highlighted with **Blue Color**   -   Entrepreneurship
           Words highlighted with **Red Color**   -   Employability
           Words highlighted with **Purple Color**   -   Skill Development

1. List of courses

Name of the Course	Course Code	Year of introduction	Activities with direct bearing on Employability/ Entrepreneurship/ Skill development
2020-2021			
XMA101	Calculus and Linear Algebra	2010-11	Test, Quiz, Problem solving
XCP102	Programming for Problem Solving	2013-14	Assignment, Class Test, Seminar
XGS103	English	2018-19	Test, Assignment
XAC104	Applied Chemistry for Engineers	2010-11	Problem solving, Assignment, Quiz, Test
XWP105	Workshop Practices	2010-11	Record Writing, Observation, Mini project
XMA201	Calculus, Ordinary Differential Equations and Complex Variables	2014-15	Test, Quiz, Tutorial
XES202	Environmental Sciences	2018-19	Assignment, Model, Test
XBE203	Electrical and Electronics Engineering Systems	2010-11	Class Notes, Assignment, MCQ Type Test
XAP204	Applied Physics for Engineers	2010-11	Test, Problem solving, Quiz, Assignment
XEG205	Engineering Graphics and Design	2010-11	Plate Submission 1,2,3,4
XMA301	Transforms and Partial Differential Equations	2010-11	Assignment, Attendance, Class Work, Problem solving
XAS302	Material Science and Metallurgy	2010-11	Assignment, Attendance, Seminar, Case study
XAS303	Solid Mechanics and Fluid Mechanics	2010-11	Assignment, Attendance, Seminar, Case study
XEM304	Engineering Mechanics	2010-11	Assignment, Attendance, Seminar, Case study
XUM305	Entrepreneurship Development	2014-15	Business plan, Seminar, Attendance, Assignment
XAS306	Engineering Thermodynamics	2013-14	Assignment, Attendance, Seminar, Case study, Slip Test
XAS307	In-Plant Training- I	2010-11	Work Diary, Report, Presentation, Attendance, Feedback from industry
XAS401	Aerodynamics I	2010-11	Assignment, Case study, Slip Test, Attendance, Record Writing, Observation, Mini project
XAS402	Aircraft Structures I	2010-11	Assignment, Class notes, Attendance

XUM403	Human Ethics, Values, Rights and Gender Equality	2010-11	Case study
XAS404	Aircraft Propulsion	2010-11	Poster Presentation, Case study, Attendance, Record Writing, Observation, Mini project
XAS405	Elements of Satellite Technology	2014-15	Assignment, Seminar, Case Study, Attendance
XASE01	Aircraft Systems and Instruments/ Airframe Maintenance and Repair	2014-15	Assignment, Test, Seminar, Case study
XAS501	Aerodynamics-II	2010-11	Assignment, Class work, Quiz, Test, Applications
XAS502	Aircraft Structures- II	2010-11	Assignment, Seminar, Case study, Record Writing, Observation, Mini project
XAS503	Rocket and Spacecraft Propulsion	2018-19	Assignment, Seminar, Slip test, Case study
XAS504	Space Mechanics	2015-16	Assignment, Seminar, Slip Test, Case study,
XASE08	Wind Tunnel Techniques	2010-11	Assignment, Test, Seminar, Case study
X**OE*	Open Elective – I	2014-15	Assignment, Seminar, Slip test, Case study
XUM507	Essence of Indian Traditional Knowledge	2018-19	Assignment, Seminar, Slip test, Quiz, Group Discussion
XAS508	In-Plant Training – II	2010-11	Work Diary, Report, Presentation, Attendance, Feedback from industry
XASM01	Elements of Drone Technology	2018-19	******
XAS601	Flight Technologies	2010-11	Assignment, Seminar, Case study
XAS602	Finite Element Analysis	2010-11	Assignment, Seminar, Case study, Test
XAS603	UAV Technologies	2014-15	Assignment, Seminar, Case study, Record Writing, Observation, Mini project
XAS604	Avionics	2010-11	Assignment, Seminar, Case study, Record Writing, Observation, Mini project
XASE14	Aircraft Rules and Regulations I and II	2010-11	Assignment, Seminar, Case study
X**OE*	Open Elective-II	2014-15	Model Presentation, Case Study, Assignment, Seminar

XUM607	Constitution of India	2018-19	Process Description, Creativity writing, Assignment
XASM02	CAD Modelling	2018-19	******
XAS701	Open Elective-II	2014-15	******
XAS702	Avionics	2010-11	Assignment, Seminar, Case study, Record Writing, Observation, Mini project
XAS703	Computational Fluid Dynamics	2010-11	Assignment, Seminar, Case study, Slip test, Record Writing, Observation, Mini project
XAS704B	Theory of Vibrations	2013-14	Assignment, Seminar, Case study
XAS705C	Rockets and Missiles	2013-14	Assignment, Seminar, Case study, Slip test
XUM706	Cyber Security	2013-14	Assignment, Seminar, Literature survey
XAS707	Project Phase – I	2014-15	Review, PPT Presentation, Fabrication, Report submission
XGS708	Career Development Skills	2015-16	Assignment, Seminar, Group Discussion
XAS709	In-Plant Training – III	2010-11	Work Diary, Report, Presentation, Attendance, Feedback from industry
XAS710	Non-Destructive Testing	2017-18	******
XAS801	Open Elective- III	2014-15	******
XAS802A	Spacecraft Power Systems	2013-14	Work Diary, Report, Presentation, Attendance, Feedback from industry
XAS803C	Cryogenics	2013-14	Assignment, Seminar, Case study
XAS804	Project Phase II	2014-15	Review, PPT Presentation, Fabrication, Report submission

SYLLABUS OF COURSES

COURSE CODE	XMA101	L	T	P	C
COURSE NAME	CALCULUS AND LINEAR ALGEBRA	3	1	0	4
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3:0.5:0.5		4	1	0	5

COURSE OBJECTIVES

- Understand the application of calculus and linear algebra in engineering.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Apply* orthogonal transformation to reduce quadratic form to canonical forms.	Cognitive	Remembering Applying
CO2	*Apply* power series to tests the convergence of the sequences and series. Half range Fourier sine and cosine series.	Cognitive Psychomotor	Applying Remembering Guided Response
CO3	*Find* the derivative of composite functions and implicit functions. Euler's theorem and Jacobian.	Cognitive Psychomotor	RememberingGuided Response
CO4	*Explain* the functions of two variables by Taylor's expansion, by finding maxima and minima with and without constraints using Lagrangian Method. Directional derivatives, Gradient, Curl and Divergence.	CognitiveAffective	Remembering Understanding Receiving
CO5	*Apply* Differential and Integral calculus to notions of Curvature and to improper integrals.	Cognitive	Applying

UNIT I	MATRICES	12L+3T

Linear Transformation - Eigen values and Eigen vectors -Properties of Eigen values and Eigen vectors - Cayley-Hamilton Theorem – Diagonalisation of Matrices – Real Matrices: Symmetric - Skew-Symmetric and Orthogonal Quadratic form – canonical form - Nature of Quadratic form and Transformation of Quadratic form to Canonical form (Orthogonal only).

UNIT II	SEQUENCES AND SERIES	12L+3T

Sequences: Definition and examples-Series: Types and convergence- Series of positive terms – Tests of convergence:comparison test, Integral test and D'Alembert's ratio test-Fourier series: Half range sine and cosine series- Parseval's Theorem.

UNIT III	MULTIVARIABLE CALCULUS: PARTIAL DIFFERENTIATION	12L+3T

Limits and continuity –Partial differentiation – Total Derivative – Partial differentiation of Composite Functions: Change of Variables – Differentiation of an Implicit Function - Euler's Theorem- Jacobian.

UNIT IV	MULTIVARIABLE CALCULUS: MAXIMA AND MINIMA AND	12L+3T

	VECTOR CALCULUS	

Taylor's theorem for function of Two variables- Maxima, Minima of functions of two variables: with and without constraints - Lagrange's Method of Undetermined Multipliers – Directional Derivatives - Gradient, Divergence and Curl.

UNIT V	DIFFERENTIAL AND INTEGRAL CALCULUS	12L+3T

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

TEXT BOOKS

1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2015**. (Unit-1, Unit-3 and Unit-4).**
2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2014. **(Unit-2).**
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2010. **(Unit-5).**

REFERENCE BOOKS

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
4. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

E –REFERENCES

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

LECTURE: 60   TUTORIAL: 15   PRACTICAL: 0TOTAL HOURS:75

XMA101 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	15	3
PO$_2$	2	1	1	2	2	8	2
PO$_3$	0	0	0	0	0	0	0
PO$_4$	0	0	0	0	0	0	0
PO$_5$	2	0	0	0	1	3	1
PO$_6$	0	0	0	0	0	0	0
PO$_7$	0	0	0	0	0	0	0

PO₈	0	0	0	0	0	0	0
PO₉	0	0	0	0	0	0	0
PO₁₀	1	1	1	1	1	5	1
PO₁₁	0	0	0	0	0	0	0
PO₁₂	2	1	1	1	2	7	2
PSO₁	0	0	0	0	0	0	0
PSO₂	1	1	1	1	1	5	1

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XCP102	L	T	P	C
COURSE NAME	**PROGRAMMINGFORPROBLEMSOLVING**	3	0	2	5
PREREQUISITES	**NIL**	L	T	P	H
C:P:A= 3:0.5:0.5		3	0	4	7

COURSE OBJECTIVES

- Understand the need of programming for problem solving.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Define*programmingfundamentalsand*Solve*simplepr ogramsusingI/O statements	Cognitive Psychomotor	Remember, Understand, Apply
CO2	*Define*syntaxand *writesimpleprograms*using control structures and arrays	Cognitive Psychomotor	Remember, Understand, Apply
CO3	*Explain*and *writesimpleprograms*usingfunctionsand pointers	Cognitive Psychomotor	Understand, Apply
CO4	*Explain*and *writesimpleprograms*usingstructures and unions	Cognitive Psychomotor	Understand, Apply, Analyze
CO5	*Explain*and *writesimpleprograms*usingfiles and *Build*simple projects.	Cognitive Affective	Remember, Understand, Create
UNIT I	**PROGRAMMING FUNDAMENTALS AND INPUT/OUTPUTSTATEMENTS**		**9L+6P**

Theory

Introductiontocomponentsofacomputersystem,Program–Flowchart– Pseudocode–Software– IntroductiontoClanguage–Character set–Tokens: Identifiers,Keywords,Constants,andOperators– sampleprogramstructure-Header files – Data Types-Variables- Output statements –Input statements.

Practical

    1.Program to displayasimple pictureusingdots.

    2.Program for addition of two numbers

    3.Program to swap two numbers

    4.Program to solve anymathematical formula.

UNIT II	CONTROLSTRUCTUREANDARRAYS	9L+6P

Theory

ControlStructures–ConditionalControlstatements:Branching,Looping-
Unconditionalcontrolstructures:switch,break,continue,gotostatements– Arrays: One Dimensional
Array–Declaration–Initialization–Accessing   Array   Elements–Searching–Sorting–Two
Dimensional arrays-Declaration –Initialization– Matrix Operations – MultiDimensional Arrays-
Declaration– Initialization.Storageclasses:auto–extern–static.Strings:Basicoperations on strings.

Practical

1. Program to find greatest of 3 numbers using BranchingStatements

2. Program to displaydivisible numbers between n1and n2 usinglooping Statement

3. Program to remove duplicate element in an array.

4. Program to perform stringoperations.

5. Performingbasic sorting algorithms.

UNIT III	FUNCTIONSANDPOINTERS	9L+6P

Theory

Functions:Builtin functions–User Defined Functions-Paramete rpassing methods-Passing arrayst
of unctions–Recursion-Programsusingarraysand functions. Pointers-Pointer declaration-
Addressoperator-Pointer expressions & pointerarithmetic-Pointers and function-Callbyvalue-
Call byReference-Pointertoarrays-UseofPointersinself-referentialstructures-Notion of linked lis
t(no implementation).

Practical

 1.Program to find factorial of a given number using four function types.

 2.Programs usingRecursion such asFindingFactorial, Fibonacci series, Ackermanfunction
 etc.Quick sort orMerge sort

 3.Programs usingPointers.

UNIT IV	STRUCTURESANDUNIONS	9L+6P

Theory

Structures andUnions -Givingvalues to members-Initializingstructure-Functions and
structures- Passingstructure to elements to functions- Passing entire function to functions-
Arrays of structure -Structurewithin a structure and Union.

Practical

    1.Program to readand displaystudent mark sheet Structureswith variables

    2.Program to readand displaystudent marks of a class usingStructures with arrays

    3.Program to create linkedlist usingStructures with pointers**.**

UNIT V	FILES	9L+6P

Theory

Filemanagementin C-File operation functionsin C-Defining and openinga file-Closing a file-The getw and putw functions-The f printf & f scanf functions - fseek function– Files and Structures.

Practical

1. Program for copying contents of one file to another file.
2. Program usingfiles usingstructure with pointer

TEXT BOOKS/ REFERNCES

1.ByronGottfried,"ProgrammingwithC",IIIEdition,(IndianAdaptedEdition),TMHpublications, 2010
2. Yeshwant Kanethker,"Let us C", BPBPublications, 2008
3. Brian W. Kernighan and Dennis M. Ritchie,"The C Programming Language", Pearson EducationInc. 2005
4. Behrouz A.Forouzanand Richard. F. Gilberg,"A Structured ProgrammingApproach UsingC",II Edition, Brooks–Cole ThomsonLearningPublications, 2001
5. Johnson baugh R. and Kalin M., "ApplicationsProgrammingin ANSIC",IIIEdition, Pearson EducationIndia, 2003
6 . E. Balaguruswamy, Programmingin ANSIC,Tata McGraw-Hill

LECTURE: 45   TUTORIAL: 0   PRACTICAL: 30TOTAL HOURS:75

XCP102 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	2	2	2	12	3
PO$_2$	2	2	2	2	2	10	2
PO$_3$	0	0	1	1	1	3	1
PO$_4$	0	0	2	2	0	4	1
PO$_5$	3	2	2	2	2	11	3
PO$_6$	0	0	0	0	0	0	0
PO$_7$	0	0	0	0	0	0	0
PO$_8$	0	0	0	0	1	1	1
PO$_9$	0	0	0	0	0	0	0
PO$_{10}$	0	0	0	0	2	2	1
PO$_{11}$	2	2	2	2	2	10	2
PO$_{12}$	3	3	2	2	2	12	2

PSO₁	0	0	0	0	0	0	0
PSO₂	0	0	1	1	1	3	1

1-6 → 1, 7-12 → 2, 13-18 → 3

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

COURSE CODE	XGS103	L	T	P	C
COURSE NAME	ENGLISH	2	0	1	3
PREREQUISITES	NIL	L	T	P	H
C:P:A= 2.6:0.4:0		2	0	2	4

COURSE OBJECTIVES

- To acquire effective communication skills in English.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Ability* to recall the meaning for proper usage	Cognitive	Remembering
CO2	*Apply* the techniques in sentence patterns	Cognitive	Applying
CO3	*Identify*the common errors in sentences	Cognitive	Remembering
CO4	*Construct* the Nature and Style of sensible Writing	Cognitive	Creating
CO5	*Practicing*thewriting skills	Psychomotor	Guided response
	Grasping the techniques in learning sounds and etiquettes	Psychomotor	Adapting

UNIT I	VOCABULARY BUILDING	9

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives
1.4 Synonyms, antonyms, and standard abbreviations.

UNIT II	BASIC WRITING SKILLS	9

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

UNIT III	IDENTIFYING COMMON ERRORS IN WRITING	9

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions

3.6 Redundancies		
3.7 Clichés.		
UNIT IV	**NATURE AND STYLE OF SENSIBLE WRITING**	**9**
4.1 Describing		
4.2 Defining		
4.3 Classifying		
4.4 Providing examples or evidence		
4.5 Writing introduction and conclusion.		
UNIT V	**WRITING PRACTICES**	**9**
5.1 Comprehension		
5.2 Précis Writing		
5.3 Essay Writing		
UNIT VI	**ORAL COMMUNICATION**	
(This unit involves interactive practice sessions in Language Lab)		
☐ Listening Comprehension		
☐ Pronunciation, Intonation, Stress and Rhythm		
☐ Common Everyday Situations: Conversations and Dialogues		
☐ Communication at Workplace		
☐ Interviews		
☐ Formal Presentations		
SUGESSTED READINGS		
(i) Practical English Usage. Michael Swan. OUP. 1995 (ii) Remedial English Grammar. F.T. Wood. Macmillan.2007 (iii) On Writing Well. William Zinsser. Harper Resource Book. 2001 (iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006 (v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011 (vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press		
LECTURE: 30 TUTORIAL: 0 PRACTICAL: 15TOTAL HOURS:45		

XGS103 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	2	2	1	2	0	7	2
PO$_2$	0	0	0	0	0	0	0
PO$_3$	0	0	0	0	0	0	0
PO$_4$	0	0	0	0	0	0	0
PO$_5$	0	0	0	0	0	0	0
PO$_6$	0	0	0	0	0	0	0

PO₇	2	2	1	1	0	6	2
PO₈	0	0	0	0	0	0	0
PO₉	1	1	1	1	0	4	1
PO₁₀	0	0	0	0	0	0	0
PO₁₁	0	0	0	0	0	0	0
PO₁₂	0	0	0	0	0	0	0
PSO₁	0	0	0	0	0	0	0
PSO₂	0	0	0	0	0	0	0

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XAC104	L	T	P	C
COURSE NAME	**APPLIED CHEMISTRY FOR ENGINEERS**	3	1	1	5
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3.5:1:0.5		3	1	2	6

COURSE OBJECTIVES

- Understand the application of chemistry in engineering.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Identify* the periodic properties such as ionization energy, electron affinity, oxidation states and electro negativity. *Describe* the various water quality parameters like hardness and alkalinity.	Cognitive Psychomotor	Remembering Perception
CO2	*Explain* and *Measure* microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces.	Cognitive Psychomotor	Understanding Set
CO3	*Interpret* bulk properties and processes using thermodynamic and kinetic considerations.	Cognitive Psychomotor Affective	Applying Mechanism Receive
CO4	*Describe, Illustrate and Discuss* the chemical reactions that are used in the synthesis of molecules.	Cognitive Psychomotor Affective	Remembering Analyzing Perception Responding
CO5	*Apply, Measure* and *Distinguish* the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	Cognitive Psychomotor	Remembering, Applying Mechanism

UNIT I	PERIODIC PROPERTIES AND WATER CHEMISTRY	8L+3T+6P

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. Water Chemistry-Water quality parameters-Definition and explanation of hardness, determination of hardness by EDTA method-Introduction to alkalinity.

UNIT II	USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA	12L+3T+6P

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion-Types, factors affecting corrosion rate and Control methods. Use of free energy considerations in metallurgy through Ellingham diagrams. Advantages of electroless plating, electroless plating of nickel and copper on Printed Circuit Board (PCB).

UNIT III	ATOMIC AND MOLECULAR STRUCTURE	10L+3T+6P

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles.. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Intermolecular forces and potential energy surfaces

Ionic, dipolar and Vander waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

UNIT IV	SPECTROSCOPIC TECHNIQUES AND APPLICATIONS	7L+3T+6P

Principles of spectroscopy and selection rules. Electronic spectroscopy-chromophore, auxochromes, types of electronic transition and application. Fluorescence and its applications in medicine. Vibrational spectroscopy-types of vibrations, Instrumentation and applications. Rotational spectroscopy of diatomic molecules. Nuclear magnetic resonance spectroscopy-concept of chemical shift and applications-magnetic resonance imaging. Diffraction and scattering.

UNIT V	STEREOCHEMISTRY AND ORGANIC REACTIONS	8L+3T+6P

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization reactions and ring opening reactions. Synthesis of a commonly used drug molecule-Aspirin and paracetamol.

TEXT BOOKS

1. Puri B.R. Sharma, L.R., Kalia K.K. Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., 1993
2. Lee. J.D. Concise Inorganic Chemistry, UK, Black well science, 2006.

3. Trapp. C, Cady, M. Giunta. C, Atkins's Physical Chemistry, 10th Edition, Oxford publishers, 2014.
4. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co. Ltd, 1983.
5. Morrison R.T. and Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., 1976.
6. Banwell. C.N, Fundamentals of Molecular Spectroscopy, (3th Edition), McGraw-Hill Book Company, Europe 1983.
7. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (4th edition), S./ Chand & Company Ltd. New Delhi, 1977.
8. P. S. Kalsi, Stereochemistry: Conformation and mechanism, (9th Edition), New Age International Publishers, 2017.

REFERENCES

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-REFERENCES

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/

Experiments :

1. Determination of chloride ion present in the water sample by Argentometric method. (CO1)
2. Determination of total, temporary and permanent hardness of water sample by EDTA method. (CO1)
3. Determination of cell constant and conductance of solutions. (CO2)
4. Potentiometry - determination of redox potentials and emfs. (CO2)
5. Determination of surface tension and viscosity. (CO3)
6. Adsorption of acetic acid by charcoal. (CO3)
7. Determination of the rate constant of a reaction. (CO4)
8. Estimation of iron by colorimetric method. (CO4)
9. Synthesis of a polymer/drug. (CO5)
10. Saponification/acid value of oil. (CO5)

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.

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: 45	TUTORIAL: 15	PRACTICAL: 30TOTAL HOURS:90

XAC104 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO₁	3	2	3	3	3	13	3
PO₂	0	0	0	0	0	0	0
PO₃	0	0	0	0	0	0	0
PO₄	0	0	0	0	0	0	0
PO₅	0	0	0	0	0	0	0
PO₆	0	0	0	0	0	0	0
PO₇	2	1	2	3	2	10	2
PO₈	3	2	3	3	2	13	3
PO₉	3	2	3	3	3	14	3
PO₁₀	0	0	0	0	0	0	0
PO₁₁	0	0	0	0	0	0	0
PO₁₂	0	0	0	0	0	0	0
PSO₁	0	0	0	0	0	0	0
PSO₂	0	0	0	0	0	0	0

 1-6 → 1, 7-12 → 2, 13-18 → 3
 0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XWP105	L	T	P	C
COURSE NAME	WORKSHOP PRACTICES	2	0	2	3
PREREQUISITES	NIL	L	T	P	H
C:P:A= 1:3:0		2	0	4	6
COURSE OBJECTIVES					

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Summarize* the machining methods and *Practice* machining operation.	Cognitive Psychomotor	UnderstandGuided Response
CO2	*Defining* metal casting process, moulding methods and **relates** Casting and Smithy applications.	Cognitive Psychomotor	Remember Perception
CO3	*Plan* basic carpentry and fitting operation and *Practice* carpentry and fitting operations.	Cognitive Psychomotor	Apply Guided Response
CO4	*Summarize* metal joining operation and *Practice* welding operation.	Cognitive Psychomotor	UnderstandGuided Response
CO5	*Illustrate* the, electrical and electronics basics and *Makes* appropriate connections**.**	Cognitive Psychomotor	Understand Origination

COURSE CONTENT		
EXP.NO	**TITLE**	**CO RELATION**
1	Introduction to machining process	CO1
2	Plain turning using lathe operation	CO1
3	Introduction to CNC	CO1
4	Demonstration of plain turning using CNC	CO1
5	Study of metal casting operation	CO2
6	Demonstration of moulding process	CO2
7	Study of smithy operation	CO2
8	Study of carpentry tools	CO3
9	Half lap joint – Carpentry	CO3
10	Mortise and Tenon joint – Carpentry	CO3
11	Study of fitting tools	CO3
12	Square fitting	CO3
13	Triangular fitting	CO3
14	Study of welding tools	CO4
15	Square butt joint – welding	CO4
16	Tee joint – Welding	CO4
17	Introduction to house wiring	CO5
18	One lamp controlled by one switch	CO5

- To obtain skills in machining methods, casting process, moulding methods and welding etc.

19	Two lamps controlled by single switch	CO5
20	Staircase wiring	CO5

TEXT BOOKS

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay
2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.

REFERENCES

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd.
2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd.,New Delhi
3. Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
4. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

E RESOURCES
1. http://nptel.ac.in/courses/112107145/

XWP105 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	2	2	2	2	2	10	2
PO$_2$	1	1	1	1	1	5	1
PO$_3$	2	2	2	2	2	10	2
PO$_4$	2	2	2	2	2	10	2
PO$_5$	1	1	1	1	1	5	1
PO$_6$	0	0	0	0	0	0	0
PO$_7$	0	0	0	0	0	0	0
PO$_8$	1	1	1	1	1	5	1
PO$_9$	1	1	1	1	1	5	1
PO$_{10}$	0	0	0	0	0	0	0
PO$_{11}$	1	1	1	1	1	5	1
PO$_{12}$	2	2	2	2	2	10	1
PSO$_1$	0	0	0	0	0	0	0

PSO₂	0	0	0	0	0	0	0

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XMA201	L	T	P	C
COURSE NAME	**CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE**	3	1	0	4
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3:0.5:0.5		3	1	0	4

COURSE OBJECTIVES

- Understand the application of Calculus, Ordinary Differential Equations and Complex Variable in engineering.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	**Find** double and triple integrals and to find line, surface and volume of an integral by **Applying** Greens, Gauss divergence and Stokes theorem.	Cognitive	Remember, Apply
CO2	**Solve** first order differential equations of different types which are solvable for p, y, x and Clairaut's type.	Cognitive	Apply
CO3	**Solve** Second order ordinary differential equations with variable coefficients using various methods.	Cognitive	Apply
CO4	**Use** CR equations to verify analytic functions and to find harmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation.	Cognitive Psychomotor	Remember, Apply Guided Response
CO5	**Apply** Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series.	Cognitive Affective	Apply Receiving

UNIT I	MULTIVARIABLE CALCULUS (INTEGRATION)	9L+3T

Multiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals - Change of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector line integrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes.

UNIT II	FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS	9L+3T

Exact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equations solvable for p - equations solvable for y- equations solvable for x and Clairaut's type.

UNIT III	ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS	9L+3T

Second order linear differential equations with variable coefficients- method of variation of parameters - Cauchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and their properties.

UNIT IV	COMPLEX VARIABLE – DIFFERENTIATION	9L+3T

Differentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic conjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties- Conformal mappings- Mobius transformations and their properties.

UNIT V	COMPLEX VARIABLE – INTEGRATION	9L+3T

Contour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof)-Liouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's series – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sine and cosine- Evaluation of certain improper integrals using the Bromwich contour.

TEXT BOOKS

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th[th] Edition, 2008.

REFERENCES

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9[th]Edn. Wiley India, 2009.
4. S. L. Ross, "Differential Equations", 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
6. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th Ed., McGraw Hill, 2004.
8. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

E- REFERNCES

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

LECTURE: 45   TUTORIAL: 15   PRACTICAL: 0TOTAL HOURS:60

XMA201 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	15	3

PO₂	2	1	1	2	2	8	2
PO₃	0	0	0	0	0	0	0
PO₄	0	0	0	0	0	0	0
PO₅	2	0	0	0	1	3	1
PO₆	0	0	0	0	0	0	0
PO₇	0	0	0	0	0	0	0
PO₈	0	0	0	0	0	0	0
PO₉	0	0	0	0	0	0	0
PO₁₀	1	1	1	1	1	5	1
PO₁₁	0	0	0	0	0	0	0
PO₁₂	2	1	1	1	2	7	2
PSO₁	0	0	0	0	0	0	0
PSO₂	0	0	0	0	0	0	0

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XES202		L	T	P	C
COURSE NAME	**ENVIRONMENTAL SCIENCES**		3	0	0	3
PREREQUISITES	NIL		L	T	P	H
C:P:A= 1.4:0.3:0.3			3	0	0	3

COURSE OBJECTIVES

- Understand the need of environmental sciences.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Describe* the significance of natural resources and *explain* anthropogenic impacts.	Cognitive	Remember, Understand
CO2	*Illustrate* the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance.	Cognitive	Understand
CO3	*Identify* the facts, consequences, preventive measures of major pollutions and *recognize* the disaster phenomenon	Cognitive Affective	Remember Receive
CO4	*Explain* the socio-economic, policy dynamics and*practice* the control measures of global issues for sustainable development.	Cognitive	Understand, Apply
CO5	*Recognize* the impact of population and the concept of various welfare programs, and *apply* themodern technology towards environmental protection.	Cognitive	Apply, Analyze
UNIT I	**INTRODUCTION TO ENVIRONMENTAL STUDIES AND**		**12**

	ENERGY	

Definition, scope and importance – Need for public awareness – Forest resources: Use, deforestation, case studies. – Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems – Mineral resources: Uses, environmental effects of mining, case studies-iron mining(Goa), bauxite mining(Odisha) – Food resources: 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 – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT II	ECOSYSTEMS AND BIODIVERSITY	7

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Biogeochemical cycles – 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 ecosystem (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	10

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management– 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	10

Rain water harvesting – Resettlement and rehabilitation of people; its problems and concerns, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents – Consumerism and waste products – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Public awareness.

UNIT V	HUMAN POPULATION AND THE ENVIRONMENT	6

Population growth, variation among nations – Population explosion– Environment and human health – HIV / AIDS– Role of Information Technology in Environment and human health.

TEXT BOOKS

1.Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000.

2. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003.

3. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003.

4. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers &   Distributors Pvt. Ltd, New Delhi, 2006.

5. Introduction to International disaster management, Butterworth Heinemann, 2006.

6. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004.

REFERNCES

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-REFERNCES

1. http://www.e-booksdirectory.com/details.php?ebook=10526

2. https://www.free-ebooks.net/ebook/Introduction-to-Environmental-Science

3. https://www.free-ebooks.net/ebook/What-is-Biodiversity

4. https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4

5. http://bookboon.com/en/pollution-prevention-and-control-ebook

6. http://www.e-booksdirectory.com/details.php?ebook=8557

7. http://www.e-booksdirectory.com/details.php?ebook=6804

8. http://bookboon.com/en/atmospheric-pollution-ebook

9. http://www.e-booksdirectory.com/details.php?ebook=3749

10. http://www.e-booksdirectory.com/details.php?ebook=2604

11. http://www.e-booksdirectory.com/details.php?ebook=2116

12. http://www.e-booksdirectory.com/details.php?ebook=1026

13. http://www.faadooengineers.com/threads/7894-Environmental-Science

LECTURE: 45   TUTORIAL: 0   PRACTICAL: 0TOTAL HOURS:45

XES202 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	3	2	2	1	2	10	2
PO$_2$	0	0	1	1	1	3	1
PO$_3$	0	0	3	2	1	6	1
PO$_4$	0	0	0	0	0	0	0
PO$_5$	0	0	0	0	0	0	0
PO$_6$	0	2	3	3	3	11	3
PO$_7$	0	1	1	2	0	3	1
PO$_8$	0	0	0	3	0	3	1
PO$_9$	0	0	2	0	0	2	1
PO$_{10}$	0	1	1	0	0	2	1

PO₁₁	0	0	0	0	0	0	0
PO₁₂	1	1	1	1	1	5	1
PSO₁	0	0	0	0	0	0	0
PSO₂	0	0	0	0	0	0	0

1-6 → 1, 7-12 → 2, 13-18 → 3

COURSE CODE	XBE203	L	T	P	C
COURSE NAME	**ELECTRICAL AND ELECTRONICS ENGINEERING SYSTEMS**	3	1	1	5
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3:1:0		3	2	2	7

COURSE OBJECTIVES

- Understand the application electrical and electronics in engineering systems.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Define, Relate,* the fundamentals of electrical parameters and *build* and *explain* AC, DC circuits by Using measuring devices	Cognitive Psychomotor	Remember, Understand Mechanism, Set
CO2	*Define and Explain* of operation of DC and AC machines.	Cognitive	Remember, Understand
CO3	*Recall and Illustrate* various semiconductor devices and their applications and displays the input output characteristics of basic semiconductor devices.	Cognitive Psychomotor	Remember, Understand Mechanism
CO4	*Relate and Explain* the number systems and logic gates. *Construc*t the different digital circuit.	Cognitive Psychomotor	Remember, Understand Origination
CO5	*Label and Outline* thedifferent types of microprocessors and their applications.	Cognitive	Remember Understand

UNIT I	FUNDAMENTAL OF DC AND AC CIRCUITS, MEASUREMENTS	9L+9T+12P

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 II	ELECTRICAL MACHINES	9L+6T

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 III	SEMICONDUCTOR DEVICES	9L+3T+8P

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

UNIT IV	DIGITAL ELECTRONICS	9L+6T+10P

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

UNIT V	MICROPROCESSORS	9L+6T

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

TEXT BOOKS

1. Metha V.K., 2008. Principles of Electronics. Chand and Company.
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. Morris Mano, 1999. Digital Design. Prentice Hall of India.
 5. Ramesh, S. Gaonkar, 2000. Microprocessor Architecture, Programming and its   Applications with the 8085. 4th ed. India: Penram International Publications.

REFERNCES

1. Corton,H.,2004. Electrical Technology. CBS Publishers & Distributors.
2. Syed, A. Nasar, 1998, Electrical Circuits. Schaum Series.
3. Jacob Millman and Christos, C. Halkias, 1967. Electronics Devices.New Delhi: McGraw-Hill.
4. Millman, J. andHalkias, C. C., 1972. Integrated Electronics: Analog and Digital Circuits and Systems.   Tokyo: McGraw-Hill, Kogakusha Ltd.
5. Mohammed Rafiquzzaman, 1999. 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.

LECTURE: 45   TUTORIAL: 35   PRACTICAL: 35   TOTAL HOURS:105

S. No.	LIST OF EXPERIMENTS :
1.	Study of Electrical Symbols, Tools and Safety Precautions, Power Supplies.
2.	Study of Active and Passive elements – Resistors, Inductors and Capacitors, Bread Board.
3.	Verification of AC Voltage, Current and Power in Series and Parallel connection.
4.	Testing of DC Voltage and Current in series and parallel resistors which are connected in breadboard by using Voltmeter, Ammeter and Multimeter.
5.	Fluorescent lamp connection with choke.
6.	Staircase Wiring.
7.	Forward and Reverse bias characteristics of PN junction diode.
8.	Forward and Reverse bias characteristics of zener diode.
9.	Input and Output Characteristics of NPN transistor.
10.	Construction and verification of simple Logic Gates.

XBE203 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	2	2	2	12	2
PO$_2$	3	3	2	2	2	12	2
PO$_3$	1	1	2	1	1	6	2
PO$_4$	1	1	1	1	1	5	1
PO$_5$	1	1	2	1	1	6	2
PO$_6$	0	1	1	2	1	6	2
PO$_7$	0	0	1	1	1	3	1
PO$_8$	0	0	1	1	1	3	1
PO$_9$	1	1	1	1	1	5	1

PO$_{10}$	1	1	1	1	1	5	1
PO$_{11}$	1	1	1	1	1	5	1
PO$_{12}$	0	0	0	0	0	0	0
PSO$_1$	0	0	0	0	0	0	0
PSO$_2$	1	1	1	1	1	5	1

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XAP204	L	T	P	C
COURSE NAME	**APPLIED PHYSICS FOR ENGINEERS**	3	1	2	6
PREREQUISITES	NIL	L	T	P	H
C:P:A= 2.8:0.8:0.4		3	1	4	8

COURSE OBJECTIVES

- Understand the application of physics in engineering.

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	*Identify* the basics of mechanics, *explain* the principles of elasticity and *determine* its significance in engineering systems and technological advances.	Cognitive Psychomotor	Remember, Understand Mechanism
CO2	*Illustrate* the laws of electrostatics, magneto-statics and electromagnetic induction; *use* and *locate* basic applications of electromagnetic induction to technology.	Cognitive Psychomotor Affective	Remember, Analyze MechanismRespond
CO3	*Understand* the fundamental phenomena in optics by measurement and *describe* the working principle and application of various lasers and fibre optics.	Cognitive Psychomotor Affective	Understand, Apply Mechanism Receive
CO4	*Analyse* energy bands in solids, *discuss* and *use* physics principles of latest technology using semiconductor devices.	Cognitive Psychomotor Affective	Understand, Analyze Mechanism Receive
CO5	*Develop* Knowledge on particle duality and *solve* Schrodinger equation for simple potential.	Cognitive	Understand, Apply

UNIT I	MECHANICS OF SOLIDS	9L+3T+9P

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.

UNIT II	ELECTROMAGNETIC THEORY	9L+3T+3P

Laws of electrostatics - Electrostatic field and potential of a dipole; Dielectric Polarisation, Dielectric constant, internal field - Clausius Mossotti Equation - Laws of magnetism - Ampere's Faraday's law; Lenz's law - Maxwell's equation - Plane electromagnetic waves; their transverse nature - expression for plane, circularly and elliptically polarized light - quarter and half wave plates - production and detection of plane, circularly and elliptically polarized light.

UNIT III	OPTICS, LASERS AND FIBRE OPTICS	9L+3T+12P

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 - Applications

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

UNIT IV	SEMICONDUCTOR PHYSICS	9L+3T+6P

Semiconductors: Energy bands in solids - Energy band diagram of good conductors, insulators and semiconductors - Concept of Fermi level - Intrinsic semiconductors - Concept of holes - doping - Extrinsic semiconductors - P type and N type semiconductors - Hall effect.

Diodes and Transistors**:** P-N junction diode - Forward bias and reverse bias - Rectification action of diode - Working of full wave rectifier using P N junction diodes - PNP and NPN transistors - Three different configurations - Advantages of common emitter configuration - working of NPN transistor as an amplifier in common emitter configuration.

UNIT V	QUANTUM PHYSICS	9L+3T

Introduction to quantum physics, black body radiation, Compton effect, de Broglie hypothesis, wave – particle duality, uncertainty principle, Schrodinger wave equation (Time dependent and Time independent), particle in a box, Extension to three dimension - Degeneracy.

TEXT BOOKS

1. Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publications, 2009.

2. Avadhanulu M. N. "Engineering Physics" (Volume I and II), S. Chand & Company Ltd., New Delhi, 2010.

REFERENCES

1. Palanisamy P. K., "Engineering Physics", Scitech Publications (India) Pvt. Ltd, Chennai.

2. Arumugam M., "Engineering Physics" (Volume I and II), Anuradha Publishers, 2010.
3. Senthil Kumar G., "Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2011.
4. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2007.
5. Samir Kumar Ghosh, "A text book of Advanced Practical Physics", New Central Agency (P) Ltd, 2008.
6. Arora C.L., "Practical Physics", S. Chand & Company Ltd., New Delhi, 2013.
7. Umayal Sundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.

E-REFERENCES
1. NPTEL , Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

LECTURE: 45   TUTORIAL: 15   PRACTICAL: 30TOTAL HOURS:90

S.No.	LIST OF EXPERIMENTS :
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.	Meter Bridge - Determination of specific resistance of the material of the wire.
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.

XAP204 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	15	3
PO$_2$	2	0	2	2	0	6	2
PO$_3$	2	1	2	2	2	9	2
PO$_4$	2	0	2	2	0	6	2
PO$_5$	1	1	1	1	0	4	1
PO$_6$	0	0	0	0	0	0	0
PO$_7$	0	0	0	0	0	0	0
PO$_8$	0	0	0	0	0	0	0
PO$_9$	1	0	1	1	0	3	1
PO$_{10}$	0	0	0	0	0	0	0
PO$_{11}$	0	0	0	0	0	0	0
PO$_{12}$	1	1	1	1	1	5	1
PSO$_1$	0	0	0	0	0	0	0
PSO$_2$	0	0	0	0	0	0	0

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XEG205		L	T	P	C
COURSE NAME	ENGINEERING GRAPHICS		2	0	1	3
PREREQUISITES	NIL		L	T	P	H
C:P:A= 1.75:1:0.25			2	0	2	4

COURSE OBJECTIVES

- Understand the application of engineering graphics in design.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Apply* the national and international standards, *construct* and *practice* various curves	Cognitive Psychomotor Affective	Apply Guided response Respond
CO2	*Interpret, construct* and *practice* orthographic projections of points, straight lines and planes.	Cognitive Psychomotor Affective	Understand Mechanism Respond
CO3	*Construct Sketch* and *Practice* projection of solids in various positions and true shape of sectioned solids.	Cognitive Psychomotor Affective	Apply overt response Respond
CO4	*Interpret, Sketch* and *Practice* the development of lateral surfaces of simple and truncated solids, intersection of solids.	Cognitive Psychomotor Affective	Understand Overt response Respond
CO5	*Construct sketch* and *practice* isometric and perspective views of simple and truncated solids.	Cognitive Psychomotor Affective	Apply Overt response Respond

UNIT I	INTRODUCTION, FREE HAND SKETCHING OF ENGG OBJECTS AND CONSTRUCTION OF PLANE CURVE	6L+12P

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. Practice on basic tools of CAD.

UNIT II	PROJECTION OF POINTS, LINES AND PLANE SURFACES	6L+12P

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-CAD practice on points and lines

UNIT III	PROJECTION OF SOLIDS AND SECTIONS OF SOLIDS	6L+12P

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-CAD practice on solid models.

UNIT IV	DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS	6L+12P

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-CAD practice on intersection of solids.

UNIT V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	6L+12P

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-CAD practice on isometric view.

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-REFERENCES

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

LECTURE: 30   TUTORIAL: 0   PRACTICAL: 60   TOTAL HOURS:90

XEG205 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	15	3
PO$_2$	3	3	3	3	3	15	3
PO$_3$	3	3	3	3	3	15	3
PO$_4$	2	1	1	1	1	6	2
PO$_5$	3	3	3	3	3	15	3
PO$_6$	2	1	1	1	1	6	2
PO$_7$	3	3	3	3	3	15	3
PO$_8$	1	1	1	1	1	5	1
PO$_9$	1	1	1	1	1	5	1
PO$_{10}$	2	1	1	1	1	6	2
PO$_{11}$	3	2	2	2	2	11	3
PO$_{12}$	3	3	3	3	3	15	3
PSO$_1$	0	0	0	0	0	0	0
PSO$_2$	1	1	1	1	1	5	1

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XMA301	L	T	P	C
COURSE NAME	**TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**	3	1	0	4
PREREQUISITES	CALCULUS AND LINEAR ALGEBRA	L	T	P	H
C:P:A= 3:0.5:0.5		3	1	0	4

COURSE OBJECTIVES

- Understand the application of transforms and partial differential equations in engineering.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Solve* standard types of first order differential equation and to solve linear partial differential equations of second order with constant coefficients. Elimination of arbitrary constants and functions.	Cognitive Psychomotor	Apply Imitation
CO2	*State* Dirichlet's condition. *Explain* general Fourier series of the curve y = f(x) in the interval $(0,2\pi)$ $(-\pi, \pi)$, $(0, 2\ell)$, $(-\ell,\ell)$ and $(0, \pi)$. Perform harmonic analysis	Cognitive Psychomotor	Remember, Understand, Imitation
CO3	*Solve* the standard Partial Differential Equations, arising in engineering Problems, like one dimensional Wave equation and Heat flow equation by Fourier series method in Cartesian coordinates. Classify second order quasi PDE.	Cognitive Affective	Apply Receiving
CO4	*Find* the Fourier transform and Fourier sine and cosine transforms of simple functions using definition and its properties.	Cognitive	Remember, Apply
CO5	*Apply* the properties of Z transform to *Find* the Z transform and inverse Z transform of sequence and functions, and to solve the difference equation using them.	Cognitive	Remember, Apply

UNIT I	PARTIAL DIFFERENTIAL EQUATIONS	9L+3T

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	9L+3T

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	9L+3T

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	9L+3T
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	TRANSFORM AND DIFFERENCE EQUATIONS	9L+3T
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.		

TEXT BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, New Delhi (2012).
2. Narayanan, S., ManicavachagomPillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S.Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai (2002).
3. Veerarajan. T., "Transforms and Partial Differential Equations", Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.

REFERENCE BOOKS

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).
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8 th Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

LECTURE: 45   TUTORIAL: 30   PRACTICAL: 0   TOTAL HOURS:60

XMA301 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	15	3
PO$_2$	0	0	2	2	2	6	2
PO$_3$	0	0	0	0	0	0	0
PO$_4$	0	0	0	0	0	0	0

PO$_5$	0	0	0	1	1	2	1
PO$_6$	0	0	0	0	0	0	0
PO$_7$	0	0	0	0	0	0	0
PO$_8$	0	0	0	0	0	0	0
PO$_9$	0	0	0	0	0	0	0
PO$_{10}$	1	1	1	1	1	5	1
PO$_{11}$	0	0	1	1	1	3	1
PO$_{12}$	1	1	2	1	1	6	2
PSO$_1$	0	0	0	0	0	0	0
PSO$_2$	1	1	1	1	1	5	1

1-6 → 1, 7-12 → 2, 13-18 → 3

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

COURSE CODE	**XAS302**	**L**	**T**	**P**	**C**
COURSE NAME	**MATERIAL SCIENCE AND METALLURGY**	**3**	**0**	**0**	**3**
PREREQUISITES	**NIL**	**L**	**T**	**P**	**H**
C:P:A= 3:0:0		**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- Understand structure-properties properties relationship.
- Manipulate atomic/micro structural processes to create desired structure & processes to create desired structure & properties.
- To study about the process of powder metallurgy.

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	*Recall*the Basic Properties of Engineering Materials.	Cognitive	Remember, Understand, Apply
CO2	*Classify*the concepts of iron and steel.	Cognitive	Remember, Understand, Apply
CO3	*Analyze*the heat treatment process and its applications.	Cognitive	Remember, Understand, Apply
CO4	*Analyze*the nonmetallic materials and its applications.	Cognitive	Remember, Understand, Apply
CO5	*Describe*the process of powder metallurgy and its applications	Cognitive	Remember, Understand, Apply

CO6	*List* the Properties and applications of smart materials	Cognitive	Remember, Understand, Apply

UNIT I	PROPERTIES OF METALLIC MATERIALS	9

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	9

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	11

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.

UNIT IV	NON METALLIC MATERIALS	8

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 and resin plastics- Engineering Ceramics – Properties and applications.

UNIT V	METALLURGY & SMART MATERIALS	8

Powder metallurgy, Manufacturing Process, Compacting, Sintering, Vacuum processing. Properties of Powder processed materials, high energy compaction. Fibre and particulate reinforced composites, Metal matrix composites, preparation properties and uses.
Metallic glasses- preparation of metallic glasses- properties – applications of the metallic glasses - Sol Gels – ball Milling – properties of nanoparticles and applications of nanoparticles - Carbon Nanotubes (CNT)–structure–properties–applications of the CNTs.

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.

REFERENCE BOOKS

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 – References

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.

LECTURE: 45   TUTORIAL: 0   PRACTICAL: 0   TOTAL HOURS:45

XAS302- Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	2	3	3	2	3	2	15	3
PO$_2$	2	3	2	3	2	2	14	3
PO$_3$	3	1	1	1	3	1	10	2
PO$_4$	3	1	1	3	3	2	13	3
PO$_5$	1	1	1	1	1	1	6	1
PO$_6$	1	0	0	0	1	0	2	1
PO$_7$	0	0	0	0	0	0	0	0
PO$_8$	2	1	1	1	1	1	7	2
PO$_9$	3	1	2	1	3	2	11	2
PO$_{10}$	3	2	3	2	3	2	14	3
PO$_{11}$	1	3	1	3	2	1	12	2
PO$_{12}$	3	2	3	2	1	1	12	2

PSO₁	2	3	3	3	2	2	15	3
PSO₂	2	1	1	2	2	3	11	2

1-6 → 1, 7-12 → 2, 13-18 → 3

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

COURSE CODE		XAS303	L	T	P	C
COURSE NAME		**SOLID MECHANICS AND FLUID MECHANICS**	3	1	0	4
PREREQUISITES		**ENGINEERING MECHANICS**	L	T	P	H
C:P:A= 4:0:0			3	1	0	4

COURSE OBJECTIVES

- To give brief descriptions on the behaviour of materials due to axial, bending and torsional and combined loads.
- To understand the structure and the properties of the fluid, boundary layer theory and hydraulic machines.

COURSE OUTCOMES			DOMAIN	LEVEL
CO1		*Describe* the concepts of stress and strain at a point and *express* the stress-strain relationship for homogenous, isotropic materials; *explain* shear force and bending moment diagrams for cantilever, simply supported beams.	Cognitive	Remember, Understand, Apply
CO2		*Calculate* bending stress and shear stress in beams**;** *Select* the beam specimen, *Express* deflection equation	Cognitive	Understand, Apply
CO3		*Measure* rotation of rod due to torsion; *Classify* principal stresses; *explain* the stresses, strains associated with thin-wall spherical and cylindrical pressure vessels.	Cognitive	Understand, Apply, Analyze
CO4		*Describe* fluid properties; *Express* the ideas of fluid statics and kinematics.	Cognitive	Remember, Understand
CO5		*Explain* about boundary layer.	Cognitive	Understand
CO6		*Compare and describe* the performance of centrifugal and reciprocating pump.	Cognitive	Evaluate, Remember

UNIT I	BASICS OF STRESS AND STRAIN OF SOLIDS	9L+3T

Rigid and deformable bodies - Stress and Strain – Hooke's Law – Stress-Strain relationship- Elastic constants and their relationship –Shear force and bending moment in beams – Cantilever, Simply supported.

UNIT II	STRESSES & DEFLECTIONS IN BEAMS	9L+3T
Bending stresses in straight beams-Shear stresses in bending of beams –Deflection of beams: Double integration method – McCauley's method		

UNIT III	TORSION & BI AXIAL STRESSES	9L+3T
Torsion of circular shafts - Shear stresses and twist in solid and hollow circular shafts - Stresses in thin circular cylinder and spherical shell under internal pressure - Principal planes and Stresses.		

UNIT IV	FLUID PROPERTIES	9L+3T
Classification of fluids - dimensions and units - system of units - fluid properties - Pascal's law - centre of pressure - pressure measurement by manometers- Continuity, energy and momentum equations - Bernoulli's equation - pitot tubes.		

UNIT V	BOUNDARY LAYER&HYDRAULIC MACHINES	9L+3T
Laminar boundary layer - turbulent boundary layer - Centrifugal pumps and reciprocating pump-slip mechanism.		

TEXT BOOKS	
1.	Rajput R K, Edition -VI "Strength of Materials" Publisher, S Chand, 2015.
2.	L S Srinath, "Advanced Mechanics of Solids" McGraw Hill Education, 2010.
3.	Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi Publications (P) Ltd., New Delhi, 2013.
4.	Frank.M. White., "Fluid mechanics", McGraw Hill series, Seventh Edition,2011.

REFERENCE BOOKS	
1.	Timoshenko, S. P, "Elements of Strength of Materials", Tata McGraw – Hill, New Delhi, 1997.
2.	Nash W. A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw – Hill Book Co, New York, 1995.
3.	Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

E – References	
1.	nptel.ac.in/courses/112107147
2.	https://nptel.ac.in/courses/112105171
	LECTURE: 45 TUTORIAL: 15 PRACTICAL: 0 TOTAL HOURS:60

XAS303 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO1	3	2	1	1	3	2	12	2
PO2	2	1	3	3	2	2	13	2
PO3	1	2	2	2	2	2	11	2
PO4	0	1	2	2	2	2	9	2
PO5	0	1	2	2	3	1	9	2
PO6	0	0	1	1	1	1	4	1
PO7	0	0	0	0	0	0	0	0
PO8	0	0	0	0	0	0	0	0
PO9	0	0	0	0	0	1	1	0
PO10	0	0	0	0	0	0	0	0
PO11	0	0	0	0	1	1	2	1
PO12	0	0	0	0	0	1	1	0
PSO1	0	0	0	2	2	2	6	1
PSO2	0	0	2	1	1	1	5	1

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XEM304**		**L**	**T**	**P**	**C**
COURSE NAME	**ENGINEERING MECHANICS**		**3**	**1**	**0**	**4**
PREREQUISITES	**NIL**		**L**	**T**	**P**	**H**
C:P:A= 3.5:0.25:0.25			**3**	**1**	**0**	**4**

COURSE OBJECTIVES

Upon successful completion of the course, student will have:

- Ability to apply mathematics, science, andengineering.
- Ability to design and conduct experiments, as well as to analyze and interpretdata.
- Ability to identify, formulate, and solve engineeringproblems.
- Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of thelimitations.
- Ability to comprehend the thermodynamics and their corresponding processes that influence the behavior and response of structural components.
- Ability to apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations) and thermodynamics to model, analyze, design, and realize physical systems, components, orprocesses.

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	*Explain* the principles forces, laws and theirapplications.	Cognitive	Understanding, Apply
CO2	*Classification*of friction, and *apply* the forces in Trusses and beams.	Cognitive	Understanding, Apply
CO3	*Explain* and *Apply* moment of Inertia and Virtual work	Cognitive	Understanding, Apply
CO4	*Outline* and *Examine* Dynamics	Cognitive	Understanding, Apply
CO5	*Explain* free and forced vibration	Cognitive	Remember, Understanding

UNIT I	**INTRODUCTION TO ENGINEERING MECHANICS**	**9L+3T**

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static indeterminacy.

UNIT II	**FRICTION AND BASIC STRUCTURAL ANALYSIS**	**9L+3T**

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines.

UNIT III	CENTROID , CENTRE OF GRAVITY AND VIRTUAL WORK AND ENERGY METHOD	9L+3T

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability ofequilibrium.

UNIT IV	REVIEW OF PARTICLE DYNAMICS AND INTRODUCTION TO KINETICS OF RIGID BODIES	9L+3T

Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid bodyrotation.

UNIT V	MECHANICAL VIBRATIONS	9L+3T

Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

TEXT BOOKS

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

REFERENCE BOOKS

1. Mathew Manimala, 2005, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition.

2. Prasanna Chandra, 2009, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill.
3. P.Saravanavel, 1997, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai.
4. Arya Kumar,2012, Entrepreneurship: Creating and Leading an Entrepreneurial Organisation, Pearson Education India.
5. Donald F Kuratko, T.V Rao, 2012, Entrepreneurship: A South Asian perspective, Cengage Learning India.
6. 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.

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

LECTURE: 45   TUTORIAL: 15   PRACTICAL: 0TOTAL HOURS:60

XEM304 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	1	1	1	1	1	5	1
PO$_2$	2	2	2	2	3	11	3
PO$_3$	3	3	3	3	3	15	3
PO$_4$	1	1	1	1	1	5	1
PO$_5$	0	0	0	0	0	0	0
PO$_6$	3	3	3	3	3	15	3
PO$_7$	1	1	1	1	1	5	1
PO$_8$	0	3	0	1	3	7	2
PO$_9$	3	3	3	3	3	15	3
PO$_{10}$	1	1	1	3	3	9	2
PO$_{11}$	2	2	2	3	3	12	3
PO$_{12}$	2	2	2	3	3	12	3
PSO$_1$	2	2	2	3	3	12	3
PSO$_2$	2	2	2	3	3	12	3

1-6 → 1, 7-12 → 2, 13-18 → 3

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

COURSE CODE	XUM305	L	T	P	C
COURSE NAME	ENTREPRENEURSHIP DEVELOPMENT	3	0	0	3
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3:0:0		3	0	0	3

COURSE OBJECTIVES

- The purpose of the course is that the students acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.
- To develop the ability of analysing and understanding business situations in which entrepreneurs act and to master the knowledge necessary to plan entrepreneurial activities.
- The objective of the course is, further on, that the students develop the ability of analysing various aspects of entrepreneurship – especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development and, finally, to contribute to their entrepreneurial and managerial potentials.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Recognise* and *describe* the personal traits of an entrepreneur.	Affective Cognitive	Receiving Understanding
CO2	*Determine* the new venture ideas and *analyse* the feasibility report.	Cognitive	Understanding Analysing
CO3	*Develop* the business plan and *analyse* the plan as an individual or in team.	Affective Cognitive	Receiving Analysing
CO4	*Describe* various parameters to be taken into consideration for launching and managing small business.	Cognitive	Understanding
CO5	*Explain the* technological management and Intellectual Property Rights	Cognitive	Understanding

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.

TEXT BOOKS

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

REFERENCE BOOKS

1. Mathew Manimala, 2005, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition.
2. Prasanna Chandra, 2009, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill.
3. P.Saravanavel, 1997, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai.
4. Arya Kumar,2012, Entrepreneurship: Creating and Leading an Entrepreneurial Organisation, Pearson Education India.
5. Donald F Kuratko, T.V Rao, 2012, Entrepreneurship: A South Asian perspective, Cengage Learning India.
6. 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.

E – References

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

LECTURE: 45 TUTORIAL: 0 PRACTICAL: 0TOTAL HOURS:45

XUM305- Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$	1	1	1	1	1	5	1
PO$_2$	2	2	2	2	3	11	3
PO$_3$	3	3	3	3	3	15	3
PO$_4$	1	1	1	1	1	5	1
PO$_5$	0	0	0	0	0	0	0
PO$_6$	3	3	3	3	3	15	3
PO$_7$	1	1	1	1	1	5	1
PO$_8$	0	3	0	1	3	7	2
PO$_9$	3	3	3	3	3	15	3
PO$_{10}$	1	1	1	3	3	9	2
PO$_{11}$	2	2	2	3	3	12	3
PO$_{12}$	2	2	2	3	3	12	3
PSO$_1$	2	2	2	3	3	12	3
PSO$_2$	2	2	2	3	3	12	3

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XAS306	L	T	P	C
COURSE NAME	**ENGINEERING THERMODYNAMICS**	2	1	0	3
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3:0:0		2	2	0	4

COURSE OBJECTIVES

- To give a brief background of application of various laws of thermodynamics and its application in heat transfer, refrigeration and air-conditioning, jet propulsion system.

COURSE OUTCOMES		DOMAIN	LEVEL
CO₁	*Describe* the laws of thermodynamics and their application to a wide range of systems.	Cognitive	Remember
CO₂	*Analyze* the work and heat interactions associated with a prescribed process path and to perform thermodynamic analysis of a flow system. An ability to evaluate entropy changes and familiarity with calculations of the efficiencies of heat engines and other related engineering devices.	Cognitive	Analyze
CO₃	*Assess* the efficiency and mean effective pressure of different thermodynamic air standard cycles.	Cognitive	Evaluate
CO₄	*Describe* the pure substance (an ideal gas) and its applications in various flow and non flow process, and ability to evaluate the efficiencies.	Cognitive	Remember
CO₅	*Describe* the construction and working principle of different types of compressors.	Cognitive	Remember
CO₆	*Compare* the different refrigeration and air-conditioning systems and able to calculate the COP /cooling load for various applications.	Cognitive	Evaluate

UNIT I	BASIC THERMODYNAMICS	6L+6T

Systems, Zeroth, First and Second laws - concept of entropy change in non-flow processes - SFEE equations [steady flow energy equation] – Heat engines – Refrigerators and heat pumps - Basic thermodynamic relations.

UNIT II	AIR STANDARD CYCLES AND IC ENGINES	6L+6T

Otto, Diesel, Dual and Brayton cycles – Air standard efficiency -Mean effective pressure –Two and four stroke IC Engines – P-V & T-S diagrams.

UNIT III	GAS TURBINES	6L+6T

Open and closed cycle gas turbines – Ideal and actual cycles – Brayton cycle – Cycle with reheat, inter-cooling and regeneration – Application of gas turbines in aviation – Velocity diagrams.

UNIT IV	AIR COMPRESSORS	6L+6T

Positive displacement compressors – Construction and working principle of centrifugal, diagonal (mixed flow) and axial compressors.

UNIT V	REFRIGERATION AND AIR CONDITIONING	6L+6T

Principles of refrigeration, Air conditioning - Heat pumps - Vapour compression – Vapour absorption types - Coefficient of performance, Properties of refrigerants - Basic functional difference between refrigeration and air conditioning – Various methods of producing refrigerating effects (RE).

LECTURE:30　　　　　**TUTORIAL: 30**　　　　　**TOTAL: 60 Hours**

TEXT BOOKS

1.	Nag P K, "Basic and Applied Engineering Thermodynamics". Tata McGraw Hill, New Delhi, 2012.
2.	Cengel & Boles , "Thermodynamics – An Engineering Approach" ,, 7th Ed., McGraw Hill, 2011.

REFERENCE BOOKS

1.	Rogers and Mayhew, „Engineering Thermodynamics – Work and Heat Transfer", Addision Wesley, New Delhi, 1999.
2.	Eastop and McConkey, „Applied Thermodynamics", Addision Wesley, New Delhi, 1999.
3.	Sankaar B K, „Thermal Engineering", Tata McGraw Hill, New Delhi, 1998.

E – References

1.	https://nptel.ac.in/courses/112105123/

XAS306 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Total /6
PO1	3	3	3	3	3	3	18	3
PO2	3	3	3	3	3	3	18	3
PO3	0	2	0	0	2	2	6	1
PO4	1	1	1	1	1	1	6	1
PO5	0	0	0	0	0	0	0	0
PO6	1	1	1	1	1	1	6	1
PO7	2	2	2	2	2	2	12	2

PO8	0	0	0	0	0	0	0	0
PO9	2	2	2	2	2	2	12	2
PO10	0	0	0	0	0	0	0	0
PO11	0	0	0	0	0	0	0	0
PO12	1	1	1	1	1	1	6	1
PSO1	1	1	1	1	1	1	6	1
PSO2	0	0	0	0	0	0	0	0
Total	14	16	14	14	16	16	**90**	**15**

COURSE CODE	XAS401	L	T	P	C
COURSE NAME	AERODYNAMICS I	3	0	2	4
PREREQUISITES	SOLID MECHANICS AND FLUID MECHANICS	L	T	P	H
C:P:A= 3:1:0		3	0	2	5

COURSE OBJECTIVES

- To understand the behaviour of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Recall* the history of aviation and *Study* of basicaerodynamics.	Cognitive	Remember Understand
CO2	*Explain* various flows and *Calibrate* the wind tunnel	Cognitive Psychomotor	Understand Analyze Mechanism
CO3	*Express* combinational stream functions for various flows and *Calibrate* pressure distribution over Cylinder.	Cognitive Psychomotor	Understand Analyze Mechanism
CO4	*Explain* Kutta Transformations and *Calibrate* pressure distribution over various models	Cognitive Psychomotor	Understand Analyze Mechanism
CO5	*Sketch* theflow visualization over the models, *Explain* Lifting line theory and *Present* solution to real time problems.	Cognitive Psychomotor Affective	Understand Analyze Mechanism Respond

CO6	*Display* the Boundary Layer Flow over models and *Discuss* Navier stokes's Equation.	Cognitive Psychomotor	Remember Understand

UNIT I	BASICS OF AERODYNAMICS	7

History of aviation - classifications of aircrafts - Components of an airplane- Physical properties and structure of the atmosphere– Forces and moments acting in Aircraft.

UNIT II	TWO DIMENSIONAL INCOMPRESSIBLE FLOWS	10

Elementary flows – uniform flow, source, sink, vortex and their combinations, Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows.

UNIT III	CONFORMAL MAPPING	8

Aerofoil terminologies - Classification of aerofoil - Transformation from circle to various shapes - Karman – Trefftz profiles – ideal and real flow – Magnus effect – D' Alembert paradox.

UNIT IV	AIRFOIL AND WING THEORY	12

Thin aerofoil theory and its applications- concept of vortex flow - Vortex line, Horse shoe vortex, Biot Savart law, Lifting line theory and its limitations.

UNIT V	VISCOUS FLOWS	8

Concepts of boundary Layer- Blasius theorem- displacement, Momentum thickness - Flow over a flat plate.

TEXT BOOKS

1.	Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York, 1998.
2.	Clancey, L.J., "Aerodynamics", Pitman, 1986.

REFERENCE BOOKS

1.	Houghton, E.L., and Carruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, 1989.
2.	Milne Thomson, L.H., "Theoretical aerodynamics", Macmillan, 1985.

E – References

1.	https://nptel.ac.in/courses/101105059/

List of Experiments

1. Flow visualization in water flow channel.

2. Flow visualization in smoke tunnel

3. Study of Low speed subsonic wind tunnel

4. Plot of rotor speed Vs velocity in a subsonic wind tunnel.

5. Find the Pressure distribution over circular cylinder and plot it.

6. Enumerate and plot Pressure distribution over Symmetrical airfoil and estimation of C_L and C_D.

7. Enumerate and plot Pressure distribution over Un Symmetrical airfoil and estimation of C_L and C_D.

8. Enumerate and plot Pressure distribution over Cambered airfoil and estimation of C_L and C_D.	
9. Study of Schlieren system to visualize shock.	
10. Study of Shadow graph system to visualize shock.**Lecture: 45** **Tutorial:0** **Practical: 30** **Total: 75 Hours**	

XAS401 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	3	15	2
PO$_2$	2	3	3	3	3	3	16	3
PO$_3$	1	2	2	3	3	3	11	2
PO$_4$	3	3	3	3	3	3	15	2
PO$_5$	0	2	2	2	3	3	9	1
PO$_6$	0	3	3	3	2	2	13	2
PO$_7$	1	2	2	2	2	2	9	1
PO$_8$	0	2	2	0	0	0	4	1
PO$_9$	0	3	3	0	0	0	6	1
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	0	0	0	0	0	0	0	0
PO$_{12}$	3	3	3	3	2	2	16	3
PSO$_1$	0	0	0	0	0	0	0	0
PSO$_2$	2	2	2	2	1	1	10	2

COURSE CODE	XAS402	L	T	P	C
COURSE NAME	**AIRCRAFT STRUCTURES I**	3	1	0	4
PREREQUISITES	SOLID AND FLUID MECHANICS	L	T	P	H
C:P:A= 4:0:0		3	1	0	4

COURSE OBJECTIVES

- To study the behaviour of various aircraft structural components under different types of loads.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Recall*** engineering mechanics and ***explain*** fuselage and wing structures.	Cognitive	Remember, Understand
CO2	***Draw*** and ***explain*** statically determinate and indeterminate structures.	Cognitive	Remember, Understand
CO3	***Discuss*** and ***analyze*** the behavior of elastic structures subjected to combined loads, including bending, torsion and axial loads.	Cognitive	Understand, Analyze
CO4	***Explain*** and ***Use*** Euler's formula for various columns to find out critical load. ***Distinguish*** Euler's formula and Rankine's formula.	Cognitive	Understand, Apply
CO5	***Explain*** the real time application of columns.	Cognitive	Understand
CO6	***List*** the theories of failure and ***explain*** themand then ***utilize*** the failure theories to investigate the engineering structures. ***Uses*** of failure theories in Aircraft structures.	Cognitive, Psychomotor, Affective	Understand, Set, Receive

UNIT I	**BASICS OF AIRCRAFT STRUCTURES**	**8L**

Fuselage structure: truss type, monocoque and semi- monocoque – Wing structure – Empennage structure.

UNIT II	**STATICALLY DETERMINATE AND INDETERMINATE STRUCTURES**	**10L+4T**

Analysis of plane truss using method of joints- Propped Cantilever- Fixed-Fixed beams - Clapeyron's Three Moment Equation.

UNIT III	**ENERGY METHODS**	**8L+3T**

Strain Energy due to axial, bending and Torsional loads – Castigliano's theorems- Maxwell's Reciprocal theorem - Unit load method.

UNIT IV	**COULMNS**	**11L+4T**

Columns with various end conditions – Euler's Column curve – Rankine's formula - Column with initial curvature - Eccentric loading – South well plot – Beam column – application of columns.

UNIT V	**FAILURE THEORIES**	**8L+3T**

Types of failure theories – Principal stress theory – Principal strain theory – Shear stress theory –

Shear strain energy theory – Strain energy theory – Fatigue and Creep Failure analysis.	

LECTURE: 45	TUTORIAL: 15	TOTAL: 60

TEXT BOOKS

1.	Rajput R K., Sixth Edition "Strength of Materials" Publisher, S Chand Publications, 2015.
2.	Donaldson, B.K., "Analysis of Aircraft Structures – An Introduction", McGraw- Hill, 1993.
3.	Megson T.M.G, "Aircraft Structures for Engineering Students", Edward Arnold, 1995.

REFERENCE BOOKS

1.	Bruhn.E.F. "Analysis and design of flight vehicle structures" Tri set of offset company, USA, 1973.
2.	Timoshenko S.,"Strength of Materials", Vol. I and II,Princeton D. Von Nostrand Co, 1990.

E – References

1.	https://nptel.ac.in/courses/101104069/21

XAS402 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	2	3	3	2	16	3
PO$_2$	2	1	1	2	2	3	11	2
PO$_3$	2	1	1	2	2	3	11	2
PO$_4$	2	1	1	3	3	3	13	3
PO$_5$	3	0	0	3	3	3	12	2
PO$_6$	0	0	0	0	0	3	3	1
PO$_7$	0	0	0	0	0	0	0	0
PO$_8$	0	0	0	0	0	0	0	0
PO$_9$	0	0	0	0	0	2	2	1
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	0	0	0	1	1	2	4	1

PO₁₂	0	0	0	0	0	1	1	0
PSO₁	0	0	0	0	0	0	0	0
PSO₂	0	0	0	0	0	1	1	0

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

COURSE CODE	XUM403	L	T	P	C
COURSE NAME	**HUMAN ETHICS,VALUES,RIGHTS AND GENDER EQUALITY**	**1**	**0**	**0**	**1**
PREREQUISITES	**NIL**	**L**	**T**	**P**	**H**
C:P:A= 1:0:0		**1**	**0**	**0**	**1**

COURSE OBJECTIVES

- Students will ultimately be assessed on their ability to demonstrate a commitment to professionalism, rights, ethical behavior, service, and, as appropriate, leadership.
- Students will ultimately be assessed on their knowledge of the legal system and legal doctrine. Students will graduate with a broad knowledge of foundational and other core areas human rights, specialized knowledge in areas of interest, and experience with advanced study.
- Students will ultimately be assessed on the development of legal analysis, legal communication, and legal research.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Relate* and *Interpret* the human ethics and human relationships	Cognitive	Remember, Understanding
CO2	*Explain* and *Apply* gender issues, equality and violence against women	Cognitive	Understanding, Applying
CO3	*Classify* and *Develop* the identify of women issues and challenges	Cognitive Affective	Analyzing Receiving
CO4	*Classify*and *Dissect*human rights and report on violations.	Cognitive	Understanding, Analyze
CO5	*List* and *respond* to family values, universal brotherhood, fight against corruption by common man and good governance.	Cognitive Affective	Remember, Respond

UNIT I	HUMAN ETHICS AND VALUES	7

Human Ethics and values - Understanding of oneself and others- motives and needs- Social service, Social Justice, Dignity and worth, Harmony in human relationship: Family and Society, Integrity and Competence, Caring and Sharing, Honesty and Courage, WHO's holistic development - Valuing Time, Co-operation, Commitment, Sympathy and Empathy, Self respect, Self-Confidence, character building and Personality.

UNIT II	GENDER EQUALITY	9

Gender Equality - Gender Vs Sex, Concepts, definition, Gender equity, equality, and empowerment. Status of Women in India Social, Economical, Education, Health, Employment, HDI, GDI, GEM. Contributions of Dr.B.R. Ambethkar, Thanthai Periyar and Phule to Women Empowerment.

UNIT III	WOMEN ISSUES AND CHALLENGES	9

Women Issues and Challenges- Female Infanticide, Female feticide, Violence against women, Domestic violence, Sexual Harassment, Trafficking, Access to education, Marriage. Remedial Measures – Acts related to women: Political Right, Property Rights, and Rights to Education, Medical Termination of Pregnancy Act, and Dowry Prohibition Act.

UNIT IV	HUMAN RIGHTS	9

Human Rights Movement in India – The preamble to the Constitution of India, Human Rights and Duties, Universal Declaration of Human Rights (UDHR), Civil, Political, Economical, Social and Cultural Rights, Rights against torture, Discrimination and forced Labour, Rights and protection of children and elderly. National Human Rights Commission and other statutory Commissions, Creation of Human Rights Literacy and Awareness. - Intellectual Property Rights (IPR). National Policy on occupational safety, occupational health and working environment.

UNIT V	GOOD GOVERNANCE AND ADDRESSING SOCIAL ISSUES	9

Good Governance - Democracy, People's Participation, Transparency in governance and audit, Corruption, Impact of corruption on society, whom to make corruption complaints, fight against corruption and related issues, Fairness in criminal justice administration, Government system of Redressal. Creation of People friendly environment and universal brotherhood.

REFERENCES

1. Aftab A, (Ed.), Human Rights in India: Issues and Challenges, (New Delhi: Raj Publications, 2012).
2. Bajwa, G.S. and Bajwa, D.K. Human Rights in India: Implementation and Violations (New Delhi: D.K. Publications, 1996).
3. Chatrath, K. J. S., (ed.), Education for Human Rights and Democracy (Shimala: Indian Institute of Advanced Studies, 1998).
4. Jagadeesan. P. Marriage and Social legislations in Tamil Nadu, Chennai: Elachiapen Publications, 1990).
5. Kaushal, Rachna, Women and Human Rights in India (New Delhi: Kaveri Books, 2000)
6. Mani. V. S., Human Rights in India: An Overview (New Delhi: Institute for the World Congress on Human Rights, 1998).
7. Singh, B. P. Sehgal, (ed) Human Rights in India: Problems and Perspectives (New Delhi: Deep and Deep, 1999).
8. Veeramani, K. (ed) Periyar on Women Right, (Chennai: Emerald Publishers, 1996)
9. Veeramani, K. (ed) Periyar Feminism, (Periyar Maniammai University, Vallam, Thanjavur: 2010).

10.Planning Commission report on Occupational Health and Safety
http://planningcommission.nic.in/aboutus/committee/wrkgrp12/wg_occup_safety.pCentral
Vigilance Commission (Gov. of India) website: http://cvc.nic.in/welcome.html.

11. Weblink of Transparency International: https://www.transparency.org/

12. Weblink Status report: https://www.hrw.org/world-report/2015/country-chapters/india

LECTURE: 15	**TUTORIAL: 0**	**SELF STUDY: 30TOTAL HOURS:45**	

XUM403- Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO$_1$							
PO$_2$					2	2	1
PO$_3$							
PO$_4$							
PO$_5$							
PO$_6$							
PO$_7$							
PO$_8$	2	3	2	3	3	13	3
PO$_9$		1			2	3	1
PO$_{10}$				2	2	4	1
PO$_{11}$							
PO$_{12}$					2	2	1
PSO$_1$							
PSO$_2$							

1-6 → 1, 7-12 → 2, 13-18 → 3

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

COURSE CODE	XAS404	L	T	P	C
COURSE NAME	AIRCRAFT PROPULSION	3	1	2	5
PREREQUISITES	ENGINEERING THERMODYNAMICS	L	T	P	H
C:P:A= 4:1:0		3	1	2	6

COURSE OBJECTIVES

- To understand the principles of operation and design of aircraft engines.
- To study about the theories behind the engine system
- To study about the Air breathing engine sections.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Describe* the concepts of piston engine and Jet engine and *measures* valve timing, frictional power of diesel engine and port timing of petrol engine.	Cognitive Psychomotor	Remember Mechanism
CO2	*Express* the performance of Inlets and diffusers	Cognitive	Understand
CO3	*Classify* the Combustion chamber and *measures* flash point, fire point, free and forced convection over a flat plate.	Cognitive Psychomotor	Understand Overt response
CO4	*Assess* the performance characteristics of turbo machineries of aircraft's jet engine	Cognitive	Evaluate
CO5	*Describe* the nozzle performance of jet engine	Cognitive Psychomotor	Remember Perception
CO6	*Discuss* about the needs of aircraft propulsion.	Affective	Responding

UNIT I	INTRODUCTION TO AIRCRAFT PROPULSION	9L+ 3T

Classification of power plants based on methods of aircraft propulsion - Factors affecting thrust and power- Reciprocating engine - types of reciprocating engine - turbojet engine - turboprop engine -turbofan engine - turboshaft engine - ramjet engine- scramjet engine - pulsejet engine - thrust equation of jet engine.

UNIT II	INLETS AND DIFFUSERS	9L+ 3T

Subsonic and supersonic inlets –Modes of inlet operation - internal and external compression intakes - intake characteristic curves - mixed compression intakes - stability of intake operation.

UNIT III	COMBUSTION CHAMBER	9L+ 3T

Classification of Combustion chambers - combustion mechanism - factors affecting combustion chamber performance and design – Flame tube cooling – Flame stabilization - fuel injection.

UNIT IV	TURBOMACHINERY	9L+ 3T

Axial compressor - velocity triangle - stalling - surging - stage losses - centrifugal compressor - Axial flow turbine - radial flow turbine - mixed flow turbine - fans and blowers - efficiencies - turbine blade cooling techniques - lubrication systems in turbo machinery.

UNIT V	NOZZLE	9L+ 3T

Over expanded, under and optimum expansion in nozzles - fixed geometry nozzle - variable geometry nozzle - attachment of jet pipe - afterburner - types of thrust reverser - types of thrust vectoring - nozzle cooling.

LECTURE: 45	TUTORIAL: 15	PRACTICAL :	TOTAL: 90

TEXT BOOKS

1.	Hill, P.G. and Peterson, C.R. "Mechanics and Thermodynamics of Propulsion" Addison – Wesley Longman INC, 1999.
2.	Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAAEducation Series, New York, 1985
3.	Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 1999.

REFERENCE BOOKS

1.	Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory",Longman, 1989.
2.	"Rolls Royce Jet Engine" – Third Edition – 1983.

List of Experiments

1. Valve Timing Diagram for single cylinder four stroke Diesel engine
2. Port Timing Diagram for single cylinder two stroke Petrol engine.
3. Retardation Test to find Frictional Power of a single cylinder Diesel Engine.
4. Studyofanaircraftpistonengine.
5. Studyofanaircraftjetengine
6. Determination of Flash Point and Fire Point (open Cup).
7. Determination of Flash Point (Closed Cup).
8. Study of forced convection and free convection heattransfer over a flat plate.
9. Study of free jet.
10. Study of wall jet.

XAS404 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	3	18	3
PO$_2$	1	1	1	1	1	1	6	1
PO$_3$	1	2	2	1	2	1	9	1
PO$_4$	1	1	1	1	1	1	6	1
PO$_5$	1	3	3	1	0	0	8	1
PO$_6$	1	1	1	1	1	1	6	1
PO$_7$	1	2	2	2	2	2	11	2
PO$_8$	0	0	0	0	0	0	0	0
PO$_9$	2	2	2	3	3	2	14	2
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	0	1	1	1	1	1	5	1
PO$_{12}$	1	1	1	1	1	1	6	1
PSO$_1$	0	0	0	0	0	0	0	0
PSO$_2$	0	0	0	0	0	0	0	0

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

COURSE CODE	XASE01	L	T	P	C
COURSE NAME`	**AIRCRAFT SYSTEMS AND INSTRUMENTS**	3	0	0	3
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3:0:0		3	0	0	3

COURSE OBJECTIVES

- To introduce the hydraulic and pneumatic systems components and operate, types of instruments and its operation including navigational instruments

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Explain* the components and concepts of various aircraft systems.	Cognitive	Understand
CO2	*Compare* the basic and modern control systems.	Cognitive	Understand
CO3	Study the *functions* of fuel system and *Examine* the auxiliary Aircraft power plant systems.	Cognitive	Understand, Analyze
CO4	*Outline* the needs of Air-conditioning systems and cabin pressurization system.	Cognitive	Understand
CO5	*Differentiate* the use of flight instruments and Navigation Instruments.	Cognitive	Analyze
CO6	*Inspect* the needs of engine instruments and their operations.	Cognitive	Analyze

UNIT I	**AIRCRAFT SYSTEMS**	**9**

Hydraulic systems –basic principle – components – hydraulic systems controllers – modes of operation – pneumatic systems – working principles – typical pneumatic power system – brake system – components, landing gear systems – classification – shock absorbers – Extension, retractable mechanism.

UNIT II	**AIRPLANE CONTROL SYSTEMS**	**8**

Conventional Systems – power assisted and fully powered flight controls – power actuated systems – engine control systems – push pull rod system – operating principles – digital fly by wire systems – auto pilot system, active control technology.

UNIT III	**ENGINE SYSTEMS**	**8**

Fuel, lubricating, starting and ignition systems in piston and jet engines- multi-engine fuel systems -types of valves used in gas turbine engines.

UNIT IV	**AIRCONDITIONING AND PRESSURIZING SYSTEM**	**9**

Basic air cycle systems – vapour cycle systems, boot-strap air cycle system – evaporative vapour cycle systems – evaporation air cycle systems – oxygen systems– fire protection systems - deicing and anti icing system.

UNIT V	**AIRCRAFT INSTRUMENTS**	**11**

Flight instruments and navigation instruments – accelerometers, air speed indicators – mach meters – altimeters - gyroscopic instruments– principles and operation – study of various types of engine instruments – digital tachometers – temperature gauges – pressure gauge – operation and principles.

LECTURE: 45	TUTORIAL: 0	PRACTICAL: 0	TOTAL: 45

TEXT BOOKS

1.	Nagabhushana S, L.K.Sudha. "Aircraft Instrumentation and systems" ISBN-13: 978-9380578354- I.K. International Publishing House Pvt.Ltd.
2.	Mekinley, J.L. and R.D. Bent, "Aircraft Power Plants", McGraw Hill 1993.
3.	Pallet, E.H.J, "Aircraft Instruments & Principles", Pitman & Co 1993.

REFERENCE BOOKS

1.	Roy Lanagton, Chuck Clark etc., "Aircraft Fuel Systems" Publication Wiley.
2.	Mckinley, J.L. and Bent R.D. "Aircraft Maintenance & Repair", McGraw Hill, 1993.
3.	Handbooks of "Airframe and Power plant Mechanics" US dept. of Transportation, Federal, Aviation Administration, The English Book Store, New Delhi, 1995.

E – References

1.	"Instrument Landing Systems (ILS)" Author: Michael Feramez.
2.	Nolan, Chap-2, Navigation Systems- Enroute
3.	Jan Rohac "Aircraft and Spacecraft Instrumentation" Lecture Notes- EFIS, EICAS, ECAM.
4.	nptel.ac.in/

XASE01 -Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO₁	3	2	2	2	2	1	12	3
PO₂	2	2	3	2	2	2	13	3
PO₃	1	2	3	3	1	1	11	3
PO₄	0	1	2	3	1	1	8	2
PO₅	0	1	2	1	0	1	5	1

PO6	1	2	3	2	2	2	12	3
PO7	0	1	3	2	2	1	9	2
PO8	1	2	1	1	1	1	7	2
PO9	1	2	2	1	1	1	8	2
PO10	0	0	1	1	1	0	3	1
PO11	1	0	0	0	0	0	1	1
PO12	2	2	3	2	2	2	13	3
PSO1	0	1	2	1	2	1	7	2
PSO2	1	0	3	0	0	1	5	1

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

COURSE CODE	XAS406	L	T	P	C
COURSE NAME	**ELEMENTS OF SATELLITE TECHNOLOGY**	3	0	0	3
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3:0:0		3	0	0	3

COURSE OBJECTIVES

- To develop a basic knowledge about the solar system.
- To learn the different cases of satellite orbit transfer, different satellite injection errors.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Describe* the basic satellite network systems.	Cognitive	Remember
CO2	*Estimate* the orbital maneuver with help of orbit equation and satellite trajectories.	Cognitive	Understand
CO3	*Explain* the structural configuration and need of thermal control in satellite.	Cognitive	Apply
CO4	*Differentiate* the different control methods and systems of satellite.	Cognitive	Analyze
CO5	*Judge* the power system and bus electronics requirements for the satellite operation.	Cognitive	Evaluate
CO6	*Explain* the telemetry and telecommand systems.	Cognitive	Apply

UNIT I	INTRODUCTION TO SATELLITE SYSTEMS	9

Common satellite applications and missions – Satellite types – Orbit types - Space environment – Launch vehicles – Satellite sub systems and their functions.

UNIT II	ORBITAL MECHANICS	9

Fundamental of flight dynamics – Time and coordinate systems – Orbit determination and prediction – Orbital equation – GPS systems and application for satellite/orbit determination – satellite trajectories.

UNIT III	SATELLITE STRUCTURES & THERMAL CONTROL	9

Satellite mechanical and structural configuration – Structural materials and fabrication – The need of thermal control: externally induced thermal environment – Internally induced thermal environment - Heat transfer mechanism – Thermal control systems: active and passive methods.

UNIT IV	SPACECRAFT CONTROL	9

Control requirements: attitude control - type of control maneuvers – Stabilization schemes: spin stabilization, gravity gradient methods, 3 axis stabilization – Commonly used control systems: mass expulsion systems, momentum exchange systems.

UNIT V	POWER SYSTEM AND BUS ELECTRONICS	9

Solar panels: Silicon and Ga-As cells – Space battery systems – battery types, characteristics and efficiency parameters – Power electronics.

Telemetry and telecommand systems: Tm & TC functions - generally employed communication bands (UHF/VHF, S, L, Ku, Ka etc), their characteristics and applications - Onboard computer.

TEXT BOOKS

1.	Rilay, FF , Space Systems Engineering, McGraw Hill, 1982.
2.	Vertregt.M.,Principles of Astronautics, Elsvier Publishing Company, 1985.
3.	Introduction Space Flight, Francis J. Hale Prentice Hall, 1994.
4.	Space Vehicle Design, Michael D. Griffin and James R. French, AIAAEducation Series, 1991.

REFERENCE BOOKS

1.	Spacecraft Thermal Control, Hand Book, Aerospace Press, 2002.
2.	Lewis H. Abraham ,Structural Design of Missiles & Space Craft, McGrawHill, 1992.
3.	Richard.F, Filipowsky Eugen I Muehllorf , Space Communications Systems, Princtice Hall, 1995.
4.	Hughes, P.C. Space Craft Altitude Dynamics, Wilsey, 1986.
5.	Gebmart, Heat Transfer, McGraw Hill, Martin J. Communication Satellite Systems, McGraw Hill, 1978.

LECTURE: 45	TUTORIAL: 0	PRACTICAL:0	TOTAL: 45

XAS406 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Total /5
PO$_1$	3	3	3	3	3	3	15	3
PO$_2$	3	2	2	3	2	2	12	2
PO$_3$	2	3	3	3	2	1	13	3
PO$_4$	2	2	2	2	2	2	10	2
PO$_5$	0	0	0	0	0	0	0	0
PO$_6$	1	1	1	2	2	2	7	1
PO$_7$	2	2	2	2	2	2	10	2
PO$_8$	0	0	0	0	0	0	0	0
PO$_9$	2	2	2	2	2	2	10	2
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	1	1	1	1	1	1	5	1
PO$_{12}$	2	2	2	2	2	2	10	2
PSO$_1$	2	2	2	2	2	2	10	2
PSO$_2$	3	3	3	3	3	2	15	3

COURSE CODE	XAS501	L	T	P	C
COURSE NAME	AERODYNAMICS II	3	1	0	4
PREREQUISITES	AERODYNAMICS I	L	T	P	H
C:P:A= 4:0:0		3	1	0	4

COURSE OBJECTIVES

- To introduce the concepts of compressibility, to make the student understand thetheory behind the formation of shocks and expansion fans in Supersonic flows.
- Tointroduce the methodology of measurements in Supersonic flows.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Recall* the basic concepts of Aerodynamics and *Explain* compressible flow for various conditions	Cognitive	Remember Understand Analysis
CO2	*Generalize* the concepts of Normal shock	Cognitive	Understand Analysis
CO3	*Analyze* about oblique shock and flow past through various shapes	Cognitive	Understand Analysis
CO4	*Analyze* differential equations of motions for steady compressible flows at Linearized condition	Cognitive	Understand Analysis
CO5	*Interpret* various designs of Aero foils and *Explain* its characteristics	Cognitive	Remember Understand
CO6	*Infer* the various types of wind tunnels and *Discuss* study of flow visualization methods	Cognitive	Remember Understand

UNIT I	ONE DIMENSIONAL COMPRESSILBLE FLOW	9L+5T

Energy –Momentum – continuity and state equations –velocity of sound –Adiabatic steady state flow equations – Flow through converging, diverging passages – Performance under various back pressures - Mach waves and Mach angles.

UNIT II	NORMAL, OBLIQUE SHOCKS AND EXPANSION WAVES	9L+6T

Prandtl equation and Rankine–Hugonoit relation - Normal shock-Oblique shocks and corresponding equations –shock polar – Flow past wedges and concave corners –Rayleigh and Fanno Flow – Flow past convex corners.

UNIT III	DIFFERENETIAL EQUATIONS OF MOTION FOR A STEADY COMPRESSIBLE FLOWS	9L+4T

Small perturbation potential theory – solutions for subsonic flows- Prandtl-Glauert affine transformation relations for subsonic flows, Linearized two dimensional supersonic flow theory.

UNIT IV	AIRFOIL IN HIGH SPEED FLOWS	9L

Lower and upper critical Mach numbers – Lift and drag divergence - Characteristics of swept wings -Effects of thickness ,camber and aspect ratio of wings - Transonic area rule - Super Critical Aerofoils - Tip effects.

UNIT V	HIGH SPEED WIND TUNNELS	9L
	Blow down, In-draft and induction tunnel layouts and their design features - Transonic, supersonic and hyper sonic tunnels and their peculiarities – Helium and gun tunnels - Shock tubes - Optical methods of flow visualization.	

LECTURE: 45TUTORIAL: 15TOTAL: 60

TEXT BOOKS

1.	John.D.Anderson, "Modern Compressible Flows". Tata McGraw Hill, New Delhi, 1999.
2.	Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2003.

REFERENCE BOOKS

1.	McCornick.W.,"Aerodynamics,AeronauticsandFlightMechanics",JohnWiley,1979
2.	Zcrow and J.D.Anderson, "Elements of Gas dynamics" Tata McGraw Hill, New Delhi, 1999.

E-REFERENCES
  1. http://nptel.ac.in/courses/101105059/
  2. http://nptel.ac.in/courses/101106040/

COURSE CODE	XAS502	L	T	P	C
COURSE NAME	AIRCRAFT STRUCTURES II	3	1	1	5
PREREQUISITES	AIRCRAFT STRUCTURES I	L	T	P	H
C:P:A= 4:1:0		3	1	2	6

COURSE OBJECTIVES

- To understand the behaviour of various aircraft structural components under different types of loads.
- To study the concepts of shear flow.
- To understand buckling stress of thin walled sections.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Express* the flexure formula and *apply* it to symmetrical and unsymmetrical sections of beams.	Cognitive	Understand, Apply
CO2	*Describe* stresses in beams and *compute* shear flow in open sections.	Cognitive	Remember, Understand, Apply
CO3	*Discuss* shear flow in closed sections and *distinguish* single cell and multi-cell structures.	Cognitive	Understand, Analyze
CO4	*Explain* bucking of plates; *calculate* crippling stresses by Needham's and Gerard's methods.	Cognitive	Understand, Apply

CO5	*Explain* and *analyze* the stresses in wing and fuselage structures of an aircraft.	Cognitive	Apply, Analyze
CO6	*Choose* the specimen and *measure* the deflection; *explain* structural repair works.	Psychomotor	Perception, Set, Guided response

UNIT I	BENDING OF BEAMS	9L+2T

Elementary theory of bending – Introduction to semi-monocoque structures - Stresses in beams of symmetrical and unsymmetrical sections -Box beams – General formula for bending stresses principal axes method – Neutral axis method.

UNIT II	SHEAR FLOW IN OPEN SECTIONS	9L+3T

Shear stresses in beams – Shear flow in stiffened panels - Shear flow in thin walled open tubes – Shear centre – Shear flow in open sections with stiffeners.

UNIT III	SHEAR FLOW IN CLOSED SECTIONS	10L+4T

Shear flow in closed sections with stiffeners– Angle of twist - Shear flow in two flange and three flange box beams – Shear centre - Shear flow in thin walled closed tubes - Bredt-Batho theory – Torsional shear flow in multi cell tubes - Flexural shear flow in multi cell stiffened structures.

UNIT IV	BUCKLING OF PLATES	8L+2T

Rectangular sheets under compression - Local buckling stress of thin walled sections - Crippling stresses by Needham'sand Gerard's methods - Thin walled column strength-Sheet stiffener panels - Effective width, inter rivet and sheet wrinkling failures.

UNIT V	STRESS ANALYSIS IN WING AND FUSELAGE	9L+4T

Procedure–Shear and bending moment distribution for semi cantilever and other types of wings and fuselage, thin webbed beam with parallel and non-parallel flanges – Shear resistant web beams - Tension field web beams (Wagner's).

TEXT BOOKS	
1.	E.F. Bruhn, "Analysis and Design of Flight Vehicle Structures", Tristate Offset Co., 1980.
2.	Megson T.M.G, "Aircraft Structures for Engineering Students", Edward Arnold, 1995.

REFERENCE BOOKS	
1.	Peery, D.J. and Azar, J.J., Aircraft Structures, 2nd Edition, McGraw-Hill, New York, 1993.
2.	Stephen P. Tinnoshenko&S.woinowsky Krieger, Theory of Plates and Shells, 2nd Edition, McGraw-Hill, Singapore, 1990.
3.	Rivello, R.M., Theory and Analysis of Flight structures, McGraw-Hill, N.Y., 1993.

Laboratory	
Ex. No.	**List of Experiments**
1	Determination of Young's modulus of Steel or Aluminum.
2	Deflection of Beams with various end conditions.
3	Verification of Maxwell's Reciprocal theorem.
4	Column – Testing.
5	Determination of Membrane stresses ina thin cylinder under internal pressure.
6	Exercise on Riveted joints & repair work.
7	Exercise on composites & repair work.
8	Repair of Sandwich panels.
9	Patch repair welding using TIG.
10	Patch repair welding using MIG.

LECTURE: 45   TUTORIAL: 15   PRACTICAL:30   TOTAL: 90

XAS502 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	2	3	0	11	2
PO$_2$	1	2	3	2	3	3	14	2
PO$_3$	0	2	2	2	3	3	12	2
PO$_4$	0	0	0	2	2	2	6	1
PO$_5$	2	2	2	3	3	3	15	3
PO$_6$	0	0	0	3	2	2	7	1
PO$_7$	0	0	0	2	2	2	6	1
PO$_8$	0	0	0	0	0	0	0	0
PO$_9$	0	0	0	2	2	3	7	1

PO₁₀	0	0	0	0	0	0	0	0
PO₁₁	0	0	0	0	0	2	2	0
PO₁₂	0	0	0	2	2	0	4	1
PSO₁	0	0	0	0	0	0	0	0
PSO₂	0	0	0	0	2	2	4	1

COURSE CODE	XAS503	L	T	P	C
COURSE NAME	**ROCKET AND SPACECRAFT PROPULSION**	3	1	0	4
PREREQUISITES	**AIRCRAFT PROPULSION**	L	T	P	H
C:P:A= 4:0:0		3	1	0	4

COURSE OBJJECTIVES

- To understand the principles of operation and design of rocket and spacecraft propulsion.
- To study about the Non Air breathing Engines.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Describe* the basic principle of operation of ramjet and scramjet	Cognitive	Remember
CO2	*Illustrate* solid, liquid and hybrid technology in space	Cognitive	Remember, Understand
CO3	*Explain* the operation of nuclear rocket and its types in space	Cognitive	Understand, Apply
CO4	*Classify* various electric propulsion techniques in space	Cognitive	Understand
CO5	*Illustrate* the applications of propulsion concepts in space	Cognitive	Understand
CO6	*Explain*the need of rocket and spacecraft propulsion	Cognitive	Apply

UNIT I	RAMJET AND SCRAMJET	9

Ramjet and scramjet: basic principle - geometry - diffuser - combustor - nozzle - performance and control - testing difficulties - thrust to weight ratio - combustion mechanism - propellant usage - advantages and disadvantages.

UNIT II	CHEMICAL ROCKETS	9

Solid rocket - different perforation - liquid rocket engine - pressure feed system - pump feed system - propellant tanks - hybrid rockets - performance analysis - fuel oxidizer combination - combustion instability - thrust vector control - nozzle selection.

UNIT III	NUCLEAR ROCKET	9

Nuclear power in space - Nuclear pulse propulsion - Nuclear thermal rocket - direct nuclear rocket - nuclear electric rocket - solid core - liquid core - gas core - test firing - current research - limitations.

UNIT IV	ELECTRIC ROCKET	
		9

Ideal flight performance - electrothermal thrusters - non thermal electric thrusters - optimum flight performance - mission applications - electric space power supplies and power conditioning systems.

UNIT V	APPLICATION	9

Rocket propulsion - rocket boosters - military operations - missiles - spaceships - reentry vehicle - satellite propulsion - application in research - future concepts.

LECTURE:45TUTORIAL:15TOTAL: 60

TEXT BOOKS

1. George P.Sutton, Oscar Biblarz, "Rocket Propulsion Elements", seventh edition, Wiley India pvt.Ltd , 2014
2. T.W.Lee, "Aerospace Propulsion", Wiley India pvt.Ltd , 2013.

REFERENCE BOOKS

1. C.D.Brown, "spacecraft propulsion", AIAA Education series, washington, DC,1996
2. R.G.Jahn, "Physics of electric propulsion", McGraw-Hill book company, New York, 1968

XAS503 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	3	18	3
PO$_2$	3	3	3	3	2	2	16	3
PO$_3$	2	3	3	3	2	2	15	3
PO$_4$	3	3	3	3	2	2	16	3
PO$_5$	0	0	0	0	0	0	0	0
PO$_6$	2	3	3	3	2	2	14	3
PO$_7$	1	1	1	1	1	2	5	1
PO$_8$	0	0	0	0	0	0	0	0

PO₉	1	1	1	1	1	1	6	1
PO₁₀	0	0	0	0	0	0	0	0
PO₁₁	0	0	0	0	0	1	0	0
PO₁₂	2	2	2	2	3	3	13	3
PSO₁	2	2	2	2	2	2	12	2
PSO₂	2	3	3	3	2	2	15	3

COURSE CODE	XAS504	L	T	P	C
COURSE NAME	SPACE MECHANICS	3	0	0	3
PREREQUISITES	ELEMENTS OF SATELLITE TECHNOLOGY	L	T	P	H
C:P:A= 3:0:0		3	0	0	3

COURSE OBJECTIVES

- To study the basic concepts of orbital Mechanics with particular emphasis on interplanetary trajectories.

S. No.	COURSE OUTCOMES	DOMAIN	LEVEL
CO1	*Recall*about basis of Solar system and*Describe* about its reference frames and systems	Cognitive	Remember Understand
CO2	*Analyze* various problems of Space Vehicles and *Assess* their characteristics	Cognitive	Understand Analysis
CO3	*Illustrate* about Satellite Injections and *Criticiz*e its limitations	Cognitive	Understand Analysis
CO4	*Illustrate* about Satellite Injections and *Criticiz*e its limitations	Cognitive	Understand Analysis
CO5	*Describe* about Interplanetary Trajectories and *Explain* its concepts	Cognitive	Understand Analysis
CO6	*Define* various phases of Missile trajectory and *Discuss* about Space Environment	Cognitive	Remember Understand

UNIT I	BASIC CONCEPTS	8

The Solar System–References Frames and Coordinate Systems–The Celestial Sphere–The Ecliptic–Motion of Vernal Equinox –Sidereal Time –Solar Time – Standard Time –The Earth's Atmosphere.

UNIT II	THE GENERAL N-BODY PROBLEM	9

The many body Problem–Lagrange–The Circular Restricted Three Body Problem–Libration Points-Relative Motion in the N-body Problem–Two–Body Problem– Satellite Orbits – Relations Between Position and Time – Orbital Elements.

UNIT III	SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS	14

General Aspects of satellite Injections – Satellite Orbit Transfer –Various Cases – Orbit Deviations due to Injection Errors - Special and General Perturbations–Cowell's Method – Encke's Method – Method of vibrations of Orbital Elements – General Perturbations Approach.

UNIT IV	INTERPLANETARY TRAJECTORIES	7

Two Dimensional Interplanetary Trajectories –Fast Interplanetary Trajectories – Three Dimensional Interplanetary Trajectories – Launch of Interplanetary Spacecraft –Trajectory about the Target Planet.

UNIT V	BALLISTIC MISSILE TRAJECTORIES AND MATERIALS	7

The Boost Phase–The Ballistic Phase–Trajectory Geometry-Optimal Flights–Time of Flight–Re–entry Phase–The Position of the Impact Point–Influence Coefficients. Space Environment–Peculiarities–Effect of Space Environment on the Selection of Spacecraft Material.

LECTURE: 45	TUTORIAL: 0	TOTAL: 45

TEXT BOOKS	
1.	Cornelisse,J.W.,"RocketPropulsionandSpaceDynamic",W.H.Freeman&Co.,1984.

REFERENCE BOOKS
1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley, 1993.
2. Van de Kamp, P., "Elements of Astro mechanics", Pitman, 1979.
3. ParkerE.R.,"MaterialsforMissilesandSpacecraft",McGraw-HillBookCo.Inc.

XAS504 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	3	18	3
PO$_2$	1	3	3	3	3	3	16	3
PO$_3$	1	3	3	3	3	3	16	3
PO$_4$	3	3	3	3	3	3	18	3
PO$_5$	0	0	0	0	0	0	0	0
PO$_6$	0	0	2	2	3	3	10	2
PO$_7$	3	0	0	0	1	1	2	1
PO$_8$	0	0	0	0	0	0	0	0
PO$_9$	0	0	0	0	0	0	0	0
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	1	1	1	1	1	1	6	1
PO$_{12}$	2	2	2	2	2	2	12	3
PSO$_1$	0	0	0	0	0	0	0	0
PSO$_2$	2	2	2	2	2	2	12	3
Total	16	17	19	19	21	21	**113**	**21**

COURSE CODE	XASE08	L	T	P	C
COURSE NAME	**WIND TUNNEL TECHNIQUES**	3	1	0	4
PREREQUISITES	AERODYNAMICS II	L	T	P	H
C:P:A= 4:0:0		3	1	0	4

COURSE OBJECTIVES

- To understand classification of wind tunnel.
- To acquire knowledge about calibration and measurements in wind tunnels.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Recall*about basis of Buckingham pi Theorem and*Describe* about various methods of model testing	Cognitive	Remember Understand
CO2	*Illustrate* various Wind Tunnels and *Sketch* its layouts	Cognitive	Understand Apply
CO3	*Explain* about Calibration of Subsonic and Supersonic Wind Tunnels	Cognitive	Understand Apply
CO4	*Demonstrate* Measuring Devices used in Wind tunnels	Cognitive	Understand Apply
CO5	*Explain* various balancing methods used in wind tunnels	Cognitive	Understand Apply
CO6	*Recall*about Visualization Methods and*Describe* about various methods of Optical Flow visualization	Cognitive	Remember Understand

UNIT I	**PRINCIPLES OF MODEL TESTING**	9L+3T

Buckingham pi Theorem – Non dimensional numbers – Scale effect – Geometric Kinematic and Dynamic similarities.

UNIT II	**WIND TUNNELS**	9L+3T

Classification – special problems of testing in subsonic, transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.

UNIT III	**CALIBRATION OF WIND TUNNELS**	9L+3T

Test section speed – Horizontal buoyancy – Flow angularities – Turbulence measurements – Associated instrumentation – Calibration of supersonic tunnels.

UNIT IV	**WIND TUNNEL MEASUREMENTS**	10L+3T

Steady and Unsteady Pressure and velocity measurements – Force measurements –Three component and six component balances – Internal balances – Principles of Hotwire Anemometer (CTA & CCA).

UNIT V	**FLOW VISUALIZAITON**	8L+3T

Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.

LECTURE: 45	TUTORIAL: 15	TOTAL: 60

TEXT BOOKS

1. Rae, W.H. and Pope, A., Low Speed Wind Tunnel Testing, John Wiley Publication, 1984.

2. R.C. Pankhurst and D.W. Holder , "Wind-tunnel Technique"Pitman Publishing; New impression edition 1968.

REFERENCE BOOKS

1.Pope, A., and Goin, L., High Speed Wind Tunnel Testing, John Wiley, 1985.

2.Bradsaw, "Experimental Fluid Mechanics",Pergamon Press; 2nd edition,1970.

XASE08 -Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	3	18	3
PO$_2$	3	3	3	3	3	3	18	3
PO$_3$	0	3	3	3	3	3	15	3
PO$_4$	0	3	3	3	3	3	15	3
PO$_5$	0	0	0	0	0	0	0	0
PO$_6$	0	0	2	2	2	2	8	2
PO$_7$	0	0	0	0	0	0	0	0
PO$_8$	1	2	2	1	1	2	9	2
PO$_9$	0	0	0	0	0	0	0	0
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	0	0	0	0	0	0	0	0
PO$_{12}$	3	2	2	3	3	2	15	3
PSO$_1$	0	0	0	0	0	0	0	0
PSO$_2$	2	2	2	2	2	2	12	2

COURSE CODE			XUM507			L	T	P	C
COURSE NAME			**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**			1	0	1	0
C	P	A				L	T	C	P
1	0.5	0.5				1	0	1	2
PREREQUISITE:									
COURSE OUTCOMES:									

Course Outcomes	Domain	Level
After the completion of the course, students will be able to		
CO 1; Relate and *Interpret* the Indian Traditional Knowledge Systems	Cognitive	Remember, Understanding
CO 2; Explain and *Apply* Yogic-science and wisdom capsules	Cognitive	Understanding, Applying
CO 3; Classify and *Develop* of Yoga and holistic health care system	Cognitive Affective	Analyzing Receiving
CO 4; Classify and Dissect human rights and report on	Cognitive	Understanding, Analyze
CO 5; List and respond to family values, universal brotherhood,	Cognitive Affective	Remember, (Respond)

UNIT-I	**RELATE AND INTERPRET THE INDIAN TRADITIONAL KNOWLEDGE SYSTEMS**	**6 + 3 hrs**
Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.		
UNIT –II	***EXPLAIN*AND *APPLY* YOGIC-SCIENCE AND WISDOM CAPSULES**	**6 + 3 hrs**
Holistic life style of Yogic-science and wisdom capsules in Indian literature are also important in modern society with rapid technological advancements and societal disruptions.		
UNIT-III	***CLASSIFY* AND *DEVELOP* OF YOGA AND HOLISTIC HEALTH CARE SYSTEM**	**6 + 3 hrs**
Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health.		
UNIT-IV	**CLASSIFY AND DISSECT HUMAN RIGHTS AND REPORT ON**	**6 + 3 hrs**
Connect up and explain basics of Indian Traditional knowledge modern scientific perspective		
UNIT-V	**LIST AND RESPOND TO FAMILY VALUES, UNIVERSAL BROTHERHOOD,**	**6 + 3 hrs**
Modern Science and Indian Knowledge System • Yoga and Holistic Health care • Case Studies.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
45		**15**	**60**

TEXT BOOKS:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Fritzof Capra, Tao of Physics
4. Fritzof Capra, The wave of Life
5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, InernationalChinmay Foundation, Velliarnad, Amaku,am
6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta

REFERENCES:

1. GN Jha(Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, VidyanidhiPrakasham, Delhi, 2016
2. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakasham, Delhi, 2016 9. P R Sharma (English translation), ShodashangHridayam

EREFERENCES:https://nptel.ac.in/courses/109106059/14

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2									2	2		2
CO 2	3	3	2	2	1		2				2	2	3	2
CO 3	3	3	2	2	1		2				2	2	3	2
CO 4	3	3	2	3	1	1	2				2	2	2	2
CO 5	3	3	3	3	1	1	2	1	1		2	3	3	3
	15	14	9	10	4	2	8	1	1		10	11	11	11

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

COURSE CODE	XASM01	L	T	P	C
COURSE NAME	**ELEMENTS OF DRONE TECHNOLOGY**	2	0	1	0
PREREQUISITES	NIL	L	T	P	H
C:P:A= 0:0:0		2	0	0	2

COURSE OBJECTIVES

- Ability to design UAV system
- Ability to develop drone using sub systems such as motor, sensor, propeller, ESC, composites, RC controller, battery and microprocessor.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Outline the history of Unmanned Aerial Vehicle and Classify the various UAV design configurations with applications.	Cognitive	Understand
CO2	Explain the various design configurations of UAV and relate with their design standards.	Cognitive	Understand
CO3	Classify the types of power plants and payloads used in drone system.	Cognitive	Understand
CO4	Examine and classify the failure modes of UAV components.	Cognitive	Analyze
CO5	Compare the deployment of UAV in different aspects.	Cognitive	Understand

UNIT I	**INTRODUCTION**	6

History, Introduction to UAV, MAV, NAV, manned vs unmanned, classification, applications, research and development, UAS architecture, autonomous configurations.

UNIT II	**DESIGN OF UAV SYSTEMS**	6

Design aspects, aerodynamics, airframe configurations, control and stability, design for stealth, design standard and regulatory aspects.

UNIT III	**PAYLOADS AND POWERPLANTS**	6

Dispensable, non-dispensable, communications, navigation, guidance system. launch and recovery, power plant selection and solar.

UNIT IV	**DEVELOPMENT OF UAV SYSTEMS**	6

System ground testing, system in-flight testing, future prospects and challenges, support equipment, analysis of trouble shooting, testing and calibration.

UNIT V	**DEPLOYMENT OF UAV**	6

Naval roles, Army roles, Air force roles, Civilian, commercial and Paramilitary conservation.

LECTURE:30	**TUTORIAL:0**	**PRACTICAL:0**	**TOTAL: 30**

TEXT BOOKS

1. Thomas Gleason, "Introduction to UAV Systems", 4th Edition Paul Fahlstrom.

2. Dr.Jerry Le Mieux, Introduction to Unmanned Systems Air, Ground, Sea & Space.

REFERENCE BOOKS

1. Roskam, Jan, Airplane Flight Dynamics and Automatic Flight Control, Part I, Design, Analysis, and Research Corporation, Lawrence, KS, 1994.

2. Bruhn, E. F., Analysis and Design of Flight Vehicle Structures, Tri-State Offset Company, Cincinnati, OH, 1965.

3. P.C.Jain (ed.), Handbook for New Entrepreneurs, EDII, Oxford University Press, New Delhi, 1999. Rae, William H. Jr., and Pope, Alan, Low-Speed Wind Tunnel Testing, Wiley-Interscience, NY, 1984.

4. Raymer, Daniel P., Aircraft Design: A Conceptual Approach, Fourth Edition, American Institute of Aeronautics and Astronautics, Inc., Reston, VA, 2006.

5. Austin, Reg. Unmanned Aircraft Systems UAVS Design, Development and Deployment, John Wiley and Sons, Ltd., Blacksburg, VA, 2010.

6. Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001

XASM02 -- Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Total /5
PO$_1$	1	1	1	1	1	5	1
PO$_2$	1	2	2	3	1	9	2
PO$_3$	2	2	2	2	2	10	2
PO$_4$	2	3	3	3	1	12	2
PO$_5$	0	2	2	1	0	5	1
PO$_6$	0	0	0	0	0	0	0
PO$_7$	2	3	2	1	0	8	2
PO$_8$	1	1	1	1	0	4	1
PO$_9$	1	1	1	1	1	10	5
PO$_{10}$	1	1	2	1	0	5	1

PO₁₁	0	1	1	1	0	3	1
PO₁₂	1	2	2	2	1	0	2
PSO₁	0	1	2	1	0	4	1
PSO₂	1	3	3	2	1	10	2

COURSE CODE	XAS601		L	T	P	C
COURSE NAME	**FLIGHT DYNAMICS**		**3**	**1**	**0**	**4**
PREREQUISITES	**AERODYNAMICS I**		**L**	**T**	**P**	**H**
C:P:A= 4:0:0			**3**	**1**	**0**	**4**

COURSE OBJECTIVES

- To study the performance of airplanes under various operating conditions and the static and dynamic response of aircraft for both voluntary and involuntary changes in flight conditions.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Recall the forces and moments and apply to investigate the flight performance of aircraft in different situations.	Cognitive	Remember, Apply
CO2	Express and Calculate the range, endurance and performance of an aeroplane, for simple accelerating cases such as take-off, landing and turning.	Cognitive	Understand, Apply
CO3	Explain and calculate the influence of forces and moments on the static and dynamic stability of aircraft including longitudinal and lateral motions for stick fixed condition and select the aerofoil.	Cognitive	Understand, Apply
CO4	Explain and calculations to predict aircraft stability for stick free condition and proceed the stability analysis.	Cognitive	Understand, Apply
CO5	Distinguish and compute the conditions of aircraft lateral and directional static stability.	Cognitive	Understand, Apply
CO6	Explain and Examine the dynamics and control of flight vehicles.	Cognitive	Understand, Apply

UNIT I	CRUISING FLIGHT PERFORMANCE	9L+3T

Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag - Drag polar of vehicles from low speed to high speeds - Variation of thrust, power with velocity and altitudes for air breathing engines. Performance of airplane in level flight - Power available and power required curves. Maximum speed in level flight - Conditions for minimum drag and power required.

UNIT II	MANOEUVERING FLIGHT PERFORMANCE	9L+3T

Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turn radius). Bank angle and load factor – limitations on turn - V-n diagram and load factor.

UNIT III	STATIC LONGITUDINAL STABILITY	9L+3T

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes–Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points – Symmetric maneuvers - Stick force gradients - Stick force per 'g' - Aerodynamic balancing.

UNIT IV	LATERAL AND DIRECTIONAL STABILITY	9L+3T

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

UNIT V	DYNAMIC STABILITY	9L+3T

Introduction to dynamic longitudinal stability: - Modes of stability, effect of freeing the stick - Brief description of lateral and directional dynamic stability - Spiral, divergence, Dutch roll, autorotation and spin.

TEXT BOOKS
1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", Son:,Inc, NY, 1988.
2. R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004.
3. Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979.

REFERENCES

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, NY, 1982.
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
3. Dommasch, D.O., Sherby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.

LECTURE: 45	TUTORIAL: 15	PRACTICAL:0	TOTAL: 60

XAS601 -Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Total /5
PO$_1$	3	3	3	3	1	3	13	2
PO$_2$	3	3	3	3	3	3	18	3
PO$_3$	3	3	3	3	3	3	18	3
PO$_4$	2	3	2	2	1	2	12	2
PO$_5$	3	0	3	3	3	3	15	3
PO$_6$	1	2	2	2	1	1	9	1
PO$_7$	1	1	1	1	1	3	8	1
PO$_8$	1	1	1	1	1	1	6	1
PO$_9$	1	2	2	2	2	1	10	2
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	1	1	1	1	1	1	6	1
PO$_{12}$	2	2	2	2	3	2	13	2
PSO$_1$	0	0	1	1	1	1	4	1
PSO$_2$	3	3	3	3	3	3	18	3

COURSE CODE	XAS602	L	T	P	C
COURSE NAME	**FINITE ELEMENT ANALYSIS**	3	1	0	4
PREREQUISITES	**AIRCRAFT STRUCTURES II**	L	T	P	H
C:P:A= 4:0:0		3	1	0	4

COURSE OBJECTIVES

- To recognise the significance and importance of finite element methods to the professional design engineer.
- To provide a theoretical understanding on the fundamentals of finite element methods for small displacement linear elastic analysis (statics).
- To provide an introduction of non-linear finite element.
- To provide experience on how to develop good models and how to interpret the numerical results in design.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Recognize* the significance and importance of finite element methods to the professional design engineer.	Cognitive	Remember
CO2	*Discuss* the fundamentals of finite element methods for small displacement linear elastic analysis (statics).	Cognitive	Understand
CO3	*Use* stress strain relationship and *express* it for continuum elements with *examples*.	Cognitive	Understand, Apply
CO4	*Analyze* the stresses and displacement in non-linear finite element.	Cognitive	Analyze
CO5	*Apply* the knowledge to develop good models and to *interpret* the numerical results in design.	Cognitive	Understand, Apply
CO6	*Explain* the procedure of FEA in aviation.	Cognitive	Apply

UNIT I	INTRODUCTION	8L+2T

Various finite element methods – Raleigh Ritz's, Galerkin method- Governing equation and convergence criteria.

UNIT II	DISCRETE ELEMENTS	10L+4T

Bar elements, uniform section, mechanical and thermal loading, varying section, truss analysis. Beam element - problems for various loadings and boundary conditions - Use of local and natural coordinates.

UNIT III	CONTINUUM ELEMENTS	8L+3T

Plane stress, Plane strain and axisymmetric problems, constant and linear strain, triangular elements, stiffness matrix, axisymmetric load vector.

UNIT IV	ISOPARAMETRIC ELEMENTS	10L+3T

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, Stiffness matrix and consistent load vector, Gaussian integration.

UNIT V	FIELD PROBLEM	9L+3T

Heat transfer problems, Steady state fin problems, Derivation of element matrices for two

dimensional problems, Torsion problems.

LECTURE: 45	TUTORIAL: 15	TOTAL: 60

TEXT BOOKS	
1.	Tirupathi.R. Chandrapatha and Ashok D. Belegundu – Introduction to FiniteElements in Engineering – Printice Hall India, Third Edition, 2003.
2.	Rao. S.S., Finite Element Methods in Engineering, Butterworth and Heinemann, 2001.

REFERENCE BOOKS	
1.	Reddy J.N. – An Introduction to Finite Element Method – McGraw Hill – 2000.
2.	Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3.	Bathe, K.J. and Wilson, E.L., Numerical Methods in Finite Elements Analysis, Prentice Hall of India, 1

XAS602 -Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	2	2	2	15	3
PO$_2$	3	3	2	2	3	3	16	3
PO$_3$	1	2	1	1	2	1	8	1
PO$_4$	0	2	3	1	1	1	8	1
PO$_5$	3	3	3	0	3	2	14	2
PO$_6$	0	1	0	0	0	0	1	0
PO$_7$	0	1	0	0	2	1	4	1
PO$_8$	0	1	0	0	0	0	1	0
PO$_9$	0	2	0	0	0	0	2	0
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	0	0	0	0	0	0	0	0
PO$_{12}$	0	1	0	0	2	1	4	1

PSO₁	0	0	0	0	0	0	0	0
PSO₂	0	0	0	0	2	1	3	1

COURSE CODE	XAS603	L	T	P	C
COURSE NAME	**UAV TECHNOLOGIES**	**3**	**0**	**1**	**4**
PREREQUISITES	**XAS502 AERODYNAMICS II**	**L**	**T**	**P**	**H**
C:P:A= 3:1:0		**3**	**0**	**2**	**5**

COURSE OBJECTIVES

- To learn about different aspects of UAV systems.
- To learn about Design modeling and control.
- To gain knowledge in improving reliability of UAV systems.
- To know about Deployment of UAV systems.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Describe*** the design considerations of Unmanned Aerial Vehicle and ***Identify*** the various roles of UAV. Classify the UAV system and ***Discuss*** the applications of UAV	Cognitive Psychomotor	Remember, Understand Set, Guided Response
CO2	***Explain*** the various types of sensors and Communication systems used in UAV also ***Discuss*** the Data link system used in UAV	Cognitive Psychomotor	Understand Set, Perception
CO3	***Discuss*** the various design configurations of HTOL, VTOL and Hybrid models. And ***Analyze*** useful of solar cells u in UAV.	Cognitive Psychomotor	Understand, Analyze Set, Guided, Response, Mech.
CO4	***Examine*** and ***classify*** the failure modes of components and control systems in UAV.	Cognitive	Apply, Analyze
CO5	***Define*** use of Navigation systems in UAV and ***Distinguish*** of various Navigation systems.	Cognitive Psychomotor	Remember, Understand Set, Perception
CO6	Explain the concepts and characteristics of Swarming and Measure the goals and operational issues of various UAV systems.	Cognitive Psychomotor	Understand, Evaluate Guided, Response, Mech

UNIT I	INTRODUCTION, BASICS, TYPES AND ROLES	9

UAV attributes, manned vs unmanned, design considerations, acquisition & life cycle costs, UAS architecture, UAS components including the air vehicle, payload, data link and ground control station, categories and classifications, civil applications.

UNIT II	SENSORS AND ITS COMMUNICATIONS AND DATA LINKS	9

EO, IR, multispectral, Hyper spectral, LIDAR, SAR, small UAV sensors, atmospheric and weather effects, sensor data rates, future sensor trends, current state of data links, future needs of data links, line of sight fundamentals, beyond line of sight fundamentals, UAS communications failure.

UNIT III	CONCEPTUAL DESIGN AND SOLAR/FUEL CELL PROPULSION	9

UAS design process, airframe design considerations, launch & recovery methods, propulsion considerations, communications, control & stability, ground control system, support equipment, transportation, solar cells & solar energy, solar aircraft challenges, solar wing design, past solar designs, energy storage methods & density, fuel cell basics & UAS integration.

UNIT IV	IMPROVING RELIABILITY AND UAV NAVIGATION SYSTEM	9

Fault Tolerant Control Architecture, Fault Detection & Identification, Reconfigurable Flight Controllers, Non-Adaptive Controllers, Adaptive Controllers, UAV Navigation, Satellite Navigation, Inertial Navigation, Sensor Fusion for Navigation, Image Navigation (Skysys).

UNIT V	SWARMING, FUTURE UAS CHARACTERISTICS AND ROLES	9

Swarming Characteristics, Swarming Concepts, Emergent Behavior Characteristics Swarming Algorithms, Swarm Communications. Goals & Operational Issues, Space, Hypersonic, Submarine Launched, UCAS, Pseudo Satellites.

TEXT BOOKS

1. Thomas Gleason, "Introduction to UAV Systems", 4th Edition Paul Fahlstrom.
2. Dr.Jerry Le Mieux, Introduction to Unmanned Systems Air, Ground, Sea & Space.

REFERENCES

1. Roskam, Jan, Airplane Flight Dynamics and Automatic Flight Control, Part I, Design, Analysis, and Research Corporation, Lawrence, KS, 1994.
2. Bruhn, E. F., Analysis and Design of Flight Vehicle Structures, Tri-State Offset Company, Cincinnati, OH, 1965.
3. Raymer, Daniel P., Aircraft Design: A Conceptual Approach, Fourth Edition, American Institute of Aeronautics and Astronautics, Inc., Reston, VA, 2006.
4. Austin, Reg. Unmanned Aircraft Systems UAVS Design, Development and Deployment, John Wiley and Sons, Ltd., Blacksburg, VA, 2010.

LECTURE: 45	PRACTICAL: 30	TOTAL: 75

XAS603 -Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Total /5
PO$_1$	3	2	2	2	2	1	12	2
PO$_2$	2	2	3	2	2	2	13	2
PO$_3$	1	2	3	3	2	1	12	2
PO$_4$	0	1	2	3	1	1	8	1
PO$_5$	0	1	2	2	0	1	6	1
PO$_6$	1	2	3	2	2	2	12	2
PO$_7$	0	1	3	2	2	1	9	2
PO$_8$	1	2	1	1	1	1	7	1
PO$_9$	1	2	2	2	1	1	9	2
PO$_{10}$	0	0	1	1	1	0	3	1
PO$_{11}$	1	0	0	0	0	0	1	0
PO$_{12}$	2	2	3	2	2	2	13	2
PSO$_1$	0	1	2	2	2	1	8	1
PSO$_2$	1	0	3	0	0	1	5	1

COURSE CODE	XAS604	L	T	P	C
COURSE NAME	AVIONICS	3	0	1	4
PREREQUISITES	CONTROL SYSTEMS	L	T	P	H
C:P:A= 3:1:0		3	0	2	5

COURSE OBJECTIVES

- To introduce various digital electronic principles and working operations of digital circuit.
- To gain knowledge in integration of digital electronics with cockpit equipments.
- To understand the various principles in Displays, I/O devices and power.
- To study the validation and certification procedures.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Know* the basics of Avionics in Civil and Military Aircraft systems	Cognitive	Understand
CO2	*Describe* the Data buses MIL–STD 1553 B – ARINC 429 -ARINC 629 and to understand the avionics architecture.	Cognitive Psychomotor	Remember Understand Perception
CO3	*Classify* the various displays, I/O devices and power systems and comparing the Military and Civil Requirements.	Cognitive Psychomotor	Understand Analyze Set
CO4	*Explain* about RADAR and its operation procedures	Cognitive	Understand
CO5	*Identify* the future avionics architecture	Cognitive	Remember
CO6	*Understand* the FAR rules and its requirements	Cognitive	Understand

UNIT I	INTRODUCTION TO AVIONICS	9

Role for Avionics in Civil and Military Aircraft systems - Avionics sub-systems and design - defining avionics System/subsystem requirements - importance of 'ilities', Avionics system architectures.

UNIT II	DIGITAL AVIONICS ARCHITECTURE	9

Avionics system architecture– Features and applications of Data buses MIL–STD 1553 B – ARINC 429 -ARINC 629 - SAFEbus /FlexRay - Time triggered communication protocol/controller Area network - AFDX - CSDB.

UNIT III	DISPLAYS, I/O DEVICES AND POWER	9

Trends in display technology, Alphanumeric displays, character displays etc., Civil and Military aircraft cockpits, MFDs, MFK, HUD, HDD, HMD, DVI, HOTAS, Synthetic and enhanced vision, situation awareness, Panoramic/big picture display, virtual cockpit-Civil and Military Electrical Power requirement standards, comparing the Military and Civil Requirements and Tips for Power System Design.

UNIT IV	AERIALS AND PROPAGATION	9

Antenna theory - various types of antenna for medium wave short wave - VHF frequencies -

propagation at microwave frequencies - atmospheric attenuation - effects of precipitation - reflection - the voltage and current distribution along antenna of various length - characteristics of ground planes -Refraction and Diffraction phenomenon - clutter signals.

UNIT V	SYSTEM ASSESSMENT, VALIDATION AND CERTIFICATION	9

Fault tolerant systems - Hardware and Software, Evaluating system design and Future architecture - Hardware assessment- FARs guide certification requirements-Fault Tree analysis – Failure mode and effects analysis – Criticality, damaging modes and effects analysis - Software development process models - Software Assessment and Validation - Civil and Military standards - Certification of Civil Avionics.

TEXT BOOKS

1. R.P.G. Collinson, "Introduction to Avionics", Chapman & Hall Publications, 1996.
2. Myron Kayton and Walter R fried, Avionics Navigation Systems, John Wiley and Sons.
3. RF Hnasforde, Heywood and Company London: Radio Aids to Civil Aviation.

REFERENCES

1. Middleton, D.H., Ed., "Avionics Systems, Longman Scientific and Technical", Longman Group UK Ltd.,England, 1919.
2. Spitzer, C.R., "Digital Avionic Systems", Prentice Hall, Englewood Cliffs, N.J., USA., 1917
3. Brain Kendal, "Manual of Avionics", The English Book House, 3rd Edition, New Delhi, 1993.

LIST OF EXPERIMENTS

1.	Study of basic gates.
2.	Study of installing and configuring of AFDX card in transmitting and receiving mode.
3.	Study of Determination of gain for the given antenna.
4.	Adder / Subtractor
5.	Multiplexer / Demultiplexer
6.	Encoder / Decoder
7.	Interface programming with 4 digit 7 segment display and switches and LEDs
8.	Study of MIL-STD 1553B Data bus
9.	Digital to analog converter.

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

XAS604 -Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Total /5
PO$_1$	3	3	3	3	3	3	18	3
PO$_2$	1	1	1	1	1	1	6	1
PO$_3$	1	2	2	1	2	1	9	2
PO$_4$	1	1	1	1	1	1	6	1
PO$_5$	1	3	3	1	0	0	8	2
PO$_6$	1	1	1	1	1	1	6	1
PO$_7$	1	2	2	2	2	2	11	2
PO$_8$	0	0	0	0	0	0	0	0
PO$_9$	2	2	2	3	3	2	14	3
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	0	1	1	1	1	1	5	1
PO$_{12}$	1	1	1	1	1	1	6	1
PSO$_1$	0	0	0	0	0	0	0	0
PSO$_2$	0	0	0	0	0	0	0	0

COURSE CODE	XASE14	L	T	P	C
COURSE NAME	**AIRCRAFT RULES AND REGULATIONS CAR I AND II**	3	0	0	3
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3:0:0		3	0	0	3

COURSE OBJECTIVES

- The objective of this subject is to study various C.A.R series rules and regulations.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Explain* about CAR series A and B	Cognitive	Understand
CO2	*Describe* about investigation and defect analysis, *explain* the maintenance process.	Cognitive	Remember Understand
CO3	CAR series F *explain* about Procedure for issue / revalidation of Type Certificate of aircraft and its engines / propeller	Cognitive	Understand
CO4	*Understand* the mandatory modifications and inspections in CAR series 'L' & 'M'.	Cognitive	Understand
CO5	*Explain* the registration markings, weight balance control and aircraft logbooks.	Cognitive	Understand
CO6	*Explain* the use of CAR I and II.	Cognitive	Understand

UNIT I	CAR SERIES 'A'	9

Responsibilities of operators / owners - Procedure of CAR issue, amendments etc - Objectives and targets of airworthiness directorate - Airworthiness regulations and safety oversight of engineering activities of operators - CAR SERIES 'B' - Issue approval of cockpit check list - MEL -CDL: Deficiency list (MEL & CDL); Preparation and use of cockpit check list and emergency list.

UNIT II	CAR SERIES 'C' AND 'D'	11

CAR SERIES 'C' - Defect recording - reporting - investigation - rectification and analysis - Flight report - Reporting and rectification of defects observed on aircraft - Analytical study of in-fight readings & recordings - Maintenance control by reliability Method.
CAR SERIES 'D'– Aircraft Maintenance Programmes - Reliability Programme (Engines); Aircraft maintenance programme & their approval - On condition maintenance of reciprocating engines - TBO - Revision programme - Maintenance of fuel and oil - Light aircraft engines; Fixing routine maintenance periods and component TBOs - Initial & revisions.

UNIT III	CAR SERIES 'F'	8

AIR WORTHINESS AND CONTINUED AIR WORTHINESS: Procedure relating to registration of aircraft - Procedure for issue / revalidation of Type Certificate of aircraft and its engines / propeller - Issue / revalidation of Certificate of Airworthiness; Requirements for renewal of Certificate of Airworthiness.

UNIT IV	CAR SERIES 'L and M'	8

Issue of AME License - its classification and experience requirements - Complete Series 'L'. CAR SERIES 'M' Mandatory Modifications / Inspections.

UNIT V	CAR SERIES 'X'	9

CAR SERIES 'X' – Registration Markings of aircraft - Weight and balance control of an aircraft - Provision of first aid kits & Physician's kit in an aircraft; Use furnishing materials in an aircraft - Concessions; Aircraft log books - Document to be carried on board on Indian registered aircraft - Procedure for issue of taxi permit - Procedure for issue of type approval of aircraft components and equipment including instruments.

LECTURE:45	TUTORIAL:0	TOTAL: 45

TEXT BOOKS

1.	Civil Aviation Requirements with latest Amendment (section 2 Airworthiness)", Published by DGCA. The English Book Store, 17-1 Connaught Circus, New Delhi.
2.	Lloyd Dingle,"Aircraft Engineering Principles",A Butterworth-Heinemann Title; 1st edition edition,2004.

REFERENCE BOOKS

1.	Aircraft Manual (India) ", Volume - Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.
2.	Aeronautical Information Circulars (relating to Airworthiness) ", from DGCA.
3.	"Advisory Circulars ", from DGCA.

XASE14 -Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Scaled to 0,1,2 and 3
PO$_1$	3	3	3	3	3	3	18	3
PO$_2$	0	0	0	0	0	0	0	0
PO$_3$	1	1	1	1	1	1	6	1
PO$_4$	1	2	2	1	1	1	8	1
PO$_5$	0	0	0	0	0	0	0	0
PO$_6$	0	0	0	0	0	0	0	0
PO$_7$	0	0	0	0	0	0	0	0
PO$_8$	0	0	0	0	0	0	0	0
PO$_9$	1	1	1	1	1	1	6	1
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	0	0	0	0	0	0	0	0
PO$_{12}$	1	2	2	2	1	1	9	2
PSO$_1$	0	0	0	0	0	0	0	0
PSO$_2$	0	0	0	0	0	0	0	0

COURSECODE	XCI607			L	T	P	C
COURSE NAME	CONSTITUTIONOFINDIA			3	0	0	3
PREREQUISITE:	NIL			L	T	P	H
C:P:A	3:0:0			3	0	0	3

COURSEOUTCOMES		Domain	Level
CO1	*Understand*theConstitutionalHistory	Cognitive	Understanding
CO2	*Understand*thePowersandFunctions	Cognitive	Understanding
CO3	*Understand* theLegislature	Affective	Remembering
CO4	*Understand*theJudiciary	Affective	Remembering
CO5	*Understand*theCentreStaterelations	Cognitive	Understanding

UNITI	08
ConstitutionalHistory-TheConstitutionalRights-Preamble-FundamentalRights-FundamentalDuties- DirectiveprinciplesofStatePolicy.	
UNITII	**09**
TheUnionExecutive-ThePresidentofIndia(powersandfunctions)-Vice-PresidentofIndia-TheCouncilofMinisters-PrimeMinister-Powersand Functions.	
UNITIII	**10**
UnionLegislature-StructureandFunctionsofLokSabha-StructureandFunctionsofRajyaSabha-LegislativeProcedureinIndia-ImportantCommittesofLokSabha-SpeakeroftheLokSabha.	
UNITIV	**09**
TheUnion Judiciary- Powers ofthe Supreme Court- Original Jurisdiction-Appeletejurisdictions- AdvisoryJurisdiction- Judicialreview.	
UNITV	**09**
Centre State relations- Political Parties- Role of governor, powers and functionsof Chief Minister-LegislativeAssembly-StateJudiciary-PowersandFunctionof theHighCourts.	

LECTURE	TUTORIAL	PRACTICAL	TOTAL
4 5	0	0	45

REFERENCES
1. W.H.MorrisShores- GovernmentandpoliticsofIndia,NewDelhi,B.1.Publishers,1974.
2. M.V.Pylee- ConstitutionalGovernmentinIndia,Bombay,AsiaPublishingHouse,1977.
3. R.Thanker-TheGovernmentandpoliticsofIndia,London:Macmillon,1995.
4. A.C.Kapur-SelectConstitutionsS,Chand&Co.,NewDelhi,1995
5. V.D.Mahajan-SelectModernGovernments,S,Chand&Co,NewDelhi,1995.
6. B.C.Rout-DemocracticConstitutionofIndia.
7. GopalK.Puri- ConstitutionofIndia, India2005.

Table1:Mapping ofCOswithPO_S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2			1					
CO2	2			1					
CO3	2			1					1
CO4	2			1				1	1
CO5	2	2		1				1	1
Total	10	2		5				2	3
Scaledto 0,1,2,3	2	1		1				1	1

1-5→1,6-10→2,11-15→3

0–NoRelation, 1- LowRelation, 2- MediumRelation, 3- HighRelation

COURSE CODE	XASM02	L	T	P	C
COURSE NAME	CAD MODELING	1	0	1	0
PREREQUISITES	NIL	L	T	P	H
C:P:A= 0:0:0		2	0	0	2

COURSE OBJECTIVES

- To make students to obtain skills in design software and designing various components of aircraft and spacecraft.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	*Summarize* sketcher tools.	Cognitive	Understand
CO2	*Sketch* part design.	Cognitive	Apply
CO3	*Manipulate* assembly design.	Cognitive	Apply
CO4	*Interpret* drafting.	Cognitive	Understand
CO5	*Demonstrate* wireframe and surface design.	Cognitive	Apply
CO6	*Design* an aircraft model.	Cognitive	Create

UNIT I	SKETCHER	6

Introduction to CATIA – toolbars operation.

UNIT II	PART DESIGN	6

3D introduction – sketch based features – reference plane – apply material – transformation features.

UNIT III	ASSEMBLY DESIGN	6

Assembly design – constraints, move, space analysis – product structure tools.

UNIT IV	DRAFTING	6

Drafting details – text/graphics properties – generative dimensions.

UNIT V	WIREFRAME AND SURFACE DESIGN	6

Extrude, fill, join, trim, intersection – corner, disassemble, boundary – fillet, sweep.

SOFTWARES USED

1.	CATIA – Licensed Software

LECTURE: 30 TUTORIAL: 0 PRACTICAL:0 TOTAL: 30

XASM01 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	CO6	Total	Total /5
PO$_1$	1	1	1	1	1	1	6	1
PO$_2$	1	1	1	1	1	1	6	1
PO$_3$	3	3	3	3	3	3	18	3
PO$_4$	0	0	0	0	0	0	0	0
PO$_5$	3	3	3	3	3	3	18	3
PO$_6$	0	0	0	0	0	0	0	0
PO$_7$	0	0	0	0	0	0	0	0
PO$_8$	0	0	0	0	0	0	0	0
PO$_9$	0	0	0	0	0	0	0	0
PO$_{10}$	0	0	0	0	0	0	0	0
PO$_{11}$	1	1	1	1	1	1	6	1
PO$_{12}$	1	1	1	1	1	1	6	1
PSO$_1$	1	1	1	1	1	1	6	1
PSO$_2$	0	0	0	0	0	0	0	0

Subject Name	AVIONICS		
Subject Code	XAS 702		
Prerequisite	NIL		
L –T –P –C **3- 0 – 1- 4**	**C:P:A** **3:0.9:0.1**	**L –T –P –H** **3- 0 -2- 5**	

Course Outcome:		Domain C or P or A
CO1	Describe, understand, construct and report Avionics system design and development	C (Remember, Understand, Apply) P (Mechanism) A (Respond)
CO2	Describe, understand, react and perform the Digital Avionics Architecture	C (Remember, Understand) P (Set) A (Respond)
CO3	Define, select, compare, reproduce and identify the displays, i/o devices and power in the avionics systems.	C (Remember, Understand, Evaluate) P (Guided Response) A (Receiving)
CO4	Outline, explain the Aerials and Propagation in the avionics systems.	C (Remember, Understand) P (Mechanism) A (Respond)
CO5	Design, create, construct and report the Assessment, Validation and Certification in the avionics systems.	C (Analyze, Create) P (Mechanism) A (Respond)

COURSE CONTENT

UNIT-I	INTRODUCTION TO AVIONICS	15 hrs

Introduction to Construction Management - Project organization – Construction Economics - Economic Decision Making - Time value of money - cash flow diagrams - Evaluation Alternatives –BOT, BOOT, BOM, DBOT Projects.

UNIT –II	DIGITAL AVIONICS ARCHITECTURE	15 hrs

Basic concepts in the development of construction plans– types of project plans - work breakdown structure – planning techniques - bar charts - preparation of network diagram - critical path method -program evaluation and review technique -

UNIT-III	DISPLAYS, I/O DEVICES AND POWER	15 hrs

Materials- inventory control: types of inventory, EOQ - different tools for inventory controls. Equipment: Classification of construction equipment- planning and selecting of equipment. Manpower: Classes of labour - cost of labour- labour productivity.

UNIT -IV	AERIALS AND PROPAGATIO	15 hrs
Tender notice-Tender document-EMD-SD-Prebid conference-Award and signing of contract agreement-Site meeting-Payment of bills-Breach of contract-Liquidated damages-Project closure		
UNIT V	SYSTEM ASSESSMENT, VALIDATION AND CERTIFICATION	15 hrs
Introduction to construction quality - Inspection, quality control and quality assurance – Quality circle - Quality management system. - Construction safety – accidents and injuries - Personal protective equipments - Health and safety act and OSHAS regulations - Safety and health management system- Safety manual.		

TEXT BOOKS

1. R.P.G. Collinson, "Introduction to Avionics", Chapman & Hall Publications, 1996
2. Myron Kayton and Walter R fried, Avionics Navigation Systems, John Wiley and Sons.
3. RF Hnasforde, Heywood and Company London: Radio Aids to Civil Aviation.

REFERENCES

1. Middleton, D.H., Ed., "Avionics Systems, Longman Scientific and Technical", Longman Group UK Ltd.,England, 1919.
2. Spitzer, C.R., "Digital Avionic Systems", Prentice Hall, Englewood Cliffs, N.J., USA., 1917
3. Brain Kendal, "Manual of Avionics", The English Book House, 3rd Edition, New Delhi, 1993.

PRACTICALS	15hrs

1. Study of basic gates.
2. Study of installing and configuring of AFDX card in transmitting and receiving mode.
3. Study of Determination of gain for the given antenna.
4. Adder / Subtractor
5. Multiplexer / Demultiplexer
6. Encoder / Decoder
7. Interface programming with 4 digit 7 segment display and switches and LED
8. Study of MIL-STD 1553B Data bus
9. Digital to analog converter

L-45 hrs   P-30hrs   Total – 75 hrs

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	3	0	2	1	1	2	0	**0**	0	0	1	0	0
CO2	2	2	0	2	2	1	1	0	0	0	0	1	0	0
CO3	3	3	0	3	2	2	2	0	0	0	0	1	2	2
CO4	1	2	0	1	1	0	0	0	0	0	0	1	0	0
CO5	2	2	0	2	3	2	1	0	0	0	0	1	0	0
	11	12	0	10	9	6	6	0	0	0	0	5	2	2

1 - Low, 2 – Medium, 3 – High

Subject Name	COMPUTATIONAL FLUID DYNAMICS		
Subject Code	**XAS 703**		
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
CO1	Describethe basic definitions and explain governing equations of CFD	C(Remember,Understand)
CO2	Explain and manipulate the approach of finite difference method	C(Apply) P(Guided)
CO3	Illustrateand measure the basic techniques of finite volume method	C(Analyze) P(Mechanism)
CO4	Formulateand measurethe basic techniques of finite element method	C(Apply,Overt) P(response)
CO5	Explain about the turbulence models and mesh generation.	C(Understand)
CO6	Appraisethe applications of CFD in various fields	C(Evaluate)

COURSE CONTENT

UNIT I	GOVERNING EQUATIONS AND BOUNDARY CONDITIONS	15 hrs

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

UNIT II	FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION	15 hrs

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three-dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

UNIT III	FINITE VOLUME METHOD FOR CONVECTION DIFFUSION	15 hrs

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

UNIT IV	FLOW FIELD ANALYSIS	15 hrs

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V	TURBULENCE MODELS AND MESH GENERATION	1 hrs

Necessity – Basics of valuation – Capitalized value – Depreciation – Escalation – Value of property – Calculation of Standard rent – Report preparation.

PRACTICAL	30 hrs

1. Steady flow over Aerofoil.

2. Transient flow over blunt body.

3. Turbulent flow and Heat transfer in a mixed Elbow.

4. Simulation of air flow in Nozzle.

5. Fluid in a spinning bowl.

6. Chemical mixing and Gaseous combustion.

7. Natural convection in a square box.

8. Interaction of air through Rotor and stator in axial compressor.

9. Turbine blade cooling techniques.

	L- 45 hrs T - 30hrs P -30hrs Total – 105Hrs

TEXT BOOKS

1. H.K. Versteeg and W. Malalsekera "An Introduction to Computational Fluid Dynamics, The Finite Volume Method", Longman Scientific & Technical, second edition 2009.M.Chakraborty,"Estimating,Costing, Specification and Valuation in Civil Engineering",Kolkata,1997.

2. John D. Anderson Jr.,"Computational Fluid Dynamics ", Mcgraw-Hill Series, 2010.

3. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.

4. C.A.J. Fletcher, "Computational Techniques for Fluid Dynamics 1" Springer Verlag,1995.

5. C.A.J. Fletcher, "Computational Techniques for Fluid Dynamics 2", Springer Verlag, 1995.

REFERENCES

1. Gautam Biswas, Somenath Mukherjee,, "Computational Fluid Dynamics" Alpha Science International, 2014.

2. T. J. Chung, "Computational Fluid Dynamics", Cambridge University Press, 2002.

3. C. Hirch, "Numerical Computation of Internal and External Flows" Volume-2, John Wiley and Sons, 1994.

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	2	0	2	0	0	1	0	0	0	0	0	0	0
CO2	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO3	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO4	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO5	2	2	0	2	0	0	1	0	0	0	0	0	0	0
CO6	1	2	0	3	0	2	2	2	2	0	2	2	0	0
	15	12	9	13	9	8	10	2	8	0	8	8	3	0

0   - Low, 2 – Medium, 3 – High

XAS704B	THEORY OF VIBRATIONS	L	T	P	C
		3	0	0	3
		L	T	P	H
		3	0	0	3

Unit I	**SINGLE DEGREE OF FREEDOM SYSTEMS, TWO DEGREE OF FREEDOM SYSTEMS**	**9**

Free and forced vibrations; Damping-classification and damped systems. Vibration measurements. Vibration isolation - Free, forced, damped and undamped motions, Use of influence coefficients, matrix methods and Lagrange's equation, Phenomenon of beat, Dynamic absorbers–applications.

Unit II	**EXPERIMENTAL METHODS IN VIBRATION ANALYSIS**	**9**

Vibration instruments, vibration exciters, transducers and measurement devices, analyzers, vibration tests- free and forced vibration tests.

Unit III	**VIBRATION OF CONTINUOUS SYSTEMS**	**9**

Transverse, flexural, torsional vibration of beams, timoshenko beam, Hamilton principle, vibration of plates, collocation method, myklested – prohl method.

Unit IV	**TRANSIENT VIBRATIONS**	**10**

Duhamel's integral, method of step input, phase plane method, method of laplace transformation, drop test spectra by laplace transformations.

Unit V	**NON LINEAR VIBRATIONS**	**8**

Non-linear vibrations and superposition principle, examples of non-linear vibrations, method of dealing with non-linear vibrations, phase plane trajectories, method of direct integration, perturbation method, iteration method, Fourier series.

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

TEXT BOOKS
1. Theory of vibration with applications:
2. Theory and practice of mechanical vibrations:

REFERENCE BOOKS
1. Mechanical vibration *:- S. S. Rao (Addison Wesley)*
2. Vibration and noise for Engineers :-*KewalPujara (DhanpatRai and Co.)*
3. Mechanical vibrations :- *G. K. Grover and Nigam (Nemchand and sons)*
4. An introduction to mechanical vibrations :-*Steidel (John Wiley)*
5. Elements of vibration analysis :-*Meirovitch (TMH)*

XAS705C   **ROCKETSAND MISSILES**

UNIT I   ROCKETS SYSTEM   10

Ignition System in rockets–Types of Igniters–Igniter Design Considerations– Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines , Valves, Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems – Propellant Slash and Propellant Hammer – Elimination of Geysering Effect in Missiles – Combustion System of Solid Rockets.

UNIT II   AERODYNAMICS OF ROCKETS AND MISSILES   13

Airframe Components of Rockets and Missiles– Forces Acting on a Missile While Passing Through Atmosphere – Classification of Missiles – Methods of Describing Aerodynamic Forces and Moments – Lateral Aerodynamic Moment – Lateral Damping Moment and Longitudinal Moment of a Rocket – lift and Drag Forces– Drag Estimation–Body Upwash and Downwash in Missiles – Rocket Dispersion –Numerical Problems.

UNIT III   ROCKETMOTION   10

One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields – Description of Vertical, Inclined and Gravity Turn Trajectories – Determination of range and Altitude Simple Approximations to Burnout Velocity.

UNIT IV   STAGING AND CONTROL OFROCKET VEHICLES   7

Rocket Vector Control–Methods – Thrust determination– SITVC– Multistaging of rockets– Vehicle Optimization – Stage Separation Dynamics – Separation Techniques.

UNIT V   MATERIALS FOR ROCKETS ANDMISSILES   5

Selection of Materials – Special Requirements of Materials to Perform under Adverse Conditions.

Total: 45 Periods

TEXT BOOKS

1. Sutton, G.P., et al., "Rocket Propulsion Elements", John Wiley & Sons Inc., 1993.

REFERENCES

1. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, 1998.
2. Cornelisse,J.W.,"RocketPropulsionandSpaceDynamics",J.W.,Freeman&Co.Ltd.,1982.
3. Parket,E.R.,"MaterialsforMissilesandSpacecraft",McGraw-HillBookCo.Inc., 1982.

Subject Name	CYBER SECURITY		
Subject Code	XUM 706		
L –T –P –C		**C:P:A**	**L –T –P –H**
0- 0 – 0- 0		3:0:0	3- 0 – 0- 3

Course Outcome:		Domain C or P or A
CO1	Able to understandthe Cyber Security Policy, Laws and Regulations	C (Remember)
CO2	Able to discuss the Cyber Security Management Concepts	C (Understand)
CO3	Able to understand *t*he Cyber Crime and Cyber welfare	C (Understand)
CO4	Able to discuss on issues related to Information Security Concepts	C (Understand)
CO5	Able to understandvarious security threats	C (Understand)

COURSE CONTENT

UNIT I	INTRODUCTION	9 hrs

Cyber Security – Cyber Security policy – Domain of Cyber Security Policy – Laws and Regulations – Enterprise Policy – Technology Operations – Technology Configuration - Strategy Versus Policy – Cyber Security Evolution – Productivity – Internet – E commerce – Counter Measures – Challenges

UNIT II	CYBER SECURITY OBJECTIVES AND GUIDANCE	9 hrs

Cyber Security Metrics – Security Management Goals – Counting Vulnerabilities – Security Frameworks – E Commerce Systems – Industrial Control Systems – Personal Mobile Devices – Security Policy Objectives – Guidance for Decision Makers – Tone at the Top – Policy as a Project– Cyber Security Management – Arriving at Goals – Cyber Security Documentation – The Catalog Approach – Catalog Format – Cyber Security Policy Taxonomy.

UNIT III	CYBER SECURITY POLICY CATALOG	9hrs

Cyber Governance Issues – Net Neutrality – Internet Names and Numbers – Copyright and Trademarks – Email and Messaging - Cyber User Issues - Malvertising - Impersonation – Appropriate Use – Cyber Crime – Geo location – Privacy - Cyber Conflict Issues – Intellectual property Theft – Cyber Espionage – Cyber Sabotage – Cyber Welfare

UNIT IV	SECURITY SYSTEMS	9hrs

Information Security Overview: Background and Current Scenario - Types of Attacks - Goals for Security - E-commerce Security - Computer Forensics – Steganography

UNIT V	LEGAL ETHICS	9hrs

Overview of Security threats -Weak / Strong Passwords and Password Cracking - Insecure

Network connections - Malicious Code - Programming Bugs - Cyber crime and Cyber terrorism - Information Warfare and Surveillance

| | | **L- 45 hrs Total – 45 hrs** |

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, SunitBelapure, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wileypublilcations, 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. VivekSood, "Cyber Laws Simplified", McGraw Hill Education (INDIA) Private Limited in 2001, ISBN-10: 0070435065, ISBN-13: 978-0070435063.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/

Mapping of COs with Gas

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	2	0	2	0	0	1	0	0	0	0	0	0	0
CO2	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO3	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO4	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO5	2	2	0	2	0	0	1	0	0	0	0	0	0	0
CO6	1	2	0	3	0	2	2	2	2	0	2	2	0	0
	15	12	9	13	9	8	10	2	8	0	8	8	3	0

1 - Low, 2 – Medium, 3 – High

Subject Name	PROJECT PHASE-I		
Subject Code	XAS 707		
L –T –P –C 0- 0 – 2- 2	**C:P:A** 1.5:0.5:0.5	**L –T –P –H** 0- 0 – 2- 4	
Course Outcome:			**Domain** **C or P or A**
CO1	Identify the engineering problem relevant to the domain interest.		C(Analyze)
CO2	Interpret and infer literature survey for its worthiness.		C(Analyze & Apply)
CO3	Analyse and identify an appropriate technique for solve the problem.		C(Analyze, Apply)
CO4	Perform experimentation /Simulation/Programming/Fabrication, Collect and interpret data.		P&C (CoR, Create, Apply)
CO5	Record and report the technical findings as a document.		C (Remember, Understand)
CO6	Devote oneself as a responsible member and display as a leader in a team to manage projects.		A & C (Value, Organization, Create)
CO7	Responding of project findings among the technocrats.		A(Responding)

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	2	0	2	0	0	1	0	0	0	0	0	0	0
CO2	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO3	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO4	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO5	2	2	0	2	0	0	1	0	0	0	0	0	0	0
CO6	1	2	0	1	0	2	2	2	2	0	2	2	0	0
	15	12	9	11	9	8	10	2	8	0	8	8	3	0

2 – Low, 2 – Medium, 3 – High

Subject Name	CAREER DEVELOPMENT SKILLS		
Subject Code	XGS 708		
L –T –P –C **2- 0– 0 - 2**	**C:P:A** **1.8:0.6:0**		**L –T –P –H** **2- 0 –0- 2**

Course Outcome		Domain/Level C or P or A
CO1	Distinguish between Resume and Curriculum Vitae and its various forms	C (Analyze)
CO2	Define thedifferent types of interviews	C(Remember)
CO3	Perform in the forum where the skills will be exhibited	P (Guidee Response)

COURSE CONTENT

UNIT I	RESUME & CV WRITING	10 hrs
Difference between Resume and CV; characteristics of resume and CV; basic elements of CV and Resume, use of graphics in resume and CV; forms and functions of Cover Letters.		

UNIT II	INTERVIEW SKILLS	10 hrs
Various types of interviews- types of questions asked; body language, etiquette and dress code in interview, interview mistakes, telephonic interview, frequently asked questions. Planning for the interview.		

UNIT III	WORKSHOPS	10hrs
Mock interviews – Group Discussions –Panel Interview – Informal Interview		

<div align="right">**L-20 hrs**   **Workshop - 10 hrs**   **Total = 30 hrs**</div>

TEXT BOOKS

1. Paul McGee, How To Write a CV That Really Works: A Concise, Clear and Comprehensive Guide to Writing an Effective CV, Hachette UK, 2014

2. Mary Ellen Guffey, Dana Loewy Essentials of Business Communication,Cengage Learning, 2012

3. D.S. Paul. Interview Skills: Goodwill Publishing House: New Delhi. 2017
4. Barun Mitra. Personality Development and Soft Skills. Oxford University Press, 2012
5. Michael Spiropoulos, Interview Skills that win the job: Simple techniques for answering all the tough questions, Allen &Unwin, 2005

6. William L. Fleisher,Effective Interviewing and Interrogation Techniques, Nathan J. Gordon, Academic Press, 2010.

E-REFERENCES

1. http://www.utsa.edu/careercenter/PDFs/Interviewing/Types%20of%20Interviews.pdf

2. http://www.amu.apus.edu/career-services/interviewing/types.htm

3. http://www.careerthinker.com/interviewing/types-of-interview/

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	2	0	2	0	0	1	0	0	0	0	0	0	0
CO2	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO3	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO4	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO5	2	2	0	2	0	0	1	0	0	0	0	0	0	0
CO6	1	2	0	3	0	2	2	2	2	0	2	2	0	0
	15	12	9	13	9	8	10	2	8	0	8	8	3	0

1 - Low, 2 – Medium, 3 – High

Subject Name	SPACE CRAFT POWER SYSTEMS		
Subject Code	XAS802A		
Prerequisite	NIL		

L –T –P –C 3– 0– 0–3	C :P:A 3:0:0	L –T –P –H 3– 0– 0– 3

Course Outcome:		Domain C or P or A
CO1	Describe the spacecraft environment & design consideration	C (Remember)
CO2	Estimate the power generation for spacecraft	C (Understand)
CO3	Generalize the energy storage technology for spacecraft	C(Apply)
CO4	Outline the concepts of power converters	C (Analyze)
CO5	Assess the power control, conditioning and distribution of the spacecraft.	C (Evaluate)

COURSE CONTENT

UNIT-I	SPACECRAFT ENVIRONMENT & DESIGN CONSIDERATION	9hrs

Orbit definition /Mission Requirements of LEO, GEO, GTO & HEO, Lunar orbits, IPO with respect to Power Generation – Power System Elements - Solar aspect angle Variations.

UNIT –II	POWER GENERATION	9hrs

Study of Solar spectrum - Solar cells - Solar Panel design - Solar Panel Realization – Solar Panel testing - Effects of Solar cells and panels (IR, UV, Particles)

UNIT-III	ENERGY STORAGE TECHNOLOGY	10hrs

Types of batteries – Primary & Secondary batteries - Nickel Cadmium - Nickel-Hydrogen – Nickel metal hydride - Lithium-ion –Lithium Polymer - Silver Zinc– Electrical circuit model – Performance characteristics of batteries - Application of batteries in launch vehicles and satellites – Fuel Cell – Polymer Electrolyte membrane Fuel Cell – Regenerative Fuel Cell.

UNIT –IV	POWER CONVERTERS	9hrs

DC – DC converters – Basic Convertors - Buck, Boost, Buck- boost converter –Derived converters: Fly back converter – Transformer coupled forward converter – Push-Pull converter - CUKs convertor– Resonant converter – Voltage and current regulators.

UNIT – V	POWER CONTROL, CONDITIONING AND DISTRIBUTION	8hrs

Solar Array Regulators – Battery changing schemes – Protection Schemes - Distribution – Harness - Thermal Design - EMI/EMC/ESD/Grounding schemes for various types of circuits and systems.

		L-45hrs T-0 hrsTotal-45 hrs

TEXT BOOKS

1. P R K Chetty, 'Spacecraft Power Systems', 1978.

2. Patel,Mukund R, "Spacecraft system Power Systems" CRC Press Raton , 2005

3. Hyder, A Ket.al, "Space power Technologies" imperial college Press London,2000.

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	3	2	3	0	1	**2**	**0**	1	0	0	2	**0**	2
CO2	3	3	3	3	0	1	**2**	**0**	1	0	0	2	**0**	2
CO3	3	3	3	3	0	1	**2**	**0**	1	0	0	2	**0**	2
CO4	3	3	3	3	0	2	2	0	1	0	0	2	0	2
CO5	3	2	2	2	0	2	2	0	1	0	0	3	0	3
	15	14	13	14	0	7	10	0	5	0	0	11	0	11

1 - Low, 2 – Medium, 3 – High

Subject Name	CRYOGENICS	
Subject Code	XAS803C	
Prerequisite	NIL	
L –T –P –C **3– 0– 0–3**	**C :P:A** **3:0:0**	**L –T –P –H** **3– 0– 0– 3**

Course Outcome:		Domain C or P or A
CO1	Describe the various cryogenic propellants used for spacecrafts	C(Remember)
CO2	Estimate the production of low temperature for cryogenics	C (Understand)
CO3	Generalize the efficiency of cryogenic systems	C(Apply)
CO4	Outline the cycles of cryogenic plants	C (Analyze)
CO5	Illustrate the various applications of cryogenics in space technologies	C (Understand)

COURSE CONTENT		
UNIT-I	**INTRODUCTION TO CRYOGENICS**	**8hrs**
Historical Background - Introduction to cryogenic propellants - Liquid hydrogen, liquid helium, liquid nitrogen and liquid oxygen and their properties.		
UNIT –II	**PRODUCTION OF LOW TEMPERATURE**	**10hrs**
Theory behind the production of low temperature - Expansion engine heat exchangers - Cascade process Joule Thompson Effect - Magnetic effect - Ortho and H2 - Helium4 and Helium 3.		
UNIT-III	**EFFICIENCY OF CRYOGENIC SYSTEMS**	**9hrs**
Types of losses and efficiency of cycles - specific amount of cooling - The fraction liquefied – Cooling coefficient of performance - Thermodynamic efficiency – The energy balance Method.		
UNIT –IV	**CYCLES OF CRYOGENIC PLANTS**	**9hrs**
Classification of cryogenic cycles - The structure of cycles - Throttle expansion cycles - Expander cycles - Thermodynamic analysis - Numerical problems.		
UNIT – V	**APPLICATION**	**9hrs**
Cryogenic liquids in missile launching and space simulation Storage of cryogenic liquids - Effect of cryogenic liquids on properties of aerospace materials – Cryogenic loading problems - Zero gravity problems associated with cryogenic propellants - Phenomenon of tank collapse - Elimination of Geysering effect in missiles.		
		L-45hrs T-0 hrsTotal-45 hrs
TEXT BOOKS		
1. Haseldom, G., Cryogenic Fundamentals, Academic Press, 1971 2. Barron, R. F., Cryogenic Systems, Oxford University, 1985.		
REFERENCES		
1.Parner, S. F., Propellant Chemistry, Reinhold Publishing Corpn., New York. 2.MukhopadhyayMamata,"Fundamentals of Cryogenic Engineering",PHI (2010).		

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	2	0	1	0	1	**1**	**0**	**1**	0	**2**	**1**	0	2
CO2	3	3	3	1	0	1	**1**	**0**	**1**	0	**2**	**1**	0	3
CO3	3	3	3	1	0	1	**1**	**0**	**1**	0	**2**	**1**	0	3
CO4	3	3	1	1	0	1	1	0	1	0	2	1	0	3
CO5	3	2	3	1	0	1	1	0	1	0	3	1	0	2
	15	14	13	14	0	5	5	0	5	0	11	11	0	13

1 - Low, 2 – Medium, 3 – High

Semester	VIII		
Subject Name	**PROJECT PHASE-II**		
Subject Code	**XAS 804**		
L –T –P –C **0- 0 – 12- 12**	**C:P:A** **6:3:3**		**L –T –P –H** **0- 0 – 12- 24**

Course Outcome:		**Domain** **C or P or A**
CO1	Identify the Engineering Problem relevant to the domain interest.	C(Analyze)
CO2	Interpret and Infer Literature survey for its worthiness.	C(Analyze, Apply)
CO3	Analyse and identify an appropriate technique for solve the problem.	C(Analyze, Apply)
CO4	Perform experimentation /Simulation/Programming/Fabrication, Collect and interpret data.	P&C(CoR, Create, Apply)
CO5	Record and Report the technical findings as a document.	C(Remember, Understand)
CO6	Devote oneself as a responsible member and display as a leader in a team to manage projects.	A & C(Value, Organization, Create)
CO7	Responding of project findings among the technocrats.	A(Responding)

Mapping of COs with GAs

	CO1	CO2	CO3	CO4	CO5	CO6	CO7	Total
PO1	3	2	1	2	1	-	1	10
PO2	3	2	1	2	1	-	1	10
PO3	-	-	1	3	1	-	-	5
PO4	-	1	2	3	1	2	2	11
PO5	-	-	2	3	1	-	-	6
PO6	1	-	1	1	-	3	3	10
PO7	1		1	1	-	1		4
PO8	1	-	1	1	-	3	-	6
PO9	-	-	-	-	2	3	1	6
PO10	-	-	-	-	3	3	3	9
PO11	-				2	2	2	6
PO12	1				3	3	1	8

1 - Low, 2 – Medium, 3 – High