I SEMESTER

S. No.	Subject code	Name of the Subject	Contact hours/week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S239	English – I	4		3	25	75	100
2	S132	Applied Mathematics - I	4+1		3	25	75	100
3	S232	Engineering Chemistry	4+1		3	25	75	100
4	S170	Computer Programming	4+1		3	25	75	100
5	S235	Engineering Graphics	2	5	3	25	75	100
6	L144	English Communication Lab.		3	2	25	50	75
7	L126	Computer Programming Lab.		3	2	25	50	75
8	L140	Engineering Chemistry Lab.		3	2	25	50	75
9	L114	Basic Simulation Lab.		3	2	25	50	75
		Total			23	225	575	800

II SEMESTER

S. No.	Subject code	Name of the Subject	Contact hours/week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S240	English – II	4		3	25	75	100
2	S133	Applied Mathematics – II	4+1		3	25	75	100
3	S238	Engineering Physics	4+1		3	25	75	100
4	S145	Basic Electronics Engineering	4+1		3	25	75	100
5	S282	Introduction to Engineering Mechanics	4+1		3	25	75	100
6	L142	Engineering Physics Lab.		3	2	25	50	75
7	L124	Computer Aided Engineering Graphics Lab.		3	2	25	50	75
8	L143	Engineering Workshop		3	2	25	50	75
9	L112	Basic Electronics Lab.		3	2	25	50	75
		Total			23	225	575	800

III SEMESTER

S. No.	Subject code	Name of the Subject	Contact hours/week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S134	Applied Mathematics – III	4+1		3	25	75	100
2	S233	Engineering Fluid Mechanics	4+1		3	25	75	100
3	S408	Thermodynamics	4+1		3	25	75	100
4	S390	Strength of Materials	4+1		3	25	75	100
5	S225	Elements of Aerospace Engineering	4+1		3	25	75	100
6	S143	Basic Electrical Engineering	4+1		3	25	75	100
7	**S243**	Environmental Studies	3		--	25	75	100
8	L147	Fluid Mechanics and Strength of Materials Lab.		3	2	25	50	75
9	L185	Basic Electrical Engineering Lab		3	2	25	50	75
		Total			22	225	625	850

Note : The Subject with Code S243 is Mandatory Course

IV SEMESTER

S. No.	Subject code	Name of the Subject	Contact hours/week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S403	Theory of Machines	4+1		3	25	75	100
2	S116	Aerodynamics – I	4+1		3	25	75	100
3	S121	Aircraft Structures - I	4+1		3	25	75	100
4	S136	Applied Thermodynamics	4+1		3	25	75	100
5	S309	Metallurgy and Material Science	4+1		3	25	75	100
6	S297	Manufacturing Technology	4+1		3	25	75	100
7	**S355**	Professional Ethics and Human Values			--	25	75	100
8	L111	Applied Thermodynamics Lab.		3	2	25	50	75
9	L158	Manufacturing Technology Lab.		3	2	25	50	75
		Total			22	225	625	850

Note: The Subject with Code S355 is Mandatory Course

V SEMESTER

S. No.	Subject code	Name of the Subject	Contact hours/week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S359	Propulsion - I	4+1		3	25	75	100
2	S117	Aerodynamics - II	4+1		3	25	75	100
3	S122	Aircraft Structures - II	4+1		3	25	75	100
4	S123	Aircraft Systems and Instruments	4+1		3	25	75	100
5	S119	Aircraft Performance	4+1		3	25	75	100
6	S226	Elements of Heat Transfer	4+1		3	25	75	100
7	L101	Aerodynamics Lab.		3	2	25	50	75
8	L119	Communication and Presentation skills lab.		3	2	25	50	75
9	L176	Seminar			2	75	--	75
		Total			24	275	550	825

VI SEMESTER

S. No.	Subject code	Name of the Subject	Contact hours/week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S360	Propulsion - II	4+1		3	25	75	100
2	S120	Aircraft Stability and Control	4+1		3	25	75	100
3	S250	Finite Element Method	4+1		3	25	75	100
4	S303	Mechanics of Composites	4+1		3	25	75	100
		Program Elective-I	4+1		3	25	75	100
5	S266	Hypersonic and High Enthalpy Flows						
	S283	Introduction to Space Technology						
	S402	Theory of Elasticity						
	S247	Experimental Stress Analysis						
		Program Elective-II	4+1		3	25	75	100
6	S260	Helicopter Aerodynamics						
	S159	Combustion						
	S404	Theory of Plates and Shells						
	S114	Aero Elasticity						
7	L104	Aircraft Structures Lab.		3	2	25	50	75
8	L173	Propulsion Lab.		3	2	25	50	75
9	L164	Mini Project			2	25	50	75
		Total			24	225	600	825

VII SEMESTER

S. No.	Subject code	Name of the Subject	Contact hours/week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S405	Theory of Vibrations	4+1		3	25	75	100
2	S329	Operations Research	4+1		3	25	75	100
3	S275	Instrumentation, Measurements and Experiments in Fluids	4+1		3	25	75	100
4	S281	Introduction to Computational Fluid Dynamics	4+1		3	25	75	100
		Program Elective-III						
5	S149	Boundary Layer Theory	4+1		3	25	75	100
	S358	Propellant Technology						
	S124	Airframe Repair and Maintenance						
	S387	Space Mechanics						
		Open Elective-I						
6	S154	CAD/CAM	4+1		3	25	75	100
	S289	Linear Control Systems						
	S372	Robotics						
	S180	Database Management Systems						
7	L102	Aircraft Component Modeling and Analysis Lab.		3	2	25	50	75
8	L103	Aircraft Design Lab.		3	2	25	50	75
9	L153	Internship			2	75	--	75
		Total			**24**	**275**	**550**	**825**

VIII SEMESTER

S. No.	Subject code	Name of the Subject	Contact hours/week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S349	Principles of Management	4+1		3	25	75	100
2		**Program Elective-IV**	4+1		3	25	75	100
	S287	Launch Vehicle Aerodynamics						
	S106	Advanced Propulsion Systems						
	S416	Virtual Instrumentation						
	S115	Aero Engine Repair and Maintenance						
3		**Open Elective-II**	4+1		3	25	75	100
	S376	Satellite Technology						
	S311	Micro Electro Mechanical Systems						
	S319	Nano Technology						
	S325	Object Oriented Programming using Java						
4	L157	Main Project		3	9	50	150	200
5	L121	Comprehensive Viva-voce			2	75	--	75
		Total			20	200	375	575

Note: A few courses as notified in the respective departments are offered to the students on electives under Massive Open Online Courses (MOOCs).

I SEMESTER

S239 - ENGLISH – I

(Common to all branches)

Prerequisite: None

Course Educational Objectives

In this course, the students will learn

1. The standard vocabulary along with the meaning and usage of the words
2. The concepts of functional grammar and syntax for better writing and speaking skills
3. The concepts of skimming, scanning and critical reading for better comprehension abilities.
4. The effective pronunciation, language usage through extensive reading
5. The concepts of writing reports, resume, statement of purpose, memos and e-mails etc.

Course Outcomes

After the completion of this course, students will have the ability to

1. Read, write and understand what ever is written and spoken in English
2. Speak fluently with acceptable pronunciation and write using appropriate words, spellings, grammar and syntax
3. Read the lines, between lines and beyond lines excelling in comprehension skills
4. Speak grammatically error free English
5. Draft reports, memos, mails & letters as part of their work.

UNIT – I

Astronomy (Learning English)
Grammar: Parts of Speech
Vocabulary: Antonyms
Analytical Writing: Unscrambling words in a sentence; Un-jumbling the sentences into a paragraph; Types of sentences; Paragraph writing

UNIT – II

Travel and Transport (Learning English)
The Trailblazers - **Jagadis Chandra Bose**(Masterminds)
Grammar: prepositions; word plurals; sentence completion
Vocabulary: Synonyms
Analytical Writing: Drafting E-Mails; Letter writing (Formal & Informal)

UNIT - III

Humour (Learning English)
The Trailblazers – **Prafulla Chandra Ray** (Masterminds)
Grammar: Active & Passive Voices
Vocabulary: Pre-fixes & Suffixes
Analytical Writing: Note-making

UNIT - IV

Health and Medicine (Learning English)
The Trailblazers – **Srinivasa Ramanujam** (Masterminds)
Grammar: Tenses
Vocabulary: Deriving words
Analytical Writing: Abstract writing/Synopsis writing

UNIT - V

The World of Figures and Physics – **Chandra Sekhara Venkata Raman** (Masterminds)
Grammar: Articles
Vocabulary: One-Word substitutes
Analytical Writing: Essay writing; Dialogue writing (Formal & Informal)

TEXT BOOKS

1 "Learning English", Orient Longman Private Limited. 2008 JNTU edition
2 Enakshi Chatterjee, "Masterminds", Orient Longman Private Limited. 2002 (Reprint)

REFERENCES

1. Andrea J Rutherford, "Basic Communication Skills for Technology", Pearson Education, New Delhi,1st edition, 2009
2. Murphy, "English Grammar with CD", Cambridge University Press, New Delhi, 2004
3. Rizvi & M. Ashraf, " Effective Technical Communication", Tata McGraw Hill, New Delhi,2008.
4. Blum Rosen, "Word Power", Cambridge University Press, New Delhi, 2009.

I SEMESTER

S132 - APPLIED MATHEMATICS – I

(Common to AE, CE, CSE, EEE, EIE, IT, ME)

Prerequisite: None

Course Educational Objectives

In this course, the students will learn about

1. The concepts of Differential Equations and solving the first order and the first degree differential equations.
2. The concepts of Higher Order Differential Equations and solving such equations with constant and variable coefficients.
3. The concepts of theory of Matrices which are used to solve linear simultaneous equations.
4. The concept of Eigen Values and Eigen Vectors and solving an Eigen Value Problem.
5. The concepts of partial differentiation and formation of partial differential equations

Course Outcomes

After the completion of this course, students will able to :

1. Know fundamental mathematical skills required to form a necessary base to analyze first order differential equations.
2. Know the Higher Order Differential Equations, Procedures to solve them and their physical applications.
3. Find the solutions of System of Homogeneous and Non Homogeneous Linear equations using matrices for different physical applications.
4. Find Eigen values and Eigen vectors, higher powers and inverse of a given matrix, and can apply it in the concept of free vibrations of two- mass systems.
5. Find the solutions of linear partial differential equations.

UNIT – I

Differential Equations of First Order and First Degree

Differential equations of first order and first degree – Exact, Linear and Bernoulli. Applications to Orthogonal trajectories, applications to LCR circuits.

UNIT – II

Higher Order Differential Equations

Linear differential equations of second and higher order with constant coefficients and with variable coefficients, method of variation of parameters , Linear differential equations of second and higher order with variable coefficients – Cauchy's Equation and Legendre's Equations.

UNIT – III

Functions of Several variables

Generalized Mean Value Theorem(without proof), Maclaurin's series, Functions of several variables, Jacobians (polar, cylindrical, spherical coordinates), Functional dependence , , Maxima and Minima of functions of two variables with constraints and without constraints – Lagrangian Multiplier Method. Formation of Partial Differential Equations by the elimination of arbitrary constants and arbitrary functions. Solution of first order and first degree linear partial differential equation – Lagranze's method

UNIT –IV

System of Linear Equations.

Matrices - Rank- Echelon form, Normal form , PAQ form– Solution of Linear Systems – Homogeneous system of equations and Non Homogeneous System of Equations, Gauss Elimination, Gauss - Seidal and Jacobi Methods.

UNIT – V

Eigen Values and Eigen Vectors

Eigen values – Eigen Vectors – Properties – Cayley Hamilton Theorem – Inverse and Powers of a matrix by using Cayley Hamilton Theorem.

TEXT BOOKS

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition,2012.
2. Dr. B. V. Ramana, "Higher Engineering Mathematics", TMGH Publications, 1st Edition,2010.

REFERENCES

1. M. D. Greenberg , "Advanced Engineering Mathematics", TMGH Publications, 2nd Edition,2011.
2. Erwin Krezig, "Advanced Engineering Mathematics", John Wiley & Sons , 8th Edition,2011.
3. W. E. Boyce and R. C. Diprima, " Elementary Differential equations", John Wiley & sons, 7th Edition,2001.

I SEMESTER

S232 - ENGINEERING CHEMISTRY

(Common to all branches)

Prerequisite: None

Course Educational Objectives:

Through this course the student will learn

1. The concept of water technology with special focus on hardness & softness of water, methods of softening and desalination of brackish water.
2. The concept of conventional and alternative fuels and working of petrol and diesel engines.
3. The concept of corrosion and control measures.
4. The concept of polymers and polymerization.
5. The concept of green chemistry and applications of liquid crystals.

Course Outcomes:

After completion of the course the students will acquire the ability to:

1. Analyze the quality of water and its maintenance for industrial purposes.
2. Analyze issues related to fuels and their synthesis and able to understand working of IC and Diesel engines.
3. Realize the principles of corrosion and make use of the principles for maintenance of various equipments more effectively.
4. Get hands on experience in various processes like polymerization, preparation, properties and applications of plastics and rubbers.

- Realize the use of liquid crystals in various technological applications.

UNIT - I

WATER TECHNOLOGY: Sources of water and quality. Hardness of Water - Temporary and Permanent hardness. Units and their interrelation. Problems on Temporary and Permanent hardness. Disadvantages of hard water in various industries.

Boiler troubles – scale & sludge formation, Caustic Embrittlement, boiler corrosion, priming & foaming (carryover).

Internal Treatment – Colloidal Phosphate, Calgon, Carbonate, Sodium aluminate Conditioning of Water.

External Treatment - Lime-Soda Process, Zeolite process , Ion- Exchange Process merits and demerits. (Note-Problems on lime-soda process are not included)

Desalination of brackish water-Electrodialysis, reverse osmosis

UNIT - II

FUEL TECHNOLOGY: Definition and classification of Fuels, merits and demerits of solid liquid and gaseous fuels. Gross and net calorific values – (definition only).

Solid Fuels - coal - analysis, Proximate and ultimate analyses of coal – significances.

Liquid Fuels – petroleum-origin and refining of petroleum- cracking- fixed bed and moving bed methods, synthetic petrol – Bergius and Fischer Tropsch's methods.

Working of I.C and C.I engines –Knocking in I.C and C.I engines, antiknocking agents Octane number , Cetane number(Definitions only)

Gaseous fuels- Natural gas, CNG Advantages of CNG, Flue gas analysis – Orsat's apparatus.

UNIT - III

CORROSION: Definition, Examples.

Dry Corrosion(Direct Chemical corrosion), Types of dry corrosion-oxidative corrosion, Pilling Bed worth rule, corrosion by other gases, liquid metal corrosion.

Wet Corrosion (Electro Chemical corrosion) Mechanism- Oxygen absorption Hydrogen evolution type, Types of wet corrosion, Galvanic Corrosion, passivity, Galvanic Series Concentration Cell Corrosion, intergranular corrosion, stress corrosion, Soil corrosion.

Factors Influencing Corrosion- Nature of metal and nature of environment.

Control of Corrosion - Proper Design, Use of pure metals and metal alloys, Cathodic Protection - Sacrificial anode and Impressed Current, Modifying the Environment and use of Inhibitors.

UNIT - IV

Polymer Science and Technology: Definition, classification of polymers, Functionality, Types of polymerization-addition, condensation, copolymerization

Plastics preparation, properties and engineering applications of, PVC, Teflon, Bakelite ,PMMA.

Conducting polymers: Polyacetylene, Polyaniline, conduction, doping, application.

Rubbers Natural rubber and it's processing, disadvantages of Natural rubber , Vulcanization and significance.

Elastomers- preparation, properties and engineering applications of Buna S, Buna N, Thiokol.

Fibers- preparation, properties and engineering applications of Polyester, fiber reinforced plastics (FRP).

UNIT – V

(a) Green chemistry-Goals and significance of green chemistry. Basic components (alternative starting materials, reagents, reaction conditions, final products) of green chemistry research.

(b) Liquid crystals –Classification of liquid crystals (Thermo tropic, lyotropic) and applications.

TEXT BOOKS

1. Jain & Jain, A text book of Engineering Chemistry by DhanpatRai Publishing Company, New Delhi (15th Edition) (2006).
2. Dr. S.S Dara, Dr.S.S Umare A Text book of Engineering Chemistry by S.Chand Publications, 12th Edition, 2010.
3 . ShashiChawla, A Text book of Engineering Chemistry by DhanpatRai Publishing Company, Third Edition, 2003.

REFERENCES

1. Dr. Y. Bharathi Kumari and Dr. JyotsnaCherukuri, A Text book of Engineering Chemistry by VGS Publications, First Edition, 2009
2. R.V. Gadag, A.Nityananda Shetty, I.K. International publishing house 1st edition 2006
3. Dr. M. R. Senapati, Advanced Engineering Chemistry by University Science Press (Impart from Laxmi Publications), 3rd Edition 2009.

I SEMESTER

S170 - COMPUTER PROGRAMMING

(Common to all branches)

Course Educational Objectives:

The Students will learn

1. The basic elements C programming structures like data types, expressions, control statements, various I/O functions and how to solve simple mathematical problems using control structures.
2. Modular programming using functions.
3. The derived data types like arrays, strings, various operations and Memory management using pointers.
4. User defined structures and various operations on it.
5. The basics of files and its i/o operations.

Course Outcomes:

After undergoing the training in this course the students will acquire the ability to:

- Identify basic elements of C programming structures like datatypes, expressions, control statements, various I/O functions and Evaluation of simple mathematical problems using control structures.
- Implementation of derived data types like arrays, strings and various operations.
- Understanding of memory management using pointers and designing of modular programming.
- Construct user defined structures and implements various applications.
- Create text & binary type files and understanding of various file I/O operations.

Pre Requisite: The students should have basic knowledge in Maths & computers

UNIT - I

Algorithm / pseudo code, flowchart, example flow charts, structure of C program, identifiers, basic data types and sizes, Constants, variables, Input-output statements, A sample c program, operators: arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence of operators and order of evaluation. Conditional statements: if, ifelse, else if ladder and switch statements, continue, go to and labels. Loops: while, do-while and for statements, break, programming examples.

UNIT - II

Arrays- one dimensional arrays-concept, declaration, definition, accessing elements, storing elements, two dimensional and multi-dimensional arrays. **Character Strings:** declaration, initialization, reading, writing strings, arithmetic operations on characters, string handling functions programming examples

UNIT – III

Pointers- concepts, declaring &initialization of pointer variables, pointer expressions, address arithmetic, pointers and arrays, pointers and character strings, pointers to pointers,Pre-processor Directives and macros. **Functions:** basics, category of functions, parameter passing techniques, recursive functions, Functions with arrays, storage classes- extern, auto, and register, static, scope rules, Standard library functions., dynamic memory management functions, command line arguments, c program examples.

UNIT - IV

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, C program examples.

UNIT - V

Files – concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling, C program examples.

TEXT BOOKS

1. B.W. Kernighan, Dennis M.Ritchie,The C Programming Language, PHI/Pearson Education.
2. N.B.Venkateswarlu, E.V.Prasad.C and Data Structures,

REFERENCES

1. Reema Thareja, Programming in C –, Oxford Publications.
2. Stephen G. Kochan, Programming in C –III Edition, Pearson Eductaion
3. Pradeep Dey, Programming in C—Oxford Publications.

I SEMESTER

S235 - ENGINEERING GRAPHICS

(Common to AE, CE, ME)

Course Educational Objectives:

1. To understand basics aspects and the various profiles/curves used in engineering practice
2. To learn the orthographic projections in different axis
3. To learn the projections of plane in parallel, perpendicular and inclined to reference plane
4. To learn the projections of solids in both horizontal and vertical planes
5. To learn the isometric projections and drawings

Course Outcomes:

1. To construct the basic profiles and curves used in the engineering practice
2. To develop a simple engineering drawing in both First angle orthographic projections, BIS standards in engineering graphics.
3. To visualize the complex geometrical objects and the machine parts.
4. To visualize the solids clearly by sectioning
5. To develop conceptual ideas of isometric views and to make designs systematically.

UNIT - I

INTRODUCTION TO ENGINEERING DRAWING: Principles of Engineering Graphics and their significance - Drawing Instruments and their use-Conventions in Drawing- Lettering and Dimensioning – BIS conventions –Geometrical Constructions.

Curves:

a) Conic Sections- Ellipse, Parabola, Hyperbola and rectangular hyperbola- General method and other methods.
b) Cycloid, Epi-Cycloid and Hypo-Cycloid.
c) Involutes.

UNIT - II

ORTHOGRAPHIC PROJECTIONS:

Principle of orthographic projection-Method of Projection – First and third angle projection methods- Projections of Points –Projection of straight lines-True lengths and traces.

UNIT – III

PROJECTIONS OF PLANES: Planes parallel to one of the reference planes-Inclined to one reference plane and perpendicular to other-Oblique planes.

UNIT – IV

PROJECTIONS OF SOLIDS: Projection of solids in simple position - Axis inclined to one of the reference planes and parallel to the other-Axis inclined to both H.P and V.P.

SECTIONS OF SOLIDS: Introduction-Sections of Prisms, Pyramids, Cylinders, Cones and Spheres

UNIT - V

ISOMETRIC PROJECTIONS: Introduction-theory of isometric projection, isometric axes, scale, lines & planes-Isometric drawing of prisms, cylinders & cones-non isometric lines-methods to generate an isometric drawing.

TEXT BOOK

N. D. Bhatt, Engineering Drawing, 51th Revised and Enlarged Edition, Charotar publishers, 2012

REFERENCES

1. Narayana K L, Kannaiah P, Textbook on Engineering Drawing, 2nd Edition, Scitech publishers.
2. R.K.Dhawan, Engineering Drawing, S.Chand Company LTD.
3. Venugopal, Engineering Drawing and Graphics, New Age publishers
4. Dhananjay A. Jolhe, Engineering Drawing, Tata McGraw Hill Publishers

I SEMESTER

L144 - ENGLISH COMMUNICATION LAB

(Common to all branches)

Prerequisite: English-I

Course Educational Objectives

In this course, the students will learn to

1. Better pronunciation through emphasis on word accent.
2. Use language effectively to face interviews, group discussions and public Speaking
3. Possess Positive attitude and inculcate group behavior
4. Negotiate well with inter personal skills and intra personal skills
5. Speak spontaneously on any topic given

Course Outcomes

After the completion of this course, students will have the ability to

1. Withstand the global competition in the job market with proficiency in English communication.
2. Articulate English with good pronunciation.
3. Face competitive exams like GRE, TOEFL, IELTS etc.
4. Face interviews and skillfully manage themselves in group discussions
5. Communicate with the people effectively.

The following course content is prescribed for English Language Communication Skills Laboratory sessions:

1. Introduction to English Phonemes; Phonetic Transcription, Stress.
2. JAM
3. Role Play
4. Information Transfer
5. Group Discussions

SUGGESTED SOFTWARE

1. Digital Mentor: Globarena, Hyderabad,2005
2. Sky Pronunciation Suite: Young India Films, Chennai, 2009
3. Mastering English in Vocabulary, Grammar, Spelling, Composition, Dorling Kindersley,USA,2001
4. Dorling Kindersley Series of Grammar, Punctuation, Composition, USA, 2001
5. Oxford Talking Dictionary, The Learning Company, USA, 2002
6. Learning to Speak English - 4 CDs. The Learning Company,USA,2002
7. Cambridge Advanced Learners English Dictionary (CD). Cambridge University Press, New Delhi, 2008

I SEMESTER

L126 - COMPUTER PROGRAMMING LAB

(Common to all branches)

Course Educational Objectives:

- To Learn the fundamentals of ANSI C programming and the standard C libraries
- To Get a solid understanding of C functions and data structures
- To Become familiar with the basic concepts of object-oriented programming
- To write programs using the C language.
- To Gain skills in C Programming Language.

Course Outcomes:

After completion of the course students..

- Can write programs in C language.
- Can use loops effectively in programming.
- Can use files concept in programming.
- Can gain skills in C programming.

COURSE EDUCATIONAL OBJECTIVES:

- To Learn the fundamentals of ANSI C programming and the standard C libraries
- To Get a solid understanding of C functions and data structures
- To Become familiar with the basic concepts of object-oriented programming
- To write programs using the C language.
- To Gain skills in C Programming Language.

COURSE OUTCOMES:

After completion of the course students..

- Can write programs in C language.
- Can use loops effectively in programming.
- Can use files concept in programming.
- Can gain skills in C programming.

Recommended Systems/Software Requirements:

- Intel based desktop PC, ANSI C Compiler with Supporting Editors, IDE's such as Turbo C.
- Linux with gcc compiler.

LIST OF LAB PROGRAMS:

I) Write a programme in 'C' language to cover the following problems.

a) Example program which shows the usage of various preliminary Data types available in C Language.

b) Example program which shows the usage of various Operators available in C Language.

c) Example programs to illustrate the *order of evaluation*.

II) WRITE EXAMPLE PROGRAMS:

a) To check whether the given year is leap year (or) not

b) Roots of Quadratic Equation.

c) Finding smallest& biggest number from the given set of 4 numbers using 'if' statement.

d) Calculate the student grade in the examination – assume suitable constraints.

e) Prepare electricity bill for the consumed units – assume suitable Constraints.

f) Converting given two digit number into words using switch statement

g) To illustrate the usage of 'goto' statement.

III) EXAMPLE PROGRAMS:

a) To Display first N natural numbers
b) To find whether the given number is Armstrong (or) not
c) To find reverse of the given number and to check whether it is palindrome (or) not.
d) To find whether given number is strong number (or) not.
e) To check whether given number is Prime (or) not
f) To display prime numbers with in the given range(Nesting of Loops).
g) To display the following structure(Nesting of Loops)

i)
```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```

ii)
```
5 4 3 2
4 3 2 1
3 2 1
2 1
1
```

IV) Write example programs in C Language to perform following operations:
a) Finding the sum and average of given numbers using Arrays.
b) To display elements of array in reverse order
c) To search whether the given element is in the array (or) not using linear search & binary search.
d) Write a C program to perform the following operations
i) Addition, subtraction and multiplication of Matrices
ii) Transpose of given matrix
(The above operations are to be exercised using functions also by passing arguments)
e) Write a C program to find whether the given string is palindrome (or) not.
f) To accept line of text and find the number of characters, number of vowels and number of blank spaces in it.
g) Write an example program to illustrate the use of any 5 string handling functions.

V) a) Example program to bring clarity on pointer declaration & initialization and Pointer arithmetic.
b) Write an example program to describe the usage of *call by reference*.
c) Write a program to find sum of the elements of the array using functions.

VI) Write example programs in C Language:
a) To find factorial of a given number using functions.
b) Swap two numbers using functions.
c) To find GCD of two numbers using recursion
d) Write a recursive function to solve Towers of Honai problem.
e) Write an example program to illustrate use of external & static storage classes.
f) Write an example program to illustrate the usage of command line arguments.
g) Program to illustrate the usage of dynamic memory management functions.

VII) a) Write an example program using structures to process the student record. Assume suitable fields for student structures (Different kinds of initialization of structure variables are to be exercised)

b) Write a program to read records of 10 employees and find their average salary (exercise array of structures & Nested structures concepts through this program).

c) Write a program to handle a structure variable using pointers and implement self referential structure(i.e. A structure variable having a pointer to itself)

VIII) Write an example program on file to perform following operations:

a) Accessing content from files and writing content in to it. (Exercise different file operation modes)

b) Copy the contents of one file into another (Exercise different file operation modes)

I SEMESTER

L140 - ENGINEERING CHEMISTRY LAB

(Common to all branches)

Prerequisite: None

Course Educational Objectives:

Through this course the student will learn

1. To analyze water for its quality and to determine the important parameters like alkalinity and hardness.
2. To distinguish types of titrations used in volumetric analysis.
3. To gain hands on experience in practical aspects of preparation of polymers.

Course Outcomes:

After undergoing the training in this course the students will acquire the ability to:

1. Assess quality of water based on the procedures given.
2. Distinguish different types of titrations in volumetric analysis after performing the experiments listed in the syllabus**.**
3. Acquire practical knowledge related to preparation of polymers.
4. Exhibit skills in performing experiments based on theoretical fundamentals.

Model experiment

1. Estimation of sodium hydroxide by using hydrochloric acid.

Water analysis

2. Determination of alkalinity of water sample
3. Determination of total Hardness of water by EDTA method
4. Determination of permanent hardness of water by EDTA method.
5. Determination of Dissolved Oxygen (D.O) content by Winkler's method

Preparation of polymers

6. Preparation of Urea formaldehyde resin.
7. Preparation of Phenol formaldehyde resin.

Redox titrations

8. Determination of amount of potassium dichromate in given solution by using sodium thiosulphate.
9. Determination of the amount of Oxalic acid and Sulphuric acid in 1 liter solution by Using given standard Sodium Hydroxide and Potassium Permanganate solution.
10. Estimation of Mohr's salt by using potassium permanganate.
11. Estimation of Mohr's salt by using potassium dichromate.
12. Estimation of Mohr's salt by using Oxalic acid.

Estimation of Vitamin content

13. Estimation of Vitamin-C

REFERENCES

Lab manual

I SEMESTER

L114 - BASIC SIMULATION LAB

(Common to AE, EEE, ME)

Course Educational Objectives:

1. To give overview to Lab VIEW and NI Software.
2. A good background in what the Lab VIEW interface looks like.
3. To learn how to navigate the graphical programming language environment and introduces some of its analysis capabilities

Course Outcomes:

1. To write the simple executable programs for a given engineering task
2. To perfrom simple debugging techniques
3. To make decisions in Lab VIEW
4. To create an executable file with Lab VIEW

LIST OF LAB PROGRAMS:

1. Perform basic arithmetic operations using Labview.
2. Debugging a VI.
3. Converting a VI into a Sub VI
4. Creating an executable file from VI.
5. Performing Boolean operations using Labview.
6. Finding the sum of ‘n’ numbers using FOR loop.
7. Performing the factorial of a given number using FOR loop.
8. Finding the sum of n natural numbers using while loop.
9. Performing the factorial of a given number using WHILE loop.
10. Sorting even numbers using WHILE loop in an array.
11. Searching and replacing a string.
12. Finding the maximum and minimum variable from an array.

II SEMESTER

S240 - ENGLISH – II

(Common to all branches)

Prerequisite: ENGLISH-I

Course Educational Objectives

In this course, the students will learn

1. English with emphasis on LSRW skills.
2. To make decisions, while thinking logically analyzing situations carefully.
3. To read speedily and meaningfully.
4. Both active and passive vocabulary.
5. To write letters and reports effectively in formal and professional situations.

Course Outcomes

After the completion of this course, prospective engineers will have the ability to

1. Use English language effectively.
2. Express right ideas in right context
3. Manage the situation and negotiate business with good English communication
4. Think and analyze the situations and make good presentations of their work and decisions
5. prepare themselves to face interviews and also to participate in group discussions

UNIT - I

Environment (Learning English)
The World of Figures and Physics – **Satyendranath Bose** (Master Minds)
Grammar: Correction of sentences
Analytical Writing: Report Writing

UNIT - II

Inspiration (Learning English)
The Institution Builders– **Santi Swarup Bhatnagar** (Masterminds)
Grammar: If-clause; Question tags
Vocabulary: Idioms and Phrases
Analytical Writing: Resume'; Statement of Purpose

UNIT - III

Human Interest (Learning English)
The institution builders – **Meghanadh Saha** (Master Minds)
Grammar: Direct & Indirect Speeches
Vocabulary: Phrasal Verbs
Analytical Writing: Memo Drafting

UNIT – IV

Media (Learning English)
The New Age – **Homi Jehangir Bhabha** (Master Minds)
Grammar: Concord
Vocabulary: Analogy
Analytical Writing: Information Transfer/ Data Interpretation (Tables, Pie charts, Bar graphs, Tree diagrams, Pictograms, etc.)

UNIT – V

The New Age – **Vikram Sarabhai** (Master Minds)
Grammar: Gerunds & Infinitives; Correction of Sentences
Vocabulary: Words often confused
Analytical writing – Comprehension, Expansions (of a given topic/ proverbs)

TEXT BOOKS

1. "Learning English", Orient Longman Private Limited. JNTU edition, 2008
2. EnakshiChatterjee, "Masterminds", Orient Longman Private Limited, Reprint-2002

REFERENCES

1. KoneruAruna, "Professional Communication", Tata McGraw-Hill, New Delhi, 2007.
2. Rizvi, "Effective Technical Communication", Tata McGraw-Hills, New Delhi, 2009.
3. Andrea J. Rutherford, "Basic Communication Skills for Technology", Pearson Education., 1st edition, 2009
4. Kaplan and Baron's, "GRE and TOEFL', Latest editions.2008

II SEMESTER

S133 - APPLIED MATHEMATICS – II

(Common to AE, CE, CSE, EEE, EIE, IT, ME)

Prerequisite: None

Course Educational Objectives:

In this course student will learn about

1. The basic concepts of Laplace Transforms and their applications in solving the Differential Equations.
2. The expansion of function in an infinite series of sine and cosines.
3. Fourier Integral Theorem, Fourier Integral Transforms along with their properties and applications.
4. Z-transform and its role in discrete analysis and in solving Difference equations.
5. The concepts of multiple integrals and changing of order of integration

Course outcomes:

At the end of this course student will be able to

1. Understand the importance of mathematics and its techniques to solve real life problems.
2. Apply the concepts of Laplace Transforms on Operational Calculus and solve Differential Equations of any order.
3. Express most of the single valued functions in the form of Fourier series and extend the ideas and techniques to non-periodic functions also.
4. Express a function as a continuous frequency resolution using Fourier Transforms.
5. Understand the analogy between Laplace Transform and Z-Transform and apply it wherever necessary & apply Multiple Integrals in various coordinate systems.

UNIT – I

Laplace Transforms

Laplace transforms of standard functions –Shifting Theorems, Transforms of derivatives and integrals – Unit step function –Dirac's delta function. Inverse Laplace transforms– Convolution theorem - Applications of Laplace transforms to ordinary differential equations.

UNIT – II

Fourier Series

Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series

UNIT – III

Fourier Transforms

Fourier integral theorem (only statement) – Fourier sine and cosine integrals – Fouriertransform – sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT – IV

Z-Transforms

Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse Z – transform - Convolution theorem – Solution of difference equation by z-transforms.

UNIT – V

Multiple Integrals

Multiple integrals - double and triple integrals (Cartesian, polar, spherical coordinates) – Changing of order of Integration and applications to areas and volumes.

TEXT BOOKS

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers,42nd Edition, 2012.
2. Dr. B. V. Ramana, "Higher Engineering Mathematics", The McGraw Hill Companies, 1st Edition, 2010.

REFERNCES

1. Michael D. Greenberg , "Advanced Engineering Mathematics", The McGraw Hill Companies, 2nd Edition, 2011.
2. Erwin Krezig, "Advanced Engineering Mathematics", John Wiley & sons, 8th Edition, 2011.

S238 - ENGINEERING PHYSICS **II SEMESTER**

(Common to all branches)

Pre-requisite course: NONE

Course Educational Objectives:

In this course student will learn about

- The basic concepts of Optics such as Interference, Diffraction and Polarization.
- The principle of quantum mechanics,dual nature of matter waves.
- The principle and working of different Lasers.
- The principle and classification of optical fibers
- classification of magnetic materials and their properties.
- Concept of Superconductivity, types and their applications

Course Outcomes:

At the end of this course student will be able to

CO1: Understand the nature of polarization, Diffraction and interference.

CO2: Understand the dual nature of particle and significance of the wave function .

CO3: Understand the principle of LASER and optical fibers. Types of lasers and optical fibers and their applications.

CO4: Understand the different types of magnetic materials and their uses.

CO5: Understand the phenomenon of superconductivity, critical parameters, types of super conductors and their applications

UNIT – I

INTERFERENCE, DIFFRACTION, POLARIZATION

INTERFERENCE: Introduction, super position principle, coherent sources, thin films, Newton's rings (in reflected system only).

DIFFRACTION:

Introduction, Fresnel and Fraunhofer diffractions – comparsion between Fresnel's and fraunhofer's diffraction-Difference between interference and diffraction-Fraunhofer diffraction at single slit - Fraunhofer diffraction at Double slit –Diffraction Grating- Grating spectrum.

POLARIZATION:

Introduction-plane of vibration and plane of polarization -Polarization by reflection Brewster's law –geometry of calcite crystal- Double refraction -nicol prism construction ,Quarter wave plate- Half wave plate.

UNIT - II

PRINCIPLES OF QUANTUM MECHANICS:

De Broglie hypothesis- Matter waves- Davison and Germer experiment- GP Thomson experiment, Heisenberg Uncertainty principle-Schrodinger time independent wave equation-Physical significance of the wave function-particle in a box.

UNIT – III

LASERS AND FIBER OPTICS

LASERS:

Introduction – Characteristics of Lasers- Principle of laser (Absorption, Spontaneous and stimulated emission of Radiation), Population Inversion- Einstein Coefficients ,three and four level pumping schemes, block diagram of laser. Ruby Laser- Helium Neon Laser, Applications of Lasers.

FIBER OPTICS

Introduction- Principle of optical Fiber- Acceptance angle and Acceptance cone- Numerical aperture – Types of optical fibers-refractive index profile- Application of optical fibers.

UNIT – IV

MAGNETIC MATERIALS:

Magnetic properties -Origin of magnetic moments-Classification of magnetic materials- Dia, Para, Ferro magnetic , Antiferromagnetic , Ferrimagnetic materials- Domain theory of ferromagnetism(qualitative), Hysteresis curve- Soft and Hard magnetic materials. Applications of magnetic materials.

UNIT – V

SUPER CONDUCTORS

Phenomenon, critical parameters, Meissner effect, Type-I, Type-II Super conductors, BCS theory of super conductivity, Flux Quantization, London Eqs., Penetration depth, Josephson Effects- Applications of Super conductors.

TEXT BOOKS

1. V RAJENDRAN, Engineering Physics, Tata Mc. Graw-Hill
2. P K Palani Samy, Engineering Physics Scitech Publications

REFERENCES

1. M R Srinivasan, Engineering Physics, New age international,2014.
   M.N.Avadhanulu, P.G.Kshirsagar, Engineering physics S.Chand, New Delhi.
2. RK GAUR, SL GUPTA, Engineering Physics Dhanpat Rai Publication, 2008.
3. Dr. P. Srinivasa Rao, Dr. K. Muralidhar, Basic Engineering Physics by Himalaya Publishing House.

II SEMESTER

S145 - BASIC ELECTRONICS ENGINEERING

Course Educational Objectives:
In this subject student will learn about

- The semiconductor physics and working of diodes and transistors.
- The physical operation of various diodes and transistor amplifiers with their applications.
- The working of operational amplifiers.
- The different Timers and DA/AD Converters.
- The various digital electronics components in combinational and sequential circuits.

COURSE OUTCOMES
At the end of this course student will be able to

- To apply various semiconductor devices in engineering fields.
- To analyze the operation and structure of the various electronic circuits.
- To examine the parameters and characteristics related to OP-AMP.
- To apply the techniques of data conversion and timer operation.
- To analyze the basic digital electronic circuits.

UNIT - I
Electronic Devices: Introduction to the semiconductors, P-N diode, Operation and V-I characteristics, Zener Diode, Photo Diode and LED. Introduction to BJT, CE characteristics, Field Effect Transistor: construction, characteristics of JFET.

UNIT – II
Basic Electronic circuits: Diode as a rectifiers, basic clippers and clampers circuits, Zener diode as a voltage regulator, Introduction to CE Amplifiers, Silicon Controlled Rectifier and UJT.

UNIT - III
Operational Amplifiers: Op-amp Block Diagram, Package Types and temperature ranges, IC 741 op-amp and its features, Power supply requirement to operate Op-amp IC741, ideal and practical characteristics of Op-amp , DC and AC characteristics of Op-Amp , IC 741 Op-Amp specifications, Measurement of slew rate and CMRR.

UNIT – IV
Timers and Data Converters:
555 Timer: functional diagram, pin diagram, Monostable and Astable operations, applications.
Digital to Analog Converters: Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC;
Analog to Digital Converters: Flash (comparator) type ADC, counter type ADC.

UNIT - V
Basic Digital Electronics:
Number Systems, Binary codes- BCD, Excess 3 code, Gray code, Boolean Algebra, De-Morgan's Theorem, Introduction to Karnaugh map, Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive –OR and Exclusive – NOR, Introduction to Combinational Logic Circuits and Sequential Logic Circuits, Introduction to microprocessor and microcontrollers.

TEXT BOOK

1. Jacob Millman, Christos C Halkias, "Electronic Devices and Circuits", Tata McGraw Hill Publishers, New Delhi.
2. D.Roy Choudhury, Linear Integrated Circuits, New Age International (P) Ltd.
3. Morris Mano, "Digital Design", PHI Publishers.

REFERENCES

1. R.L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits, Pearson/Prentice Hall Publishers.
2. T.F. Bogart Jr., J.S.Beasley, G.Rico, Electronic Devices and Circuits, Pearson Education, 6th edition, 2004.
3. Thomas L.Floyd, Electronic Devices, Prentice Hall/ Pearson Education Publishers.
4. Charles H. Roth, Fundamentals of Logic Design, Cengage learning Publishers.

II SEMESTER

S282 - INTRODUCTION TO ENGINEERING MECHANICS

Course Educational Objectives:

1. To learn basics of force systems and equilibrium system of forces
2. To learn about the friction and its influence on bodies in static condition
3. To learn about the centriod and area moment of intertia
4. To learn about the centre of gravity, their influence on mass moment of inertia
5. To learn about dynamic analysis by solving problems on kinematics and projectiles.

Course Outcomes:

- To solve the different types of force systems under equilibrium condition
- To analyze the effect of friction on bodies in static condition
- To determine the area moment of inertia for various cross-sections
- To determine the mass moment of inertia for various 3-D bodies
- To analyze motion of bodies and their projectiles.

UNIT - I

RESULTANT OF SYSTEM OF FORCES: Introduction - Force and Components - parallelogram Law of forces - Resultant of Coplanar Concurrent Force System - Resultant of Coplanar Non-Concurrent Force System – Moment of a Force – Couple – Varignon's Theorem - Resultant of Force Systems.

EQUILIBRIUM OF SYSTEM OF FORCES: Introduction to Equilibrium - Free body diagram - Equilibrium of a Body Subjected to Concurrent Forces - Lami's Theorem - Equilibrium of Connected Bodies.

UNIT - II

FRICTION: Introduction - Types of Friction - Laws of Friction - Angle of Friction - Angle of Repose – Friction on bodies resting on horizontal planes - Friction on bodies resting on inclined planes - wedge friction - Roller Friction - Ladder Friction.

UNIT - III

CENTROID: Introduction - Use of axis of symmetry – Determination of Centriod of Triangle, Semicircle, Quarter circle, Sector of a circle, Parabola and ellipse from basic principle.

AREA MOMENT OF INERTIA: Theorems of Moment of Inertia – Determination of Moment of Inertia of Circle, Rectangle, Hollow circle, Semi circle, Quarter of a circle and Triangle from basic principles - Moment of Inertia of composite areas.

UNIT - IV

CENTRE OF GRAVITY: Use of symmetry - Determination of Centre of gravity of Simple Bodies from basic principles.

MASS MOMENT OF INERTIA: Determination of Mass Moment of Inertia of Uniform Rod, Rectangular Plate, Circular Plate, Circular Ring, Solid Cylinder - Rectangular Prism, Solid Cone and Solid Sphere - Radius of gyration - Moment of Inertia of composite bodies.

UNIT - V

KINEMATICS: Type of motion - Rectilinear Motion – Motion Curves – Motion with Uniform Velocity – Motion with Uniform Acceleration - Motion with varying acceleration.

PROJECTILES: Definitions – Motion of a Body Projected Horizontally – Inclined projection on Level Ground – Inclined Projection with Point of Projection and Point of Strike at Different Levels.

TEXT BOOKS

1. S.S. Bhavikatti, Engineering Mechanics, New Age International (P) Ltd.
2. N.H.Dubey, Engineering Mechanics, McGraw Hill

REFERENCES

1 Fedinand, L. Singer, Engineering Mechanics, Harper – Collins
2 B.Bhattacharya, Engineering Mechanics, Oxford University Press
3. A.K.Tayal, Engineering Mechanics, Umesh Publications
4. R.K.Bansal, Engineering Mechanics, Laxmi Publications
5. Manoj K Harbola, Cengage Learning, Engineering Mechanics.

II SEMESTER

L142 - ENGINEERING PHYSICS LAB

(Common to all branches)

Pre-requisite course: NONE

Course Educational Objectives:

In this course student will learn about

- The scientific method of experiments in the laboratory.
- The procedures and observational skills for appropriate use of simple and complex apparatus.
- Analytical techniques, statistical analysis and graphical analysis.
- The theoretical ideas and concepts covered in lecture by completing a host of experiments.
- The radius of curvature of a Plano-convex lens by forming Newton's rings.

Course Outcomes:

At the end of this course, student will be able to

CO1: Understand to calculate the radius of curvature of a plano-convex lens by forming Newton's Rings.

CO2: Understand the concept of diffraction and also find wavelengths of different spectral lines of the grating.

CO3: Estimate the wavelength of layer radiation.

CO4 : Study the magnetic field along the axis of a current carrying coil and to verify Biot –savart's law .

CO5 : Estimate the Refractions index of the given prism

CO6 : Find the thickness of a thin material using a wedge shaped film.

CO7 : Estimate the width of the slit by forming diffraction pattern.

CO8 : Understand the phenomenon of optical – activity

CO9 : Study the characteristics of LCR circuit

CO10: Understand the Phenomenon of resonance

CO11: Determine the rigidity modules of given material

CO12 : Understand the longitudinal and transverse vibrations of tuning fork.

List of Experiments: (Any 8 Experiments)

1. Determine the Radius of Curvature of Plano - Convex lens by forming Newton's Rings.
2. Determine the Wavelengths of various spectral lines using grating with the normal incidence method.
3. Determination of wavelength of laser radiation.
4. Study the magnetic field along the axis of a current carrying coil and to verify Biot –Savart's law.
5. Determine the Refractive index of a given prism.
6. Determine the thickness of a thin material using wedge shaped film.
7. Determine the width of the slit by using laser source by forming diffraction pattern.
8. Determine the specific rotation of an optically active substance.
9. Study the characteristics of L.C.R Circuit.
10. Determine the frequency of AC supply by using Sonometer.
11. Determine the rigidity modulus of a given material using Torsional pendulum.
12. Determine the frequency of a vibrating bar or electrical tuning fork using Meldy's apparatus.

REFERENCES

Lab Manual prepared by the LBRCE.

II SEMESTER

L124 - COMPUTER AIDED ENGINEERING GRAPHICS LAB

(Common to AE, CE, ME)

Course Educational Objectives:

The main objectives of this course are To learn the basic commands necessary for professional 2D drawing, design, and drafting using AutoCAD essentials.To acquire orthographic projections and isometric drawings using AutoCAD. To understand the solids by developing the surfaces without any complexity. To learn the shapes due to interpenetration of solids

Course Outcomes:

CO1: Understand the basic features of Auto CAD Software.
CO2: Draw different plane and solid geometrical engineering objects.

At least 10 Experiments.

LIST OF EXPERIMENTS:

1. 2D construction of the guide plate, base plate, side bracket and top gasket by using auto cad.
2. 2D construction of the filter plate, metric wrench, square plate, filter gusset by using auto cad.
3. 2D construction of the guide gasket, star space, top filter, chess board by using auto cad.
4. 2D construction of the strap plate, distance plate, square plate and lace gasket-I by using auto cad.
5. 2D construction of the fold pattern, pulley system, and pointer clip by using auto cad.
6. 2D construction of the star ratchet, lace gasket-II, combination wrench, by using auto cad.
7. 2D construction of the crane hook, regulator, housing by using auto cad.
8. 2D construction of the upright, socket, quadrant by using auto cad.
9. Isometric view of guide block and bearing brass support by using auto cad.
10. Isometric view of angle plate and fork by using auto cad.
11. Isometric view of cross stop and clamp by using auto cad.
12. Isometric view of crank and journal bearing by using auto cad.
13. Isometric view of pivot bearing and shaft support by using auto cad.
14. Projection of points (I, II, III, &IVquadrants).
15. Projection of lines parallel to both reference planes.
16. Projection of lines parallel to one reference plane & inclined to other reference plane.
17. Projection of planes parallel to one reference plane & perpendicular to other reference plane.
18. Projection of planes inclined to one reference plane& perpendicular to other reference plane.

REFERENCES

1. Bethune, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.
2. M. Kulkarni, A.P Rastogi, A.K. Sarkar, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.
3. N. D. Bhatt, Engineering Drawing, 51th Revised and Enlarged Edition, Charotar Publishers, 2012.

II SEMESTER

L143 - ENGINEERING WORKSHOP

(Common to EIE, AE, CE, ECE, EEE, ME)

Course Educational Objectives:
In this subject student will learn build or craft in every trade they practice. Know the terminology or specification and the purpose or usage of different tools used for different purposes in mechanical workshop.

COURSE OUTCOMES:
CO1: To use basic tools in trades like carpentry, fitting, house wiring, tin smithy and black smithy etc.
CO2: To fabricate simple products in different trades

At least **four trades** with **two exercises** from each trade:

1. Carpentry
2. Fitting
3. House – Wiring
4. Plumbing
5 Tin - Smithy
6. Black - Smithy

REFERENCE

P. Kannaiah, K.L. Narayana, Workshop manual, Scitech Publications, India Pvt Ltd

II SEMESTER

L112 - BASIC ELECTRONICS LAB

(Common to AE, EEE)

Course Educational Objectives

In this Lab student will learn about

1. Behavior of PN junction diode, rectifiers, and characteristics of BJT and JFET.
2. Operation and characteristics of OP-AMP, multivibrator circuits and verification of logic gates.
3. Simulation basics and resistor colour coding by using LABVIEW simulation software.

Course Outcomes

At the end of this course student will be able to

1. Analyze various electronic circuits
2. Analyze ICs and to apply logic gates
3. Analyze and design the basic circuits using LABVIEW simulation software.

LIST OF EXPERIMENTS

(The following experiments are to be simulated using PSPICE/MULTISIM software and verified by Bread board)

1. Study of CRO.
2. PN Junction diode Characteristics.
3. Zener diode Characteristics.
4. Full wave rectifier.
5. Clipper and clamper circuits
6. Transistor Characteristics under CE Configuration.
7. Characteristics of FET
8. Characteristics of op-amp
9. Astable Multivibrators using op-amp.
10. Monostable and Astable operations using 555 Timer
11. Verification of basic logic gates.
12. Verification of JK and D filp-flop.

III SEMESTER

S134 - APPLIED MATHEMATICS – III

(Common to AE, CE, CSE, EEE, EIE, IT, ME)

Prerequisite: Applied Mathematics-II, Applied Mathematics-II

Course Educational Objectives:

In this course student will learn about

1. The methodology of interpolation and extrapolation to common problems using different formulae
2. The application of Numerical Techniques in Integration; solving the algebraic and transcendental equations.
3. Solving Differential equations by using Numerical Methods..
4. The concepts of Vector Calculus Vector Differentiation and Conservative Fields.
5. The concepts of line integrals, surface and volume integrals, vector integral theorems and their applications

Course outcomes:

At the end of this course student will be able to

1. Apply the knowledge acquired to identify, formulate and solve problems in engineering using Numerical Techniques.
2. Apply the techniques of numerical interpolation and approximation of functions with ease.
3. Perform integration of functions when the actual function is not given and solve algebraic and transcendental equations.
4. Solve Ordinary Differential Equations with given initial conditions.
5. Apply Integration to find length, area and volume of any given surface.

UNIT – I

Solution of Algebraic and Transcendental Equations and Numerical Integration

Solutions of Algebraic and Transcendental Equations – Regula False Position method and Newtons Raphson Method in one variable. Numerical Integration – Trapezoidal rule – Simpson's 1/3 Rule –Simpson's 3/8 Rule.

UNIT – II

Interpolation and Finite Differences

Interpolation: Introduction – Finite differences- Forward Differences- Backward Differences- Backward differences –Central differences – Symbolic relations and separation of symbols- Differences of a polynomial- Newton's formulae for interpolation – Lagrange's Interpolation formula.

UNIT – III

Numerical solution of Ordinary Differential Equations

Numerical solution of Ordinary Differential equations, Solution by Taylor's series - Picard's Method of successive Approximations - Euler's Method - Runge- Kutta Methods.

UNIT – IV

Vector Differentiation

Vector Differentiation: Gradient- Directional Derivatives -Divergence – Solenoidal fields- Curl – Irrotation fields-potential surfaces - Laplacian and second order operators and related properties of sums and products

UNIT – V

Vector Integration

Vector Integration - Line integral – work done –area - surface and volume integrals Vector integral theorems: Greens, Stokes and Gauss Divergence Theorems (Without proof) and related problems.

TEXT BOOKS

1. S. S. Sastry, "Introductory Methods of Numerical Analysis". Prentice Hall of India, 5th Edition,2005.
2. Dr. B. V. Ramana, "Higher Engineering Mathematics", The McGraw Hill Companies, 1st Edition,2010.

REFERNCES

1. Dr. B.S. Grewal , "Higher Engineering Mathematics", Khanna Publishers, 42ndEdition,2012.
2. Steven .C. Chopra , Ra. P. Canale, "Numerical Methods for Engineers with programming and software application", The McGraw Hill Companies, 4th Edition,2002.
3. M. K. Jain, S. R. K. Iyengar, R.K. Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers., 5th Edition,2007.

III SEMESTER

S233 - ENGINEERING FLUID MECHANICS

Course Educational Objectives:

1. To demonstrate the properties of fluids and behavior of fluids under static conditions
2. To understand the differential relations for fluid such as mass conservation, conservation of momentum.
3. To learn features of flow though pipes by applying conservation principles
4. To understand the working of Hydraulic turbines and their performance analysis
5. To understand the working of Hydraulic pumps and their performance analysis

Course Outcomes:

CO1: To understand the fluid properties and behavior of fluid under static conditions
CO2: To analyse the fluid flow using differential relations
CO3: To develop relationships considering fluid viscosity in the case of flow though pipes
CO4: To examine the elementary differences in the performance of various hydraulic turbines
CO5: To examine the functional differences between various hydraulic pumps

UNIT - I

Introduction: Fluids and Continuum, Classification of Fluids, Properties of Fluid – Pressure, Temperature, Density, Specific Weight, Specific Gravity, Viscosity, Compressibility, Surface Tension, Capillarity, Vapor Pressure

Fluid Statics: Pressure Force on a Fluid Element, Hydrostatic Pressure Distributions, Hydrostatic forces on submerged plane and curved surfaces, Manometers, Buoyancy and Stability

UNIT - II

Analysis of Fluid Flow: Eulerian and Lagrangian approaches, Velocity Field, Flow Patterns-Pathline, Streamline, Streakline, Timeline, Stream Tube

Differential Relations for Fluid Flow: Acceleration Field of a Fluid, Differential Equation of Mass Conservation, Differential Equation of Linear Momentum, Euler's Equation, Stream Function, Vorticity and Irrotationality, Velocity Potential, Rotationality, Potential Flow, Bernoulli Equation and Its Applications-Venturi meter, Orifice meter, Limitations on the use of the Bernoulli equation

UNIT - III

Flow Through Pipes: Introduction, Reynolds Experiment, Head loss, Darcy-Wiesbach equation, Hydraulic Gradient and Total Energy Lines, Laminar Fully Developed Pipe Flow- Hagen Poiseuille Law, Moody Chart, Pipes in Series, Equivalent Pipe, Pipes in Parallel, Minor Losses, Hydraulic Diameter

Dimensional Analysis and Similarity: Introduction, Principle of Dimensional Homogeneity, Buckingham's Pi Theorem, Dimensionless Groups, Similarity.

UNIT - IV

Hydraulic Turbines: Introduction, Classification of turbines- impulse and reaction turbines, Pelton Turbine, Francis Turbine and Kaplan Turbine-working principle, Work Done and Efficiency, Draft tube

Performance of Hydraulic Turbines: Geometric similarity, Unit and specific quantities, Characteristic curves, Governing of turbines, Selection of type of Turbine, Cavitation, Surge Tank, Water Hammer.

UNIT V

Reciprocating Pumps: Classification, Working Principle, Co-efficient of Discharge and Slip, Indicator Diagram

Centrifugal Pumps: Classification, Working Principle, Work done, Head and Efficiencies, Losses, Specific Speed, Pumps in Series and Parallel, Performance Characteristics

TEXT BOOK

White F.M , Fluid Mechanics, Tata McGraw-Hill

P. Balachandran, Engineering Fluid Mechanics, Prentice Hall of India, 2012

REFERENCES

1. E. Rathakrishnan, Fluid Mechanics an Introduction, 3rd Edition, Prentice Hall of India, 2012
2. Fox, R.W., Mcdonald, A.J, Introduction of Fluid Mechanics, 5th Edition, John Wiely
3. Douglas, J.F., Gesiorek, J.M., Swaffield, J, A., Fluid Mechanics, 4th ed., Pearson Education, 2002
4. Shames, H., Mechanics of Fluids, 3rd Edition, McGraw-Hill,

III SEMESTER

S408 – THERMODYNAMICS

(Common to AE, ME)

Course Educational Objectives:

1. To learn the basic concepts of energy conversions
2. To learn basic aspects of first law of thermodynamics
3. To learn the irreversibilities of various systems using second law of thermodynamics
4. To learn the properties of different gas mixtures and pure substances.
5. To learn the basic aspects of ideal thermal cycles.

Course Outcomes:

CO1: To understand the concepts of heat, work and energy and temperature measurement.
CO2: To apply the first law of thermodynamics to various thermal systems for analysis.
CO3: To analyze the irreversibilities of various systems using second law of thermodynamics.
CO4: To analyze the properties of different gas mixtures and pure substances.
CO5: To apply ideal cycle analysis to simple heat engines to estimate various performance parameters.

UNIT - I

BASIC CONCEPTS AND DEFINITIONS: Introduction, Macroscopic and Microscopic View Point, Continuum, System, Control Volume, Properties of System, State, Path, Process, Cycle and Equilibrium-Thermodynamic Equilibrium, Quasi static process, Temperature-Temperature Scales, Zeroth law of Thermodynamics, Energy-Forms of Energy, Heat, Work, Mechanical forms of Work, Path and Point Functions.

UNIT - II

FIRST LAW OF THERMODYNAMICS: Introduction, Energy A Property of System, First Law Analysis of Closed System, Displacement work, Thermodynamic processes, Different Forms of Stored Energy –Energy Balance, Internal Energy, Specific Heat, Enthalpy, Entropy, PMM1.

FIRST LAW ANALYSIS OF CONTROL VOLUME-Conservation of Mass, Conservation of Energy Principle-Flow work, The Steady Flow Process-Steady Flow Energy Equation, Steady Flow Engineering Devices-Nozzles, Diffusers, Turbine, Compressors, Throttling Valves, Heat Exchangers.

UNIT - III

SECOND LAW OF THERMODYNAMICS: Introduction, Thermal Energy Reservoirs, Heat Engines, Kelvin-Plank & Clasius Statements of Second law of Thermodynamics, Refrigerators, Heat Pumps, Equivalence of Kelvin-Plank and Clasius Statements, Perpetual Motion Machines, Reversible and Irreversible Process, Carnot Cycle, Carnot Theorem, Corollary of Carnot's Theorem Thermodynamic Temperature Scale.

ENTROPY: Introduction, Clausius Theorem , Clasius Inequality, T-S Plot, Principle of increase of entropy, Tds-Relations, Maxwell Relation, Entropy Change for Ideal gases, Isentropic relations for ideal gases, Third Law of Thermodynamics.

UNIT - IV

NON REACTIVE GAS MIXTURES: Introduction, Composition of Gas Mixture, Mass Fraction, Mole Fraction, Daltons Law of Additive Pressures, Amagat`s Law of Additive Volumes, Ideal Gas Mixtures.

PROPERTIES OF PURE SUBSTANCE: Introduction, Phases of Pure Substance, Properties of steam, dryness fraction, Phase Change Processes, Property Diagrams of (P-v, P-T, T-s.)Pure Substance, P-v-T Surface, , h-s Diagram or Mollier Diagram for a Pure Substance .

UNIT - V

GAS POWER CYCLES: Introduction, Analysis of Power Cycles- Carnot, Otto, Diesel, Dual, and Brayton Cycles

VAPOR POWER CYCLES: Analysis of Carnot Vapour Cycle, Simple Rankine Cycle.

REFRIGERATION CYCLES: Reversed Carnot Cycle, Bell-Coleman Cycle, Simple Vapour Compression Cycle.

TEXT BOOKS

1. E.Rathakrishnan, Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice Hall of India, 2010

REFERENCES

1. P.K.Nag , "Engineering Thermodynamics"- 5th Edition, McGraw-Hill, 2013.
2. Cengel, Y.A and Boles, M.A "Thermodynamics: An Engineering Approach",7th Edition, 2011, McGraw-Hill.
3. G.J.Van Wylen & Sonntag, "Fundamentals of Thermodynamics", John Wiley& sons, publications Inc 5th Edition 1998.

III SEMESTER

S390 - STRENGTH OF MATERIALS

Course Educational Objectives:

1. To understand basic concepts of stress, strain and relations based on linear elasticity.
2. To demonstrate the shear bending diagrams on beams & know the location & magnitude of the bending moment.
3. To understand theory of simple bending.
4. To understand the graphical and analytical methods to compute principal stresses and strains.
5. To familiarize the concepts of cylinders & shells subjected to internal & external pressures.

Course Outcomes:

CO1: To analyze the stress and strain behavior in different types of members under various load conditions

CO2: To evaluate shear force and bending moments for different types of beams for different loading conditions.

CO3: To understand theory of bending and torsion these are very useful to determine strength of structural members.

CO4: To analyze deflection in the various types of beams while designing machine components.

CO5: To analyze thin and thick shells behavior under various loading conditions

UNIT - I

SIMPLE STRESSES AND STRAINS: Stresses and strains due to axial force. Hooke's law, factor of safety, stepped bars – uniformly varying sections - stresses in composite bars due to axial force and temperature - strain energy due to axial force, stresses due to sudden loads and impact. Lateral strain: Poisson's ratio - change in volume – shear stress - shear strain - relationship between elastic constants

UNIT - II

SHEAR FORCE AND BENDING MOMENT: Relationship between loading - shear force and bending moment - shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to concentrated loads and uniformly distributed loads only - maximum bending moment and point of contra flexure.

UNIT - III

STRESSES IN BEAMS: Theory of simple bending: assumptions - derivation of the equation $M/I = E/R = f/y$ – section modulus - calculation of normal stresses due to flexure application.

TORSION: Theory of torsion and assumptions - derivation of the equation $T/J = C\theta/L = q/r$, polar modulus, power transmitted by a shaft, stresses in solid and hollow circular shafts

UNIT - IV

ANALYSIS OF STRESSES IN TWO DIMENSIONS: State of stress at a point, normal and tangential stresses on inclined planes. **Failure Theories:** Maximum Stress theory – Maximum Strain theory – Maximum Shear Stress Theory –Distortion energy theory – Maximum Strain energy theory

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beam cross sections like Rectangular, Circular, Triangular, I and T Sections.

UNIT - V

DEFLECTION OF BEAMS: Differential equation of elastic line - deflection in statically determinate beams - Macaulay's method for prismatic members - area moment method for stepped beams with concentrated loads.

THIN, THICK AND SPHERICAL SHELLS: Hoop and longitudinal stress- thin and thick cylinders- spherical shells-changes in dimensions and volume.

TEXT BOOK

S.Ramamrutham, Strength of Materials, Dhanpat Rai & Sons

REFERENCES

1. Popov, E.P., Mechanics of Materials, Prentice Hall Inc., 1976.
2. Andrew, P., Singer, F.L., Strength of Materials, Harper and Row Publishers, New York, 1987.
3. M.L.Gambhir, Fundamentals of Solid Mechanics, PHI Learning.
4. R.Subramanian, Strength of Materials, Oxford University Press

III SEMESTER

S225 - ELEMENTS OF AEROSPACE ENGINEERING

Course Educational Objectives:

1. To learn the components of airplane and different types of flight vehicles
2. To learn the basic aspects of aerodynamics and airfoils
3. To learn the elements of propulsive systems used in airplanes
4. To learn the function of structural components in wing
5. To learn the fundamental aspects of flight vehicle in space

Course Outcomes:

CO1: To know the properties of standard atmosphere relevant to the aspects of aerospace engineering.
CO2: To understand the basics issues of aerodynamics forces acting on an airfoil.
CO3: To analyze the working principles of various aircraft engines systems.
CO4: To identify and know functions of the various components of aircraft wing
CO5: To analyzee the basics aspects of space vehicles trajectories

UNIT - I

History-Early planes, Components of Airplane and their functions, Types of Flight Vehicles, Classifications, Standard Atmosphere, Altitude, Hydrostatic Equation, Geopotential and Geometric Altitudes

UNIT - II

Basic Aerodynamics: Introduction, Aerofoils, Aerofoil Nomenclature, Classifications of NACA aerofoils, Wing Geometry, Aerodynamic Forces, Lift, Drag and Moment Co-efficients, Co-efficient of Pressure, Aerodynamics Center, Pressure Distribution over Aerofoil, Types of Drag, High Lift Devices

UNIT - III

Propulsion: Introduction, Propeller, Reciprocating Engine, Jet Propulsion-The Thrust Equation, Elements of Turbojet Engine-Turbofan Engine-Rocket Engine, Rocket Propellants-Liquid Propellants, Solid Propellants, Rocket Staging

UNIT - IV

Aircraft Structure and Material: Introduction, Fluselage-Monocoque, Semi-Monocoque Structures, Components of Wing-Spars, Ribs, Longerons, Stringers, Bulkheads, Aircraft Materials-Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials.

UNIT - V

Space Flight: Introduction, Orbit Equation, Basic Aspects of Space Vehicle Trajectories, Kepler's Laws, Earth and Planetary Entry, Space Explorations- space vehicles and its types, reusable space vehicles, space shuttle, satellites, Types of satellites and their functions

TEXT BOOK

John D. Anderson, Jr., Introduction to Flight, McGraw-Hill

REFERENCES

1. Houghton E. L., Carpenter P.W., Aerodynamics for Engineering Students, 6th Edition, Elsevier
2. A.C. Kermode., Mechanics of Flight, 11th Edition, Pearson Education

III SEMESTER

S143 - BASIC ELECTRICAL ENGINEERING

(Common to AE, CSE, IT)

The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electrical Engineering.

Course Outcomes

1. To develop and employ circuit models for elementary electrical components, e.g., sources, resistors, inductors, capacitors
2. To identify basic dc motor and dc generator parts as to their specific use and application.
3. To ddetermine voltages, currents, turns-ratios and power for single-phase transformers and synchronous generators.
4. To Analyze the sinusoidal-steady-state response of first and second-order systems;
5. To ccalculate motor horsepower, speed, slip, efficiency, power factor, and torque of three phase induction motor and applications.

UNIT – I

Electrical Circuit Fundamentals

Basic definitions, Types of elements-active and passive, Ohm's Law, Kirchhoff's Laws-Network reduction techniques-series, parallel, star to delta ,delta to star transformations, source transformations(for resistive networks).

UNIT – II

DC Machines

DC Generator: Principle of operation of DC Generator- E.M.F Equation-Types of DC Generator - Magnetization and Load characteristics of DC Generators.

DC Motor: Principle of operation of DC Motor- Types of DC motors- 3 Point Starter-losses and Efficiency

UNIT – III

AC Fundamentals & Transformers

AC Fundamentals : Peak, R.M.S, average, instantaneous values, Form factor and Peak factor– periodic waveforms – Phase and Phase difference –Concepts of Reactance, Impedance, Susceptance and Admittance, Real , Reactive and apparent Powers, Power Factor.

Transformers: Principle of operation of single phase transformers, ideal transformer, Practical transformer –Emf equation-Losses- efficiency and regulation-O.C and S.C tests.

UNIT – IV

A.C Machines

Alternators: Fundamentals of Alternating Current-Principle of operation of Alternators –Salient pole and Non-Salient pole rotors, Voltage Regulation by synchronous impedance method only.

Induction Motor: Principle of operation of Induction Motors –Slip ring and Squirrel cage motors –Slip-Torque characteristics.

UNIT – V

Electrical Measuring Instruments.

Basic Principles of indicating instruments – permanent magnet moving coil and moving iron instruments.

TEXT BOOKS

1. WH Hayt, JE Kemmerly, SMDurbin, "Engineering Circuit Analysis" - Tata McGraw Hill Publication, 6th Edition.
2. M.S Naidu, S. Kamakshaiah, "Introduction to Electrical Engineering"- Tata McGraw Hill Publication

REFERENCES

1. Kothari , Nagarath, "Basic Electrical Engineering" -TMH Publications, 2nd Edition.
2. V.K.Mehta, "Principles of Electrical Engineering" - S.Chand Publications.

III SEMESTER

S243 - ENVIRONMENTAL STUDIES

(Common to all branches)

Prerequisite: None

Course Educational Objectives:

In this course the student will learn about

- Environmental issues related to local, regional and global levels.
- Concepts of ecosystems and threats to global biodiversity.
- Environmental pollution problems.
- Environmental issues in the society.
- Problems associated with over population and burden on environment.

Course Outcomes:

After the completion of this course, the students will be able to

1. Evaluate local, regional and global environmental issues related to resources and management.
2. Understand the implications of the ecosystems and identify the threats to global biodiversity
3. Realige the problems related to pollution of air, water and soil.
4. Investigate and solve social issues of the environment.
5. Create awareness on the concept of sustainable population growth**.**

UNIT – I

Natural Resources: Definition, Scope and importance of Environmental Studies – Need for Public Awareness. Renewable and non-renewable resources –

Natural resources and associated problems – Forest resources, Water resources, Mineral resources, Food resources and Energy resources.

UNIT - II

Ecosystems: Concept of an ecosystem - Structure and functions of an ecosystem - Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession, Food chains, Food webs and ecological pyramids. Bio-Geo Chemical Cycles.

Biodiversity and its conservation: **Introduction** – Definition & Levels of Measuring Biodiversity: Genetic, Species, Community and Ecosystem diversity.

Bio-geographical classification of India, India as a mega diversity nation, Values of Biodiversity: Direct and Indirect Values, Hot-spots of biodiversity, Threats to biodiversity, Man-wildlife conflicts, Endangered and endemic species of India. Conservation of biodiversity.

UNIT - III

Environmental Pollution: Definition, Sources, Effects and Control measures of

a) Air pollution
b) Water pollution
c) Soil pollution
d) Noise pollution
e) Radioactive Pollution

Solid waste Management: Sources of waste, Effects of improper handling of waste and measures to reduce the waste production and management methods of Municipal solid waste.

Disaster management: Floods, Earthquakes, Cyclones, Landslides and Tsunami.

UNIT - IV

Social Issues and the Environment: From Unsustainable to Sustainable development & Equitable use of resources for sustainable life style - Environment and human health - Resettlement and Rehabilitation of people, its problems and concern & Case Studies - Climate change : Global warming, Acid rains, Ozone layer depletion, Nuclear accidents and Holocaust & Case studies - Consumerism and waste products.

UNIT -V

Human Population and the Environment: Population growth & Variations among Nations, Population explosion – Family Welfare Program - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health & Case Studies. Environmental legislation in India.

TEXT BOOKS

1 P.N.Palanisamy et al., "Environmental Science" 2nd edition, Dorling Kindersley (India) Pvt.Ltd. Licenses of Pearson Education in South Asia, 2013.

2 R. Rajagopalan, "Environmental Studies (From Crisis to Cure)", by Oxford University Press, 2011, Second Edition.

REFERENCE

1. M. Anji Reddy, "Textbook of Environmental Sciences and Technology" by BS Publications, 2011 Second Edition.

2. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", by University Grants Commission, University Press (India) Private Limited, 2005. (2010 Reprinted).

III SEMESTER

L147 - FLUID MECHANICS AND STRENGTH OF MATERIALS LAB

Course Educational Objectives:

1. To learn the properties of fluids and its measuring devices
2. To learn the basics of hydraulic machines
3. To learn the methods to predict the response of a structure under loading and it susceptibility to various failure modes

Course Outcomes:

After completion of the course students are able to:

1. To analyze different types of flow systems based on basic principles of fluid flow
2. To analyze the simple hydraulic systems
3. To analyze the various materials under different equilibrium loading conditions.
4. To perform tests and analyze materials subjected to tension, torsion, bending, and bucking.

Any of the 5 Experiments are required to be conducted from each section

FLUID MECHNAICS

1. Calibration of Orifice and Mouth Piece
2. Calibration of Venturimeter and Orifice meter
3. Verification of Bernoulli Theorem
4. Determination of friction factor for a given pipe line
5. Determination of loss of head due to sudden contraction in a pipeline
6. Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Kaplan Turbine.
9. Performance Test on Single Stage Centrifugal Pump.
10. Performance Test on Reciprocating Pump.

STRENGTH OF MATERIALS

1. Tension test on mild steel rod.
2. Deflection test on Cantilever beam.
3. Deflection test on Simply supported beam
4. Compression test on helical spring.
5. Torsion test on mild steel rod.
6. Impact test on metal specimen.
7. Hardness test on metals.
8. Double shear test on metals

III SEMESTER

L185 – BASIC ELECTRICAL ENGINEERING LAB

Course Educational Objectives:

1. To know the usage of electrical equipment
2. To understand the performance characteristics of transformers, induction motor and alternator

Course outcomes:

After undergoing this lab course, students will be able to:

A. Design the circuits for verification of Kirchhoff's laws.
B. Design amplifier circuit with different biasing techniques.
C. Identify the suitable method to find out the performance characteristics of AC machines

LIST OF EXPERIMENTS

1. Verification of Kirchhoff's Laws (KCL and KVL.)
2. Measurement of peak, average, rms values, frequency and time period of periodic waveforms.
3. Brake test on DC Shunt motor
4. Pre determination of efficiency of dc shunt machine as a motor.
5. Open circuit characteristics of a dc shunt machine.
6. OC and SC tests on 1-phase transformer.
7. Separation of core losses of 1-phase transformer.
8. Load test on 1-phase transformer
9. Regulation of 3-phase Alternator by Synchronous Impedance Method.
10. Brake test on 3-phase Squirrel Cage Induction Motor.

Additional Experiments

1. Calculation of equivalent resistance for Series and Parallel circuitis by using LabVIEW.
2. Calculation of equivalent resistance using star/delta transformations by using MATLAB.

IV SEMESTER

S403 - THEORY OF MACHINES

Course Educational Objectives:

1. To understand the concepts of simple mechanisms
2. To learn the effect of friction in various machine parts
3. To learn the gear profiles, kinematics of gear trains and design of cams
4. To learn the stability of moving vehicles
5. To learn the aspects in static and dynamic balancing of masses

Course Outcomes:

1. To analyze the kinematics of linkages to determine position, velocity and acceleration variation throughout the range of motion.
2. To analyze the performance of various power transmission systems
3. To design cams and gear trains to produce a desired motion.
4. To analyze the static and dynamics stability of motor vehicles
5. To analyze the mechanical systems for static and dynamics balancing

UNIT - I

MECHANISMS: Machine- Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom – Four bar mechanism - Single and Double slider crank chains – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration of four bar and single slider crank mechanism only.

UNIT - II

FRICTION: Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

UNIT - III

GEARING AND CAMS: Gear profile and geometry – Nomenclature of spur and helical gears only– Gear trains - Simple, compound gear trains and epicylic gear trains - Determination of speed and torque Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

UNIT - IV

PRECISION: Effect of Precision on Stability of moving vehicles such as motorcar motorcycle Aero planes- Static and Dynamic forces generated due to in Precision in moving mechanisms including Gyroscopic motions.

UNIT-V

BALANCING: Static and dynamic balancing – Single and several masses in different planes – Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.

TEXT BOOKS

1. Rattan.S.S, "Theory of Machines", Tata McGraw–Hill Publishing Co, New Delhi,2004.
2. Ballaney.P.L, "Theory of Machines", Khanna Publishers, New Delhi, 2002.

REFERENCES

1. Rao, J.S., Dukkipati, R.V, "Mechanism and Machine Theory", Second Edition, Wiley Eastern Ltd., 1992.
2. Malhotra, D.R., Gupta, H.C., "The Theory of Machines", Satya Prakasam, Tech. India Publications, 1989.
3. Gosh, A., Mallick, A.K., "Theory of Machines and Mechanisms", Affiliated East West Press, 1989.
4. Shigley,J.E.,Uicker, J.J., "Theory of Machines and Mechanisms", McGraw-Hill, 1980.
5. Burton Paul, "Kinematics and Dynamic of Planer Machinery", Prentice Hall, 1979.

IV SEMESTER

S116 - AERODYNAMICS - I

Course Educational Objective:

1. **To learn the**theoretical methods to solve the potential flow problems,
2. To lean the conformal transformation to from aerodynamics shapes
3. To learn the potential flow theory to solve for aerofoil characteristics
4. To learn the finite wing theory
5. To learn properties of viscous flows and boundary layer development over flat plate

Course Outcomes:

CO1: To apply Laplace equation for obtaining 2D and axisymmetric solutions
CO2: To apply conformal transformation to from aerodynamics shapes
CO3: To apply potential flow theory to solve for aerofoil characteristics
CO4: To Apply the Prandtl's lifting line theory to predict finite wing properties
CO5: To analyze the effect of boundary layer on flow over objects

UNIT - I

Potential Flow: Introduction, Laplace's Equation, Basic flows – Uniform parallel flow, Source, Sink, Simple Vortex, Doublet, Combination of Simple flows-Flow past a half body, Rankine Oval, Flow past a circular cylinder without circulation and with circulation, Circulation and lift (Kutta-Joukowsky Theorem)

UNIT - II

Conformal Mapping: Introduction, Basic Principles, Methods for Performing Transformation, Kutta-Joukowski Transformation, Transformation of Circle to Straight Line, Transformation of Circle to Ellipse, Transformation of Circle to Symmetrical Aerofoil, Transformation of Circle to Cambered Aerofoil

UNIT - III

Aerofoil Theory: Introduction, Aerofoil Characteristics, Vortex sheet, The Kutta condition, Kelvin's circulation theorem, Starting Vortex, Thin aerofoil theory-symmetrical aerofoil and cambered aerofoil The flapped aerofoil, The hinge moment coefficient, The normal force and pitching moment derivatives due to pitching, Basics of Panel Method

UNIT - IV

Finite Wing Theory: Introduction, down wash, induced drag, Trailing Vortex, Vortex filament, Biot-Savart law and Helmholtz Theorms, Prandtl's Lifting Line Theory-Elliptic Lift Distribution, General Lift Distribution

UNIT - V

Boundary Layer: Introduction, Boundary layer development, Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness, Types of boundary layer, Momentum Integral Estimates- Karman Analysis of the Flat plate, Navier-Stokes Equations, Boundary layer Equaltions-2D Flow, Boundary layer growth on a flat plate-Blasius Solution, Boundary Layer with Pressure Gradient

TEXT BOOK

Anderson, J.D., Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York,1998.

REFERENCES

1. Houghton, E.L., Carpenter P.W., "Aerodynamics for Engineering students", 6th Edition, Elseveir
2. Milne Thomson, L.H., "Theoretical aerodynamics", Macmillan, 1985.
3. Clancey, L.J., "Aerodynamics", Pitman, 1986

IV SEMESTER

S121 - AIRCRAFT STRUCTURES - I

Course Educational Objectives:

1. To learn the basic aspects of elasticity
2. To learn the characteristics of statically determinate structures
3. To learn the characteristics of statically indeterminate structures
4. To learn the energy methods and theorem applicable to beams and trusses
5. To learn the behavior of columns under loading conditions

Course Outcomes:

CO1: To solve problems by apply the stress-strain relations
CO2: To analyze the trusses under loading conditions
CO3: To analyze the statically indeterminate structures under loading conditions
CO4: To evaluate the strain energy stored in the structural members
CO5: To analysis the buckling of columns and compressive members.

UNIT - I

Basic Elasticity: Concept of principal planes-Principal stresses-Determination of normal and tangential stresses-Mohr's circle. Basic elasticity stresses and strains, equations of equilibrium, plane stress and plane strain problems, compatibility equations, stress - strain relations.

UNIT - II

Statically Determinate Structures: Analysis of plane truss- Method of joints- Method of sections- Plane frames-Composite beam.

UNIT - III

Statically Indeterminate Structures: Propped cantilever- Fixed-Fixed beams- Clapeyron's three moment equation – Moment distribution Method.

UNIT - IV

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

UNIT - V

Columns: Introduction- Axially loaded compression members-Crushing load- Buckling load-Euler's theory-Effective length of column- limitations-Euler's formula- Rankine's formula – Column with initial curvature- Columns subjected to eccentric loading – Euler's method-Rankine's method.

TEXT BOOKS

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

REFERENCES

1. Donaldson, B.K.,"Analysis of Aircraft Structures-An Introduction", McGraw-Hill, 1993.
2. B.C.Punmia, "Theory of Structures", Laxmi Publication.
3. S.Ramamrutham, R.Narayanan,"Theory of Structures"-Dhanpat Rai Publishing Co, 2003.

IV SEMESTER

S136 - APPLIED THERMODYNAMICS

Course Educational Objectives:

1. To understand the energy conversions in various vapor power cycles
2. To learn the working of different components in power plants.
3. To learn principles of operation of steam turbines.
4. To learn the working of different components in I.C. engines
5. To learn the working of various refrigeration and air conditioning systems.

Course Outcomes:

CO1: Identify all the essential components of a thermal power plant and develop methods of reducing losses in a vapor power cycle.
CO2: To analyze performance the stream nozzles and condensers
CO3: To analyze and compare the performance of Impulse, Reaction turbines
CO4: To know the function of various components I.C engines
CO5: To evaluate the basic aspects of Refrigeration and Air conditioning systems

UNIT - I

VAPOUR POWER CYCLES: Introduction- Carnot vapour power cycle-Rankine Cycle-Comparision between Carnot & Rankine Cycles-Irreversibilities and losses in vapour power cycle-Effect of operating Variables on Rankine Cycle-Reheating of steam-Supercritical Rankine Cycle-Regenerative Rankine Cycle.

STEAM GENERATORS: Boiler Systems- Fire tube Boilers- Water tube boilers-Comparision-High Pressure boilers, Boiler draught-Natural,or Chimney,Draught-Artificial draught-Performance evolution of boilers.

UNIT - II

STEAM NOZZLES: Types of steam nozzles-steam flow through a nozzle-Flow through actual nozzles-Supersaturated expansion of steam.

STEAM CONDENSERS: Introduction-Function of a condenser-Elements of a condensing Plant-Types of Condensers-Jet Condensers-Surface Condensers-Condenser Efficiency.

UNIT - III

STEAM TURBINES: Introduction-Working Principle of a steam turbine-Classification-The Simple Impulse Turbine-Optimum Operating Conditions from blade velocity diagram-Effect of blade friction on velocity diagram-Condition for axial discharge-Compounding of Impulse Turbine-Reaction Turbine-Comparison between Impulse and Reaction Turbines-Losses in Steam Turbines.

UNIT - IV

I.C Engines: Classification-Components-S.I and C.I engines-Comparison –Four Stroke and Two stroke Engines-Comparision-Air-fuel mixure-Carburetion-Simple Carburettor-Fuel Injection System in C.I engines-Engine cooling Systems-Types-Engine Lubrication System-Performance of I.C engines-Simple Problems

UNIT - V

Refrigeration: Introduction-Refrigerators-Unit of Refrigeration-Types of Refrigeration Systems-Air Refrigeration System-Simple air cooling System-Simple air evaporative cooling system-Boot-Strap air evaporative cooling system-Reduced ambient air cooling system-Regenerative air cooling system.

Air Conditioning: Introduction-Psychrometry -Types of air conditioning systems -Summer air conditioning-Winter air-conditioning-Year round air-conditioning (Qualitative treatment).

TEXT BOOK

1. Mahesh M Rathore,Thermal Engineering, Tata McGraw Hill
2. T.D Eastop and A. McConkey, Applied Thermodynamics, Pearson Education

REFERENCES

1. Rayner Joel, Basic Engineering Thermodynamics, Fifth Edition, AWL
2. Roy Choudhury, Basic Engineering Thermodynamics, 2nd Edition, Tata McGraw Hill
3. P.K Nag, Power Plant Engineering, 3rd Edition, Tata McGraw Hill

IV SEMESTER

S309 - METALLURGY AND MATERIAL SCIENCE

(Common to AE, ME)

Course Educational Objectives:

1. To acquire knowledge on structure of metals and alloys.
2. To learn to construct equilibrium diagrams.
3. To learn the basic concepts of ferrous materials.
4. To understand the concepts of mechanical working process and heat treatment
5. To acquire the basic concepts of non-ferrous and composite materials.

Course Outcomes:

CO1: To estimate the properties of the material based on crystal structures.
CO2: To develop the equilibrium diagram of the binary system of different metals
CO3: To analyze the Fe-Fe_3C equilibrium diagram to determine the properties of steel
CO4: To analyze effect of heat treatment to get the desired properties in materials.
CO5: To know the properties of non ferrous metals and composite materials

UNIT – I

STRUCTURE OF METALS: Crystal structures-Body cantered cubic, Face cantered cubic, closed packed hexagonal, crystallographic planes. Mechanism of crystallization of metals, grain and grain boundaries, Effect of grain boundaries on the properties of metal / alloys – Determination of grain size.

Constitution of Alloys: Necessity of alloying, Solid solutions-Interstitial Solid Solution and Substitution Solid Solution, Hume Rotherys rules.

UNIT - II

EQUILIBRIUM DIAGRAMS: Experimental methods of construction of equilibrium diagrams, Classification of equilibrium diagrams- isomorphous, eutectic, partial eutectic equilibrium diagrams. Equilibrium cooling and heating of alloys, lever rule, coring. Transformations in the solid state – allotropy, eutectic, eutectoid, peritectoid reactions. Study of Cu-Ni and Bi-Cd equilibrium diagrams.

UNIT - III

FERROUS METALS AND ALLOYS: Study of Iron-Iron carbide equilibrium diagram.

Steel: Classification of steels, structure, properties and applications of plain carbon steels-low carbon steel, medium carbon steel and high carbon steel.

Cast Irons: structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, spheroidal graphite cast iron.

UNIT - IV

MECHANICAL WORKING: Hot working, Cold working, Strain hardening, Recovery, Recrystallisation and Grain growth. Comparison of properties of cold and hot worked parts.

Heat Treatment of Alloys: Annealing, normalizing and hardening. Construction of TTT diagram for eutectoid steel. Hardenability-determination of harden ability by jominy end quench test. Surface - hardening methods and age hardening treatment and application .

UNIT - V

NON-FERROUS METALS AND ALLOYS: structure, properties and applications of copper and its alloys, Aluminium and its alloys.

Composite Materials: Classification of composites, various methods of component manufacture of fiber reinforced composites-Hand layup process, Filament winding process, SMC processes, Continuous pultrusion processes, Resin transfer moulding.

Introduction to metal ceramic mixtures, Metal – Matrix composites and C – C composites and applications

TEXT BOOK

1. Sidney H. Avener, Introduction to Physical Metallurgy, Tata McGraw-Hill, 3rd Edition, 2011.
2. V.D.Kotgire, S.V.Kotgire, Material Science and Metallurgy, Everest Publishing House, 24th Edition, 2008.

REFERENCES

1. Richard A. Flinn, Paul K. Trojan, Engineering Materials and Their Applications, Jaico Publishing House, 4th Edition, 1999.
2. William and callister, Materials Science and Engineering, Wiley India private Ltd., 2011.
3. U.C Jindal., Atish Mozumber., Material Science and Metallurgy , 1st Edition, Pearson Education-2012

IV SEMESTER

S297 - MANUFACTURING TECHNOLOGY

Course Educational Objectives:

To The objective is to give basic knowledge to the students about primary manufacturing processes like casting, forging, joining (like welding, soldering and brazing), forming, extrusion and some of sheet metal operations. The course also gives some idea about the basic machines, different operations to be performed and also about unconventional machining processes.

Course Outcomes:

CO1: To acquire knowledge of the basic aspects of casting process.
CO2: To know the various basic concepts of welding process
CO3: To apply metal forming process and sheet metal operations in the manufacturing of products
CO4: To apply various lathe operations to manufacture products.
CO5: To apply different types machining operations while manufacturing a product.

UNIT - I

Introduction to Manufacturing: Historical perspective; Importance of manufacturing; Classification of manufacturing processes; Engineering materials.
Casting: Steps involved in making a casting- Advantages of castings and its applications – Pattern making- Types of patterns- Materials used for patterns- pattern allowances and their constructions-principles of Gating, Gating ratio, types of raisers, casting defects
Special casting processes: 1.Centrifugal 2.Die 3. Investment 4. Continuous

UNIT - II

Welding and other joining processes: Classification of welding process- Types of weld- welded joints and their characteristics- Principle and applications- Gas welding- Arc welding- welding defects; Inert gas welding- Tig and Mig welding; Friction welding, Induction welding, Soldering and Brazing.

UNIT - III

Metal forming processes: Rolling fundamentals- Theory of rolling, types of rolling mills and products; Principles of Forging - Tools and dies – Types of Forging-Smith forging, Drop forging-Drawing and its types- Wire drawing and Tube drawing-Coining- Hot and Cold Spinning.
Extrusion of metals: Basic extrusion process and its characteristics, Hot extrusion and Cold extrusion –Forward extrusion and Backward extrusion, Impact extrusion, Hydrostatic extrusion.
Sheet metal operations: Stamping, Forming and other cold working processes, Blanking and piercing, Bending and forming

UNIT - IV

Machining Processes: Mechanism of chip formation; Tool geometry; cutting tool & tool wear-cutting materials; tool life & mechinability - cutting fluids; Introduction to Lathe- working Principle of lathe and operations

UNIT - V

Machining operations: Shaping, planning, milling, drilling, grinding processes, Finishing processes Introduction to unconventional machining processes: EDM,ECM,UCM,CHM and LBB

TEXT BOOK

1. Amitabha Ghosh, Ashok Kumar Malik., Manufacturing Science, 2nd Edition, East West Publisher
2. SeropeKalpakjain, Steven R. Schmid., Manufacturing Processes for Engineering Materials, 4th Edition, Pearson Education

REFERENCES

1. P.N. Rao., Manufacturing Technology,Tata McGraw-Hill, Volume 1
2. R.K. Jain., Production Technology, Khpub
3. Lindberg P E, Process and materials of manufacturing, Professional Publications
4. Sarma P C ., Production Technology, S.Chand publisher
5. B.S. Raghuvamsi.,Workshop Technology, Volume-I

IV SEMESTER

S355 - PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to all branches)

Course Educational Objectives:

1. To create an awareness on engineering ethics and human values.
2. To adumbrate the inevitability of different intellectual property rights like patents, copyrights, trademarks, and trade secret.
3. To give an impetus on achieving higher positions in profession, with ethic and human values as a base and support for the growth.
4. To explicate the professional and societal responsibilities of the engineers.
5. To make the student realize the sensitiveness associated with experimentation process

Course Outcomes:

At the end of the course, the student

1. Acquires the basic concepts of Professional ethics and human values & Students also gain the connotations of ethical theories.
2. Knows the duties and rights towards the society in an engineering profession
3. Would realize the importance and necessity of intellectual property rights.
4. Can take all the necessary precautions while conducting the experiments, which may reduce the risk.
5. Understands the importance of risk evacuation system in reality and takes the utmost responsibility while handling the risky situations.

UNIT - I
ETHICS

Senses of 'Engineering Ethics' -Variety of moral issues - Types of inquiry -Moral dilemmas Moral autonomy -Kohlberg's theory Gilligan's theory -Consensus and controversy – Models of Professional Roles -Theories about right action- Self interest - Customs and religion -Uses of Ethical theories.

UNIT - II
HUMAN VALUES

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning - Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing - Honesty – Courage– Valuing Time - Cooperation – Commitment – Empathy – Self Confidence – Character – Spirituality

UNIT – III
ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation - Engineering Projects VS. Standard Experiments - Engineers as responsible experimenters – Codes of ethics - Industrial Standards - A balanced outlook on law- The challenger case study.

UNIT - IV
SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and risk- Assessment of safety and risk- Risk benefit analysis and reducing risk- Three Mile Island and Chernobyl case study - Collegiality and loyalty -Respect for authority - Collective bargaining – Confidentiality- Conflicts of interest - Occupational crime - Professional Rights- Employee rights- Intellectual Property Rights (IPR) discrimination.

UNIT - V

GLOBAL ISSUES

Multinational Corporation's -Environmental ethics-computer ethics -weapons development Engineers as managers - consulting engineers-engineers as expert witnesses and advisors Moral leadership - sample code of Ethics (Specific to a particular Engineering Discipline).

TEXT BOOKS

1. R.S.Nagarajan, A Textbook on "Professional Ethics and Human Values", New Age Publishers – 2006.
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York 1996.

REFERENCES

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey,2004 (Indian Reprint now available)
3. Charles E Harris, Michael S. Protchard, Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available).
4. John R Boatright, "Ethics and the conduct of business", Pearson Education, New Delhi,2003.
5. Edmund G Seebauer, Robert L Barry, "Fundamentals of ethics for scientists and engineers", Oxford University Press, Oxford, 2001.

IV SEMESTER

L111 - APPLIED THERMODYNAMICS LAB

Course Educational Objectives:

To learn the construction and working principle of I.C.Engines practically. Understand the performance of air compressor practically. To acquire the priorities given to the efficient use of energy and the minimization of environmental pollution. to learn the concepts of Psychometric terms

Course Outcomes:

After completion of the course students are the able to:

1. Analyze the Volumetric efficiency of air compressor.
2. Evaluate the engine performance and explore the ways to improve the efficiency of engines.
3. Realize the need to minimize the losses in engines.
4. Realize the need for developing the less polluting engines by adopting alternate fuels and engine modifications.

Any of the 10 Experiments are required to be conducted

1. I.C. Engines Valve & Port Timing Diagrams
2. Performance Test on Variable Compression Ratio single cylinder 4-Stroke petrol Engine By using Eddy Current Dynamometer
3. Performance Test on single cylinder 4 -Stroke Diesel Engine by using Mechanical Dynamometer
4. Performance test on twin cylinder 4-stroke diesel engine.
5. Performance Test on single cylinder 2-Stroke Petrol Engine.
6. Evaluation of Engine friction power by conducting Morse test on Multi cylinder 4-Stroke Petrol Engine.
7. Evaluation of Engine friction by conducting Retardation test on 4-stroke Diesel Engine.
8. I.C. Engine Heat Balance.
9. Performance test on PC based diesel Engine test rig.
10. Measurement of pollutants and smoke of I.C Engine.
11. Performance Test on Reciprocating Air – Compressor.
12. Performance Test on Vapour Compression Refrigeration Unit.
13 Performance Test on Air Conditioning Unit.
14. Assembly / Disassembly of Engines.
15. Viscosity of lubricants by using Redwood/ Say bolt viscometer Apparatus
16. Flash and Fire Point of fuels by using pesky Martin Apparatus
17. Carbon Residue test
18. Determination of calorific value of fuel using calorimeter.

IV SEMESTER

L158 - MANUFACTURING TECHNOLOGY LAB

Course Educational Objectives:

The objectives of this course are:

1. To acquire knowledge on structure of metals and alloys.
2. To understand to construct equilibrium diagrams.
3. To learn the basic concepts of ferrous materials.
4. To understand the concepts of mechanical working process and heat treatment
5. To acquire the basic concepts of non-ferrous and composite materials.

Course Outcomes:

After completion of the course students will able to:

1. To find the crystal structures affects the properties of the material.
2. To develop the equilibrium diagram of the binary system of different metal.
3. To analyze the Fe-Fe_3C equilibrium diagram.
4. To distinguish between non ferrous metals and composite materials.
5. To analyze how the heating and cooling will affect the metal like iron and Aluminium.

I. METAL CASTING LAB

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II. MACHINE TOOLS LAB

1. Lathe Operations
2. Special Machines: Drilling, Shaping, Milling Grinding (Surface Grinding), Slotting
3. Preparation of Single Point Cutting Tool

III WELDING LAB

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise

IV MECHANICAL PRESS WORKING

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations

V PROCESSING OF PLASTICS

1. Injection Moulding

V SEMESTER

S359 - PROPULSION - I

Course Educational Objectives:

1. To learn engineering concepts of gas turbine engines
2. To learn the flow through subsonic and supersonic inlets of a jet engine
3. To introduce principle of operation of aircraft compressors
4. To learn the fundamentals of combustion process in a combustion chamber
5. To learn the working principles of axial flow turbines of jet engine

Course Outcomes:

CO1: To analyse the performance characteristics of various Gas turbine engines
CO2: To design subsonic and supersonic inlets for jet engines
CO3: To analyse the performance characteristics aircraft compressors
CO4: To identify the parameters governing the design of combustion chambers
CO5: To analyse the performance of axial flow turbines of jet engines

UNIT - I

Fundamentals of Gas Turbine Engine: Working of gas turbine engine – The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet – Performance characteristics.

UNIT - II

Subsonic and supersonic inlets: Introduction, Subsonic Inlets, internal flows, external flow, Supersonic inlets – Starting problem on supersonic inlets, Shock-Swallowing, Flow stability problem

UNIT - III

Compressors: Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of Prewhirl, Stall and Surge, Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional Analysis– Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.

UNIT - IV

Combustion Chambers: Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – Use of flame holders, Fuel Injection System

UNIT - V

Axial Flow Turbines: Impulse and reaction turbines – Velocity triangles and power output – Elementary theory – Vortex theory – Choice of blade profile, pitch and chord – Estimation of stage performance – Limiting factors in gas turbine design- Overall turbine performance – Methods of blade cooling – Matching of turbine and compressor, The radial flow turbine

TEXT BOOK

1. Cohen, H. Rogers, G.F.C., Saravanamuttoo, H.I.H. "Gas Turbine Theory", Longman
2. Hill, P.G., Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 1999.

REFERENCES

1. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
2. "Rolls Royce Jet Engine" – Third Edition – 1983.
3. Mathur, M.L., Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 1999.

V SEMESTER

S117 - AERODYNAMICS - II

Course Educational Objectives:

1. To learn the basic concepts of compressible fluid flows
2. To learn steady one-dimensional flow properties discharging from a reservoir
3. To learn the supersonic flow properties
4. To learn the basic formulation for flow with friction and heat transfer
5. To learn the theoretical aspects of compressible flow over wings

Course Outcomes:

CO1: To apply the of compressible fluid flow equations to solve flow problems
CO2: To apply the steady one-dimensional flow principles in designing the nozzles and diffusers
CO3: To analyze the supersonic flow behavior over objects
CO4: To design ducts for fluid flows by considering friction and heat transfer affects
CO5: To apply compressible flow theory to analyze flow over wings

UNIT - I

Basics of Compressible Flow: Introduction, Compressibility, Basic Equations of compressible flow- Energy equation, Isentropic flow relations, Stagnation Properties, Speed of sound, Mach Number, Mach angle, Mach cone, Mach wave, Shock wave, Wave propagation

UNIT - II

Steady One-dimensional Flow: Introduction, Fundamental Equations, Discharge from a reservoir, Critical values, Stream tube area-velocity relation, Types of nozzles, Applications of nozzles, Area-Mach number relation, Isentropic flow through nozzles, Diffusers, Dynamics head measurement in compressible flow, Compressibility correction to dynamics pressure, Pressure coefficient

UNIT - III

Shock and Expansion Waves: Introduction, Types of waves, Normal shock-equations of motion, The normal shock relations for perfect gas, Hugoniot equation, Oblique shocks- Relation between β-θ-M, Shock Polar, Detached Shocks, Expansion waves, Prandtl-Meyer Flow, Simple and Nonsimple Regions, Flow with shocks and expansion waves at the exit of a convergent-divergent nozzle, Method of Characteristics

UNIT - IV

Flow with Friction and Heat Transfer: Introduction, Flow in constant Area Duct with friction, Adiabatic Constant area flow of a perfect gas, Fanno line Flow, Flow with heating and cooling in ducts,Rayleigh line relation.

UNIT - V

Compressible Flow over Wings: Introduction, Crocco's Therorem, Potential Equation for Compressible flow, Linearization of Potential Equation, Prandtl-Glauert Rule, Critical Mach Number, Drag-Divergence Mach Number, Area-Rule, Supercritical Aerofoil, Forward Swept and Swept Back Wings, Delta Wings

TEXT BOOK

E. Rathakrishnan, Gas Dynamics, Fourth Edition, Prentice Hall of India pvt. Ltd, New Delhi, 2010

REFERENCES

1. Ascher H. Shapiro, The dynamics and thermodynamics of compressible fluid flow Vol 1, The Ronald press Co. New York, 1953
2. H.W. Lipmann., A. Roshko., Elements of Gas Dynamics, John Wiley & Sons, New York
3. Thomson P.A ., Compressible Fluid Dynamics, McGraw-Hill, New York, 1972
4. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York, 1998.

V SEMESTER

S122 - AIRCRAFT STRUCTURES - II

Course Educational Objectives:

The objective of the course is to enable the students to apply standard methods to calculate the stress and displacement of thin walled symmetrical and unsymmetrical beam-like components subjected to static loads.

Course Outcomes:

CO1: To analyze the behavior of beam structures subjected to different loading conditions
CO2: To analyze the shear flow distribution and location of shear centre for open sections
CO3: To analyze the shear flow distribution in closed sections
CO4: To design elementary beam structures to withstand specified loads.
CO5: To analysis the stress distributions over aircraft components

UNIT - I

UNSYMMETRICAL BENDING: General, Principal axis and neutral axis methods- bending stresses in beams of symmetric sections with skew loads- bending stresses in beams of unsymmetrical sections.

UNIT - II

SHEAR FLOW IN OPEN SECTIONS: Thin walled beams, Concept of shear flow, shear centre, Elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT - III

SHEAR FLOW IN CLOSED SECTIONS: Bredt – Batho formula, Single and multi – cell structures- Shear flow in single & multicell structures under torsion. Shear flow in single and multicell under bending with walls effective and ineffective.

UNIT - IV

BENDING OF THIN PLATES: Pure bending of thin plates, Plates subjected to bending and twisting, Plates subjected to a distributed transverse load, combined bending and in-plane loading of a thin rectangular plate, bending of thin plates having a small initial curvature- Energy method for the bending of thin plate

BUCKLING OF THIN PLATES: Inelastic buckling of plates, Experimental determination of critical load for a flat plate, Local instability, Instability of stiffened panels, Failure stress in plates and stiffened panels, Tension field beams

UNIT - V

STRESS ANALYSIS IN WING AND FUSELAGE: Wing spars and box beams, Shear resistant web beams-Tension field web beams (Wagner's) – Shear and bending moment distribution for cantilever and semi-cantilever types of beams-loads on aircraft.

TEXT BOOKS

1. Peery, D.J., Azar, J.J., "Aircraft Structures", 2nd edition, McGraw–Hill, N.Y., 2007.
2. Edward Arnold., Megson, T.M.G., "Aircraft Structures for Engineering Students", 2007.

REFERENCES

1. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri – state off set company, USA, 1985.
2. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, 1993.

V SEMESTER

S123 - AIRCRAFT SYSTEMS AND INSTRUMENTS

Course Educational Objectives:

1. To learn the conventional and modern control systems of an airplane
2. To understand the working of different types of hydraulic and pneumatic systems used in an aircraft
3. To learn the concepts of working of aircraft engine systems
4. To know the working of auxiliary systems used in the aircraft
5. To know the working of flight instruments and navigation instruments used in an aircraft

Course Outcomes:

CO1: To apply the various types of controls in the airplane design
CO2: To analyze the performance of hydraulic and pneumatic systems in the aircraft operation
CO3: To analyze the performance of various engine systems of an aircraft
CO4: To employ necessary auxiliary systems in the operation of an aircraft
CO5: To employ various instruments necessary of the aircraft operation

UNIT - I
AIRPLANE CONTROL SYSTEMS

Conventional Systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push pull rod system – operating principles – Modern control systems – Digital fly by wire systems – Auto pilot system, Active Control Technology

UNIT - II
AIRCRAFT SYSTEMS

Hydraulic systems - Study of typical workable system - components – Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system - Typical Pneumatic power system - Components, Landing Gear systems - Classification

UNIT - III
ENGINE SYSTEMS

Fuel systems for Piston and jet engines, - Components of multi engines. Lubricating systems for piston and jet engines - Starting and Ignition systems - Typical examples for piston and jet engines

UNIT - IV
AUXILIARY SYSTEM

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

Flight Instruments and Navigation Instruments – Accelerometers, Air speed Indicators – Mach Meters – Altimeters - Gyroscopic Instruments– Principles and operation – Study of various types of engine instruments – Tachometers – Temperature gauges – Pressure gauge – Operation and principles.

TEXT BOOKS

1. McKinley, J.L., Bent, R.D., "Aircraft Maintenance & Repair", McGraw-Hill, 1993.
2. "General Hand Books of Airframe and Power plant Mechanics", U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi1995.

REFERENCES

1. Mekinley, J.L., Bent, R.D., "Aircraft Power Plants", McGraw-Hill, 1993
2. Pallet, E.H.J., "Aircraft Instruments & Principles", Pitman & Co., 1993.
3. Treager, S., "Gas Turbine Engine Technology", McGraw-Hill Education; 3rd Edition

V SEMESTER

S119 - AIRCRAFT PERFORMANCE

Course Educational Objectives:

1. To learn the general concepts of atmosphere and propeller theory
2. To learn the drag force acting on streamlined and bluff bodies
3. To learn the basic performance estimation of steady level flight at various altitudes and velocities
4. To demonstrate the performance of Maneuvering Flight at unaccelerated and accelerated conditions

Course Outcomes:

CO1. To analyze the performance of an airplane propellers
CO2: To analyze the various sources of drag force acting on an airplane
CO3. To apply the analytical approaches to identify the various parameters dictating the steady level flight performance at various altitudes and velocities
CO4: To analyze the nature of response of forces acting on manoeuvring flight to determine its performance
CO5: To analyze the performance of accelerated flight at various altitudes and velocities

UNIT - I

GENERAL CONCEPTS: Earth's Atmosphere, International Standard atmosphere-IAS, EAS, TAS, Propeller theory-Froude's Momentum Theory, Blade Element Theory, Propeller co-efficients, Use of propeller charts, Performance of fixed and variable pitch propellers, Propulsion characteristics

UNIT - II

DRAG POLAR: Streamlined and bluff body, Types of drag, Effect of Reynold's number on skin friction and pressure drag, Drag reduction of airplanes, Drag polar, Effect of Mach number on drag polar, High lift devices

UNIT - III

STEADY FLIGHT: Equations of motion of a airplane in flight, Thrust required and Power required, Thrust available and Power available for propeller driven and jet powered aircraft, Maximum level flight speed, Conditions for minimum drag and minimum power required, Effect of drag divergence on maximum velocity

UNIT - IV

MANOEUVERING FLIGHT: Rate of climb, Maximum Climb angle and Maximum Rate of climb- Effect of design parameters for propeller and jet aircrafts, Hodograph diagram, Gliding flight, Absolute and service ceiling, Time to Climb, Range and Endurance for propeller driven and jet powered aircraft

UNIT - V

ACCELERATD FLIGHT: Level turn, bank angle and load factor, Constraints on load factor, Minimum turn radius, Maximum turn rate, Pull up and pull down maneuvers, V-n diagram, Take of performance, Landing performance

TEXT BOOKS

1. J.D Anderson ., Aircraft Performance and Design, Tata McGraw-Hill Edition
2. Perkins, C.D., Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, NY, 1988.

REFERENCES

1. Kuethe, A.M., Chow, C.Y., Foundations of Aerodynamics, John Wiley & Sons,1982.
2. J.J.Bertin, Aerodynamics for Engineers, Prentice-Hall, 1988.
3. L.J. Clancey., Aerodynamics, Pitman, 1986
4. Anderson, Jr., J.D. Introduction to Flight, McGraw-Hill International Edition, 1999

V SEMESTER

S226 - ELEMENTS OF HEAT TRANSFER

Course Educational Objectives:

1. To learn the basic differential equations of heat transfer in conduction, convection and radiation.
2. To acquire the phenomenon of critical thickness of Insulation, Heat Transfer in Fins.
3. To understand the significance of Non Dimensional Numbers in Heat Transfer ,Natural and Forced Convection Mechanisms and correlations
4. To learn the basics of phase change processes of boiling and condensation in thermal systems and laws of radiation.
5. To learn about the LMTD, NTU concepts used in heat exchangers.

Course Outcomes:

CO1: To formulate heat conduction phenomenon through plane, cylindrical, and spherical surfaces

CO2: To solve practical problems of steady and unsteady state heat transfer.

CO3: To analyse the convective heat transfer phenomenon in both external and internal flows

CO4: To understand the thermal radiation concepts.

CO5: To design simple heat exchanger units of moderate capacity.

UNIT - I

Introduction: Basic Modes of Heat Transfer- Basic laws of Heat transfer-Applications of heat transfer- Heat conduction-Fourier equation-Thermal conductivity-General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates and its simplification.

One- Dimensional Steady State Conduction: Heat flow through plane wall and cylinder and sphere with constant thermal conductivity- Electrical analogy-Thermal resistance-Heat flow through Composite Wall and Cylinder - Critical radius of insulation for Cylinder- Uniform internal heat generation in Slabs.

UNIT – II

Extended Surfaces: - -Extended Surfaces- Analysis of Long Fin, Short fin with insulated tip - Fin efficiency and Effectiveness.

Transient Heat Conduction: Systems with negligible internal resistance-Lumped Heat Capacity analysis–Significance of Biot and Fourier Numbers-Plane wall with finite surface and internal resistance using Heisler Chart.

UNIT - III

Convective Heat Transfer: Introduction-Types of Convection- Convective heat transfer coefficient- Significance of Non Dimensional numbers

Forced Convection: External Flow-Laminar and Turbulent Flow over a Flat plate –Internal Flow through Circular pipe-Laminar and Turbulent Flows- Reynolds Colburn analogy

Natural Convection: Development of Hydrodynamic and thermal boundary layer along Vertical plate- Empirical correlations for Vertical plate, Vertical Cylinder, Horizontal Plate and Horizontal Cylinder.

UNIT - IV

Thermal Radiation: Introduction-Nature of Thermal radiation-concept of Black body –Laws of Black Body Radiation- Radiation heat exchange between two black isothermal surfaces- view factor- Heat exchange between non black infinite parallel plates- Radiation shields

UNIT - V

Heat Exchangers: Introduction-Classification of heat exchangers -Flow arrangement, Overall heat transfer coefficient- Fouling factor- LMTD method of Heat exchanger analysis-Correction for LMTD for use with multi pass and cross flow Heat Exchangers, Effectiveness - NTU method of Heat Exchanger analysis.

NOTE: Heat and Mass Transfer Data Book by C.P. Kothandaraman and Subramanian- New Age Publications is to be allowed in Examination.

TEXT BOOK

R.C. Sachdeva., Fundamentals of Engineering Heat and Mass Transfer —New Age Intl. Publishers 2nd Edn. 2005

REFERENCES

1. E. Rathakrishnan., Elements of Heat transfer CRC press, New York
2. C. J. Cengel .,Heat Transfer, TMH
3. J.P.Holman ., Heat transfer, McGrawHill
4. P.S Ghoshdastidar ., Heat Transfer, Oxford University Press.

V SEMESTER

L101 - AERODYNAMICS LAB

Course Educational Objectives:

1. To learn the basic experiments in wind tunnel
2. To learn the basic experiments in open jet facility
3. To learn the basic flow visualization techniques

Course Outcomes:

CO1: To analyze the flow characteristics over aerodynamic bodies
CO2. To design nozzle and analyze its flow characteristics

Any of the 10 Experiments are required to be conducted

1. Calibration of a Subsonic Wind Tunnel.
2. Determination of lift and drag for the symmetrical aerofoil.
3. Determination of lift and drag for the cambered aerofoil.
4. Generation of potential flow pattern over objects using Hele-Shaw Apparatus.
5. Visualization of flow field around a flat plate using open channel.
6. Pressure Distribution over a smooth circular cylinder.
7. Pressure Distribution over a symmetrical aerofoil.
8. Pressure Distribution over a cambered aerofoil.
9. Combination of uniform flow with source and combination of uniform flow with source and sink using Hele-Shaw apparatus
10. Twin vortex generation using water flow channel.
11. Calibration of open jet facility.
12. Supersonic Flow Visualization using Shadowgraph Technique.
13. Flow visualization in smoke tunnel.
14. Yaw effect on Pitot probe and Pitot-Static probe in incompressible flows
15. Yaw effect on Pitot probe and Pitot-Static probe in compressible flows
16. Design and Calibration of Convergent- Divergent Nozzle
17. Estimation of Mach Number of Convergent and Convergent- Divergent Nozzle.

V SEMESTER

L119 - COMMUNICATION AND PRESENTATION SKILLS LAB

(Common to all branches)

Prerequisite: English -I, English - II

Course Educational Objectives

In this course, the students will learn to

1. Gather information and to organize ideas relevantly and coherently
2. Participate in group discussions and debates, Face interviews
3. Write project/research reports/technical reports/ formal letters
4. Make oral presentations
5. Transfer information from non-verbal to verbal texts and vice versa

Course Outcomes

After the completion of this course, prospective engineers will have the ability to

1. Make power point presentations and oral presentations
2. Articulate English with good pronunciation
3. Face competitive exams like GRE, TOEFL, IELTS etc.
4. Face interviews and skillfully manage through group discussions
5. Negotiate skillfully for better placement

The following course content is prescribed for the Communication and presentations Lab:

- Vocabulary building – synonyms and antonyms, one-word substitutes, analogy, idioms and phrases, verbal & alphabet series.
- Oral Presentations – JAM
- Functional English - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
- Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
- Making power point presentations.
- Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, practicing mock-interviews.
- Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets, summary, formats and styles, letter-writing.
- Reading comprehension – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, and critical reading.

Minimum Requirement:

The English Language Lab shall have two parts:

i. **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

ii. **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):
Computer network with LAN with minimum 60 multimedia systems with the following

specifications:

i. P – IV Processor
   1. Speed – 2.8 GHZ
   2. RAM – 512 MB Minimum
   3. Hard Disk – 80 GB

ii. Headphones of High quality

Suggested Software:

- Glob arena's software,2002
- Young India's Clarity software,2005

Books Recommended:

1. Stephen Bailey, "Academic Writing- A Practical guide for students", Rontledge Falmer, London & New York, 2004.
2. Dr A Ramakrishna Rao, Dr G Natanam, Prof SA Sankaranarayanan, "English Language Communication : A Reader cum Lab Manual, Anuradha Publications, Chennai, ,1st edition,2006
3. DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice, New Age International (P) Ltd., Publishers, New Delhi,2007
4. Books on TOEFL/GRE/GMAT/CAT by Barron's/cup, ,15th edition,2010
5. IELTS series with CDs by Cambridge University Press.3rd Edition,2007

VI SEMESTER

S360 - PROPULSION-II

Course Educational Objectives:

1. To learn the working principle of ramjet
2. To learn the working principle of rocket
3. To learn the working of liquid propellant rocket systems
4. To learn the working of solid propellant rocket systems
5. To learn the working of various advance rocket propulsion techniques

Course Outcomes:

CO1: To analyze the performance of ramjet engine components
CO2: To understand the basic aspects of rocket propulsion
CO3: To analyze the performance of liquid propellant rocket systems
CO4: To analyze the performance of solid propellant rocket systems
CO5: To apply the advanced rocket propulsion techniques for a mission

UNIT - I

RAMJET PROPULSION: Operating principle – Sub critical, critical and supercritical operation – Combustion in ramjet engine – Ramjet performance – Sample ramjet design calculations, Need of Supersonic Combustion, Components and Working principle of Supersonic Ramjet Engine, Isolators, Types of Combustion Chambers for Scramjet Engine, Operating Envelop of Ramjet Engine, Mixing Process in SCRAMJET Combustion

UNIT - II

ROCKET PROPULSION: Operating principle, Effective Exhaust Velocity and Specific impulse, Rocket Propulsion Requirements, Equations of Motion for an Accelerating Rocket, Multistage Rocket

UNIT - III

LIQUID PROPELLANT ROCKET: Introduction, Liquid Propellants, Propellant Feed Systems-Gas pressure feed systems, Types of Fuels and Oxidizers, Combustion Process, Combustion Instability, Propellant Tanks, Tank pressurization, Maneuvering, Orbit Adjustment, Attitude control

UNIT - IV

SOLID PROPELLANT ROCKET: Solid propellant rockets, Combustion process, Propellant Burning Rate, Selection criteria of solid propellants, Propellant grain and its configuration, Hybrid Rockets, Propellant Grain Stress and Strain, Attitude Control Rocket Motor **SIDE MANEUVERS ATTITUDE CONTROL AND SIDE MANEUVERS**

UNIT - V

ADVANCED PROPULSION TECHNIQUES: Electric rocket propulsion- Electrothermal, Non-Electrothermal, Electrostatic Electro Magnetic Thrusters, Ion propulsion techniques, Arcjet, Pulsed Magnetoplasma Accelerators, Solar sail, Nozzleless propulsion, Energy Spike, MHD Propulsion, Nuclear rockets

TEXT BOOK

Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York,5th Edn.,1993.

REFERENCES

1. J.D Mattingly., Elements of propulsion: Gas Turbines and Rockets, AIAA Educational Series
2. Cohen, H., Rogers, G.F.C., Saravanamuttoo, H.I.H., "Gas Turbine Theory", Longman Co., ELBS Ed., 1989.
3. Hill, P.G., Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 1999.
4. Gorden, C.V., "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1989.
5. Mathur, M., Sharma, R.P., "Gas Turbines and Jet and Rocket propulsion", Standard Publishers, New Delhi, 1988.

VI SEMESTER

S120 - AIRCRAFT STABILITY AND CONTROL

Course Educational Objectives:

1. To demonstrate the details of static longitudinal stability and control of an aircraft
2. To demonstrate the details of lateral and directional static stability and control of an aircraft
3. To demonstrate the details of dynamic stability and control of an aircraft

Course Outcomes:

CO1: To apply the conditions in static longitudinal stability in the aircraft design
CO2: To apply the static lateral stability condition s in the design of an aircraft
CO3: To apply the static directional stability conditions in the design of an aircraft
CO4: To analyze the dynamics longitudinal motion of an aircraft
CO5: To analyze the dynamic lateral and directional mode of motion of an aircraft

UNIT - I

STATIC LONGITUDINAL STABILITY AND CONTROL: Introduction, Moments on the airplane, Absolute Angle of Attack, Criteria for Longitudinal Static Stability, contribution to stability by wing, tail, fuselage, wing fuselage combination, Neutral Point, Static Margin, Stick fixed and Stick free stability, Elevator Hing Moment, Stick-free Longitudinal Static Stability, Power Effects

UNIT - II

STATIC LATERAL STABILITY AND CONTROL: Lateral stability-Dihedral effect, criterion for lateral stability, evaluation of lateral stability-contribution of fuselage, wing, wing fuselage, tail, total static lateral stability, lateral control, aileron control power, aileron effectiveness, strip theory estimation of aileron effectiveness, roll control by spoilers, aileron reversal, aileron reversal speed

UNIT - III

STATIC DIRECTIONAL STABILITY AND CONTROL: Directional stability-yaw and sideslip, Criterion of directional stability, contribution to static directional stability by wing, fuselage, tail, Power effects on directional stability propeller and jet aircrafts, Rudder fixed and rudder free aspects, Rudder lock and Dorsal fin, Directional control, rudder control effectiveness, rudder requirements, adverse yaw, asymmetric power condition, spin recovery

UNIT - IV

DYNAMIC LONGITUDINAL STABILITY: Aircraft Equations of motion, Small disturbance theory, Estimation of longitudinal stability derivatives, Routh's discriminant, solving the stability quartic, Phugoid motion, Factors affecting the period and damping

UNIT-V

DYNAMIC LATERAL AND DIRECTIONAL STABILITY: Dutch roll and spiral instability, Auto rotation and spin, Stability derivatives for lateral and directional dynamics.

TEXT BOOKS

1. Perkins C.D., Hage R.E., Airplane performance, stability and control, John Wiley & Sons 1976.
2. Nelson, R.C., Flight Stability & Automatic Control, McGraw Hill, 1998.

REFERENCES

1. McCormick, B.W., Aerodynamics, Aeronautics & Flight Mechanics John Wiley,1995.
2. Babister A.W., Aircraft Stability and response, Pergamon Press, 1980
3. Etkin B., Dynamics of Flight Stability and Control, John Wiley, New York, 1982.
4. Pamadi B.N., Performance, Stability, Dynamics, and Control of Airplanes, AIAA Education Series, 2004

VI SEMESTER

S250 - FINITE ELEMENT METHOD

(Common to AE, ME)

Course Educational Objectives: The objectives of this course are to

1. Understand the concepts such as discretization, natural co-ordinates, interpolation functions, stiffness matrix, force vectors, nodal displacements, boundary conditions etc
2. Understand the beams subjected to different loads
3. Understand the concepts of axisymmetric solids subjected to axisymmetric loading and the importance of isoparametric elements
4. Understand the steady state heat transfer through plane walls and fin
5. Understand the Eigen value and Eigen vectors for dynamic problems

Course Outcomes:

CO1: To identify mathematical model for solution of common engineering problems
CO2: To determine the design quantities (deformation, strain, stress) for engineering structures under different loading conditions.
CO3: To formulate the design and heat transfer problems with application of FEM.
CO4: To create new solutions for the existing problems using FEM approaches.
CO5: To evaluate the natural frequencies of bar and beam structures

UNIT - I

INTRODUCTION TO FINITE ELEMENT METHOD FOR SOLVING FIELD PROBLEMS:
Stress and Equilibrium - Strain – Displacement relations- Stress – strain relations
ONE DIMENSIONAL PROBLEM: Finite element modeling coordinates and shape functions-Potential Energy approach - Assembly of Global stiffness matrix and load vector-Finite element equations- Treatment of boundary conditions

UNIT - II

ANALYSIS OF BEAMS: Hermite shape functions - Element stiffness matrix for two nodes, two degrees of freedom per node beam element – Treatment of boundary conditions
Finite element modeling of two dimensional stress analysis with Constant Strain Triangles and treatment of boundary conditions.

UNIT - III

Finite element modeling of axisymmetric solids subjected to axisymmetric loading with triangular elements. Two dimensional four noded isoparametric elements, problems on isoperimetric formulation of four node quadrilateral element Numerical integration-Gauss quadrature

UNIT - IV

HEAT TRANSFER: Heat conduction in plane walls, convection heat transfer in fins.
Two dimensional analysis of thin plate with triangular elements-Element conductivity matrix-Convection matrix-Heat rate vector

UNIT - V

DYNAMIC ANALYSIS: Formulation of finite element model-Lumped and consistent mass matrices -Evaluation of Eigen values and Eigen vectors for a stepped bar.

TEXT BOOKS

1. Chandraputla, Ashok, Belegundu., Introduction to Finite Elements in Engineering, 3rd edition, 5th impress, Prentice – Hall, 2008.
2. SS Rao., The Finite Element Methods in Engineering, 4th edition, 6th reprint, B.H. Pergamon, 2010.

REFERENCES

1. JN Reddy., An introduction to Finite Element Method, 3rd edition, 13th reprint, McGraw Hill, 2011.
2. Kenneth H. Huebner, Donald L. Dewhirst, Douglas E Smith, Ted G. Byrom., The Finite Element Method for Engineers, 4th edition, John Wiley & sons (ASIA) Pvt Ltd, 2001.
3. David Hutton., Fundamentals of Finite Element Analysis, Tata McGraw Hill, 2005
4. George R Buchanan, R.Rudra Moorthy., Finite Element Analysis, Tata McGraw Hill, 2006

VI SEMESTER

S303 - MECHANICS OF COMPOSITES

(Common to AE, ME)

Course Educational Objectives:

- To Learn the basic knowledge about composite materials and advantages of composites
- To Learn about the methods of composites at micro and macro level
- To Familiarize the students with different equations for different laminates
- To Learn about basic design concepts of sandwich panels
- To Learn about mould processes, types of resins and those properties

Course Outcomes:

CO1: To understand the stress-strain relations applicable for composite materials
CO2: To analyze behaviour of composite materials at micro level and macro level
CO3: To design the multi directional composites
CO4: To design different types of sandwich panels used in aerospace industries
CO5: To apply techniques of fabrication processes to manufacture composites

UNIT - I

STRESS STRAIN RELATION: Introduction- Definition of composites-classification Advantages and application and limitations of composite materials, reinforcements and matrices, Generalized Hooke's Law – Compliance and reduced stiffness matrix- stress-strain relation of orthotropic lamina.

UNIT- II

METHODS OF ANALYSIS: Micro mechanics – Mechanics of materials approach, elasticity approach to determine material properties – Macro Mechanics – Stress-strain relations with respect to on axis, off axis

UNIT- III

MULTI DIRCTIONAL COMPOSITES: Governing differential equation for a general laminate, Classical Lamination Theory- Symmetric, Antisymmetric laminates, angle ply and cross ply laminates. Failure criteria for composites.

UNIT- IV

SANDWICH CONSTRUCTIONS: Basic design concepts of sandwich construction -Materials used for sandwich construction - Failure modes of sandwich panels.

UNIT- V

FABRICATION PROCESSES: Open and closed mould processes, lay-up, Vacuum bagging, Pultrusion, Resin Transfer Molding - Auto Clave-Filament Winding

TEXT BOOKS

1. Calcote, LR., "The Analysis of laminated Composite Structures", Von – Noastrand Reinhold Company, New York 1998.
2. Jones, R.M., "Mechanics of Composite Materials", 2nd Edition McGraw-Hill, Kogakusha Ltd.,Tokyo, 1998

REFERENCES

1. Agarwal, B.D., Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.
2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.

VI SEMESTER

S266 - HYPERSONIC AND HIGH ENTHALPY FLOWS

Course Educational Objectives:

1. To learn the basic properties of Hypersonic flows
2. To learn the inviscid hypersonic flow theories
3. To learn the mathematical formulations for viscous hypersonic flows
4. To learn the high temperature effects in high-speed flows

Course Outcomes

CO1: To apply the hypersonic flow theories to analyze flow over bodies
CO2. To analyze the hypersonic flow properties

UNIT - I

FUNDAMENTALS OF HYPERSONIC AERODYNAMICS:

Introduction to hypersonic aerodynamics-differences between hypersonic aerodynamics and supersonic aerodynamics-concept of thin shock layers-hypersonic flight paths-hypersonic similarity parameters-shock wave and expansion wave relations of in viscid hypersonic flows

UNIT - II

INVISCID HYPERSONIC FLOWS: Local surface inclination methods-Newtonian theory-modified Newtonian law-tangent wedge and tangent cone and shock expansion methods-approximate theory-thin shock layer theory.

UNIT - III

VISCOUS HYPERSONIC FLOW: Boundary layer equation for hypersonic flow-hypersonic boundary layers-self similar and non self similar boundary layers-solution methods for non self similar boundary layers, Aerodynamic heating

UNIT - IV

VISCOUS INTERACTIONS IN HYPERSONIC FLOWS: Introduction to the concept of viscous interaction in hypersonic flows-strong and weak viscous interactions-hypersonic viscous interaction similarity parameter-introduction to shock wave boundary layer interactions

UNIT - V

HIGH TEMPERATURE GAS DYNAMICS: Nature of high temperature flows-chemical effects in air-real and perfect gases-Gibb's free energy and entropy-chemically reacting mixtures-recombination and dissociation.

REFERENCES

1. John. D. Anderson. Jr., "Hypersonic and High Temperature Gas Dyanmics", Mc. Graw hill Series, New York, 1996.
2. John. D. Anderson. Jr ., "Modern compressible flow with historical perspective", Mc. Graw Hill Publishing Company, New York, 1996
3. John. T Bertin, "Hypersonic Aerothermodynamics", published by AIAA Inc.,Washington. D.C., 1994.

VI SEMESTER

S283 - INTRODUCTION TO SPACE TECHNOLOGY

Course Educational Objectives:

1. To learn the space mission strategies and fundamental orbital mechanics
2. To learn the flight trajectories of rockets and missiles
3. To learn the fundamentals of atmospheric re-entry issues and satellite attitude

Course Outcomes

CO1: To analyze the orbital elements and it's maneuvering
CO2: To analyze the trajectories of rockets and missiles
CO3: To analyze the dynamics of spacecraft attitude

UNIT - I

INTRODUCTION

Space Mission-Types-Space Environment-Launch Vehicle Selection, Introduction to rocket propulsion-fundamentals of solid propellant rockets- Fundamentals of liquid propellant rockets-Rocket equation

UNIT - II

FUNDAMENTALS OF ORBITAL MECHANICS & ORBITAL MANEUVERS

ORBITAL MECHANICS: Two-body motion-Circular, elliptic, hyperbolic, and parabolic orbits-Basic Orbital Elements-Ground Trace

ORBITAL MANEUVERS: In-Plane Orbit changes-Hohmann Transfer-Bi-elliptical Transfer-Plane Changes- Combined Maneuvers-Propulsion for Maneuvers

UNIT - III

ASCENT FLIGHT MECHANICS OF ROCKETS AND MISSILES

Two-dimensional trajectories of rockets and missiles-Multi-stage rockets-Vehicle sizing-Two stage Multi-stage Rockets Trade-off Ratios-Single Stage to Orbit- Sounding Rocket-Aerospace Plane-Gravity Turn Trajectories

UNIT - IV

ATMOSPHERIC REENTRY

Introduction-Steep Ballistic Reentry-Ballistic Orbital Reentry-Skip Reentry-"DoubleDip" Reentry - Aero-braking - Lifting Body Reentry

UNIT - V

SATELLITE ATTITUDE DYNAMICS

Torque free Axi-symmetric rigid body-Attitude Control for Spinning Spacecraft - Attitude Control for Non-spinning, Spacecraft - The Yo-Yo Mechanism – Gravity – Gradient Satellite-Dual Spin Spacecraft-Attitude Determination

TEXT BOOKS

1. W.E. Wiesel, "Spaceflight Dynamics", McGraw-Hill, 1997
2. Cornelisse, Schoyer HFR, Wakker KF, "Rocket Propulsion and Space flight dynamics", Pitman publications, 1984

REFERENCES

1. J.Sellers., "Understanding Space: An Introduction to Astronautics", McGraw- Hill, 2000.
2. Francis J Hale., "Introduction to Space Flight", Prentice-Hall, 1994.
3. Charles D. Brown., "Spacecraft Mission Design", AIAA Education Series, 1998.
4. Meyer Rudolph. X .,"Elements of Space Technology for Aerospace Engineers", Academic Press, 1999

VI SEMESTER

S402 - THEORY OF ELASTICITY

(Common to AE, ME)

Course Educational Objectives:

1. To understand the principles of elasticity theory and to find of stress in elastic stress analysis
2. To understand the displacement of simple beams
3. To acquire the knowledge analysis of linear elastic solids under mechanical loads.
4. To learn the Airy stress functions for 2-D plane stress and plane strain problems in Cartesian and cylindrical coordinate systems
5. To understand the stress functions for rectangular and circular cross-sectional cantilever beams.

Course Outcomes:

1. To analyze the equations of compatibility by using plane stress and plane strain conditions.
2. To apply Saint Venant's principles to determine the displacements of simple beams.
3. To analyze the stresses and strains in 3-Dimensional problems.
4. To solve the linear elasticity problems using various analytical techniques.
5. To analyze the vectors and tensors to enhance the theory of elasticity where ever necessary

UNIT - I

ELASTICITY: Two dimensional stress analysis - Plane stress - Plane strain - Equations of Compatibility - Stress function - Boundary conditions.

PROBLEM IN RECTANGULAR COORDINATES - Solution by polynomials - Saint Venant's principles -Determination of displacement - Simple beam problems.

UNIT - II

PROBLEMS IN POLAR COORDINATES - General equations in polar coordinates - Stress distribution symmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

UNIT - III

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS - Principle stresses – Homogeneous deformations – Strain at a point – Principal axes of strain - Rotation.

UNIT - IV

GENERAL THEOREMS: Differential equations of equilibrium and conditions of compatibility – Determination of displacement - Uniqueness of solution - Reciprocal theorem.

UNIT - V

BENDING OF PRISMATIC BARS - Stress function - Bending of cantilever beam - Beam of rectangular cross-section - Beams of circular cross-section.

TEXT BOOKS

1. Timoshenko, Goodier., Theory of Elasticity 6th Edition 2009 - McGraw Hill
2. A.I.Lurie, Theory of Elasticity., 4th Edition 2005-Springer Verlag New York, LLC

REFERENCES

1. Dr.Sadhu Singh., Applied stress analysis, Khanna Publishers
2. Dally and Riley., Experimental stress analysis, Mc Graw-Hill
3. LOVE .A.H., A treatise on Mathematical theory of Elasticity, Dover publications Inc
4. A.Meceri., Theory of Elasticity, Springer

VI SEMESTER

S247 - EXPERIMENTAL STRESS ANALYSIS

Course Educational Objectives:

1. To learn the stress transformation and stress equations in equilibrium.
2. To learn properties of strain gage and its circuits
3. To learn the mechanism formation of moiré fringe
4. To learn the methods in photo elasticity
5. To learn the bifringent coating of stress and strain

Course Outcomes:

CO1: To formulate equations of stress under equilibrium conditions
CO2: To apply the strain gage system for strain measurement on bodies acted upon forces
CO3: To apply and analyze the moiré fringe method in a stress field
CO4: To analyze the fringe pattern of materials using polariscope

UNIT - I

Stress: Stress at a point - Stress equations of Equilibrium - Laws of stress transformation - Principal stresses – Maximum Shear stress - Dimensional state of stress.

UNIT - II

Strain Measurement: Strain - its relation to experimental determination - properties of strain Gauge systems - Electrical resistance strain gauges - strain gauge circuits - recording instruments - analysis of strain gauge data.

UNIT - III

Moire Methods: Mechanism of formation of Moire fringe - geometrical approach to Moire fringe analysis - displacement field approach to Moire fringe analysis - out of plane measurements experimental procedure.

UNIT - IV

Photo Elasticity Methods: Temporary double refraction - stress optic law - effects of stressed model in a plane polariscope fringe multiplication - isochromatic fringe patterns - isoclinic fringe pattern compensation techniques – calibration methods - separation methods - scaling model to phototype stresses - materials.

UNIT - V

Birefrigent Coatings: Coating stresses and strains - sensitivity - materials and applications - effect of thickness - stress separation.

TEXT BOOK

1. James Dalley, W.F.Riley, Experimental Stress Analysis, McGraw Hill
2. Sadhusingh, Experimental Stress Analysis, Khanna Publisher

REFERENCES

1. Dove Adams, Experimental Stress Analysis, McGraw Hill
2. Primer, Perry Lissiener, Strain Gauge, McGraw Hill
3. Durelli, Photomechanics, Prentice Hall

VI SEMESTER

S260 - HELICOPTER AERODYNAMICS

Course Educational Objectives

1. To learn the function of various parts of Helicopter
2. To learn the rotor theories and power requirements of helicopter motion
3. To learn the Lift, propulsion and control of V/STOL aircrafts
4. To learn about the fundamental of hover craft dynamics

Course Outcomes:

CO1: To analyze the performance various components of helicopter
CO2: To analyze the performance of V/STOL aircrafts
CO3: To analyze the ground effects of various vehicles

UNIT – I

ELEMENTS OF HELICOPTER AERODYNAMICS: Configurations based on torque reaction-Jet rotors and compound helicopters- Methods of control – Collective and cyclic pitch changes - Lead - Lag and flapping hinges.

UNIT – II

IDEAL ROTOR THEORY: Hovering performance - Momentum and simple blade element theories - Figure of merit - Profile and induced power estimation - Constant chord and ideal twist rotors.

UNIT – III

POWER ESTIMATES: Induced, profile and parasite power requirements in forward flight-performance curves with effects of altitude-Preliminary ideas on helicopter stability

UNIT – IV

LIFT, PROPULSION AND CONTROL OF V/STOL AIRCRAFT: Various configuration - Properller, rotor, ducted fan and jet lift - Tilt wing and vectored thrust - Performance of VTOL and STOL aircraft in hover, transition and forward motion.

UNIT – V

GROUND EFFECT MACHINES: Types - Hover hieight, lift augmentation and power calculations for plenum chamber and peripheral jet machine - Drag of hovercraft on land and water. Applications of hovercraft.

REFERENCES

1. Gessow, A., Myers, Aerodynamics of Helicopter, G.C MacMillan & Co., N.Y. 1987.
2. McCormick, B.W., Aerodynamics of V/STOL Flight, Academic Press, 1987.
3. Johnson, W., Helicopter Theory, Princeton university Press, 1980.
4. McCormick, B.W., Aerodynamics, Aeronautics & Flight Mechanics, John Wiley, 1995.
5. Gupta, L., Helicopter Engineering, Himalayan Books, 1996.

VI SEMESTER

S159 - COMBUSTION

Course Educational Objectives

1. To learn the combustion process in aircraft piston engine
2. To learn the combustion phenomenon in gas turbine combustion chamber
3. To learn the combustion aspects in solid and liquid propellant rockets
4. To learn the basics of supersonic combustion

Course Outcomes

CO1: To analyze the various factors effecting the combustion process in aircraft engines-piston and jet engines
CO2: To analyze the various combustion models of rocket engines
CO3: To analyze the reaction and mixing process in supersonic combustion

UNIT - I

Fundamental Concepts: Thermo chemical equations - Heat of reaction first order, second order and third order reactions – premixed flames - Diffusion flames - Measurement of burning velocity - Various methods - Effect of various parameters on burning velocity - Flame stability - Detonation - Deflagration - Rankine - Hugoniot curve - Radiation by flames.

UNIT - II

Combustion in Aircraft Piston Engine: Introduction to Combustion in Aircraft Piston Engines, Various Factors affecting the combustion Efficiency, Fuels used for Combustion in Aircraft Piston Engines and their Selection, Detonation in Piston Engine Combustion and The Methods to Prevent the Detonation

UNIT - III

Combustion in Gas Turbines Engines: Combustion in gas turbine combustion chambers - Re-circulation - Combustion efficiency - Factors affecting combustion efficiency - Fuels used for gas turbine combustion chambers - Combustion stability – Ramjet Combustion, Flame holder types

UNIT - IV

Combustion in Rockets: Solid propellant combustion - Double base and composite propellant combustion - Various combustion models -Combustion in liquid rocket engines - Single fuel droplet combustion model - Combustion in hybrid rockets.

UNIT - V

Supersonic Combustion: Introduction to Supersonic combustion, Need for supersonic combustion for hypersonic airbreathing propulsion, Supersonic combustion controlled by diffusion and heat convection - Analysis of reaction and mixing processes - Supersonic burning with detonation shocks.

REFERENCES

1. Sharma,S.P., Chandra Mohan, Fules and Combustion, Tata McGraw Hill Publishing Co., Ltd., New Delhi 1987.
2. Mathur, M., Sharma, R.P., Gas turbines and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1988.
3. Loh, W.H.T., Jet Rocket, Nuclear, Ion and Electric Propulsion Theory and Design, Springer Verlag, New York 1982
4. Beer, J.M., Chigier, N.A.Combustion Aerodynamics, Applied Science Publishers Ltd., London, 1981.
5. Chowdhury,R., Applied Engineering Thermodynamics, Khanna Publishers, New Delhi, 1986
6. Sutton, G.P., Rocket Propulsion Elements, John Wiley and Sons, Inc., New York, 1993.
7. D.P Mishra, Fundamentals of Combustion**,** PHI Learning Pvt. Ltd., 2008

VI SEMESTER

S404 - THEORY OF PLATES AND SHELLS

Course Educational Objectives

1. To learn the methods to solve the plates with various shapes
2. To learn types of shell structures in aerospace vehicles

Course Outcomes

CO1: To analyze the stability of rectangular plates under various loading conditions
CO2: To analyze the circular cylindrical shells under various loading conditions

UNIT - I

CLASSICAL PLATE THEORY: Plate Structures in aerospace vehicles-Classical Plate Theory– Assumptions – Differential Equation – Boundary Conditions, different Loads

UNIT - II

PLATES OF VARIOUS SHAPES: Navier's Solution and energy method- Rectangular and circular plates with various end conditions – Levy's Method of Solution for Rectangular Plates under Different Boundary Conditions.

UNIT - III

EIGEN VALUE ANALYSIS: Stability and free Vibration Analysis of Rectangular Plates.

UNIT - IV

APPROXIMATE METHODS: Rayleigh – Ritz, Galerkin Methods– Finite Difference Method – Application to Rectangular Plates for Static, Free Vibration and Stability Analysis.

UNIT - V

SHELLS: Shell structures in aerospace vehicles- Basic Concepts of Shell Type of Structures – Membrane analysis and Bending Theories forCircular Cylindrical Shells.

TEXT BOOKS:

1. Timoshenko, S.P. Winowsky. S., Kreger, "Theory of Plates and Shells", McGraw-Hill Book Co. 1990.
2. K. Chandrashekhara, "Theory of Plates", University of Press,2001.

REFERENCES

1. T. K. Varadan, K. Bhaskar, "Theory of Plates and Shells",1999, Narosa .
2. Flugge, W. "Stresses in Shells", Springer – Verlag, 1985.
3. Timoshenko, S.P. and Gere, J.M., "Theory of Elastic Stability", McGraw-Hill Book Co. 1986

VI SEMESTER

S114 - AERO ELASTICITY

Course Educational Objectives

1. To learn the phenomenon of aero elasticity in aircraft
2. To learn the theories and solutions to understand the aeroelastic problems

Course Outcomes

CO1: To analyze the effects of vortex induced vibration on components of an aircraft
CO2: To design the aircraft components by considering effects of flow induced vibration

UNIT - I

AEROELASTICITY PHENOMENA: Vibration of Beams due to Coupling and Torsion, The Aero-elastic Triangle of Forces, Stability versus Response Problems, Aeroelasticity in Aircraft Design, Vortex Induced Vibration

UNIT - II

DIVERGENCE OF A LIFTING SURFACE: Simple Two Dimensional Idealizations, Strip Theory, Fredholm Integral Equation of the Second Kind, Exact solutions for simple rectangular wings, Semirigid assumption and approximate solutions, Generalized coordinates, Successive approximations, Numerical approximations using matrix equations.

UNIT - III

STEADY STATE AEROELASTIC PROBLEMS: Loss and reversal of aileron control, Critical aileron reversal speed, Aileron efficiency, Semirigid theory and successive approximations, Lift distributions, Rigid and elastic wing.

UNIT - IV

FLUTTER PHENOMENON: Non-dimensional parameters, Stiffness criteria, Dynamic mass balancing, Model experiments, Dimensional similarity, Flutter analysis, Two dimensional thin airfoils in steady incompressible flow, Quasi-steady aerodynamic derivatives, Galerkin method for critical speed, Stability of distributed motion, Torsion flexure flutter, Solution of the flutter determinant, Methods of determining the critical flutter speeds, Flutter prevention and control.

UNIT - V

AEROELASTIC PROBLEMS IN CIVIL AND MECHANICAL ENGINEERING: Galloping of transmission lines and flow induced vibrations of tall slender structures and suspension bridges.

TEXT BOOKS:

1. Fung, Y.C., An Introduction to the Theory of Aeroelasticity , John Wiley & Sons Inc., New York 1985.
2. Broadbent, E.G., Elementary Theory of Aeroelasticity, BunHill Publications Ltd., 1986.

REFERENCES

1. Bisplinghoff., R.L., Ashley, H., Halfmann, R.L., Aeroelasticity , Addison Wesley Publishing Co., Inc., II ed, 1987.
2. Scanlan, R.H.,Rosenbaum, R., Introduction to the Study of Aircraft Vibration and Flutter, MacMillan Co., N.Y., 1991.

VI SEMESTER

L104 - AIRCRAFT STRUCTURES LAB

Course Educational Objectives:

- The understand and appreciate various principles and theorems involved in the theory of aircraft structures, vibrations and experimental analysis by doing simple and advanced experiments and analyzing the results.
- To study different types of beams and columns subjected to various types of loading and support conditions with particular emphasis on aircraft structural components.

Course Outcomes:

- To analyze beam structures subjected to different loading conditions
- To analyze deflection based on different theories
- To analyze the performance of cams, governors, gyroscope

Any of the 10 Experiments are required to be conducted

1. To determine gyroscopic couple on Motorized Gyroscope
2. To find the stability and sensitivity of Watt and Porter governor
3. Balancing of rotating and reciprocating masses
4. To determine the time period for simple and compound pendulum
5. To determine the time period by using Bi-filar suspension
6. Shear Failure of Bolted and Riveted Joints
7. To find the transverse vibrations of free-free and cantilever beam
8. Forced Vibration of Beams
9. Combined Bending and Torsion of a Hollow Circular Tube
10. Bending Modulus of a Sandwich Beam
11. Unsymmetrical Bending of a Cantilever Beam
12. Determination of Material Fringe Constant of a Photo Elastic Model
13. Determination of Shear Center of a Channel Section
14. Wagner beam-Tension Field beam
15. Buckling Load of Slender Eccentric Columns
16. Determination of Material Properties of a Composite Laminate
17. Construction of South – well's plot.
18. Verification of Maxwell's Reciprocal theorem
19. Verification of Castigliano's theorem
20. Verification of Superposition Theorem

VI SEMESTER

L173 - PROPULSION LAB

Course Educational Objectives:
To learn the various basic experiments related to components of jet engines and piston engines

Course Outcomes:
CO1: To analyze the performance of various jet engines components
CO2: To analyze the performance of piston engine components

Any of the 10 Experiments are required to be conducted

1. Study of free jet
2. Study of wall jet
3. Study of free convective heat transfer over a flat plate
4. Study of forced convective heat transfer over a flat plate
5. Study of an aircraft jet engine - assembly of sub systems
6. Cascade testing of a model of axial compressor blade row
7. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
8. Study of an aircraft jet engine - various components, their functions and operating principles
9. Study of Properties of aviation fuel
10. Flame stabilization Studies using Conical Flame Holders
11. Burnrate measurements of Solid propellant
12. Study of performance of a propeller
13. Combustion performance studies in a jet engine combustion chamber
14. Study of Co-axial jet
15. Studies on cross-flow
16. Studies on Subsonic Inlets
17. Studies on Supersonic Inlets
18. Study of ramjet

VII SEMESTER

S405 - THEORY OF VIBRATIONS

Course Educational Objectives:

1. To construct a free body diagram and write the differential equations of motion of vibratory system to find natural frequency.
2. To learn the effects of damped free vibrations of single degree of freedom systems.
3. To understand the forced vibrations of unbalanced system and knowing about isolators, vibration measuring instruments.
4. To learn about the two degree of freedom systems of forced vibrations with harmonic excitation.
5. To learn about multi degree of freedom systems by applying exact analysis, influence coefficients and numerical methods.

Course Outcomes:

CO1: To formulate mathematical models for mechanical systems using mass, spring and dampers
CO2: To analyze the systems with damped free vibrations single degree of freedom
CO3: To develop a single degree of freedom forced vibrating mechanical system under various types of excitation conditions
CO4: To analyze and modify two degree of freedom mechanical systems
CO5: To analyze and design mechanical systems of multi degrees of freedom

UNIT - I

Undamped free vibrations of single degree of freedom systems: Introduction- Differential equation – Solution of differential equation - Torsional vibrations – Equivalent stiffness of spring combinations - Springs in series – Springs in parallel – Natural frequency of a vibration system by energy method.

UNIT - II

Damped free vibrations of single degree of freedom systems: Introduction – Different types of dampings – Free vibrations with viscous damping – Over damped, critically damped and under damped systems - Logarithmic decrement – Viscous dampers

UNIT - III

Forced vibrations of single degree of freedom systems: Introduction – Forced vibrations with constant harmonic excitation – Steady state vibrations – Forced vibration with rotating and reciprocating unbalance -Forced vibrations due to excitation of the support –Vibration isolation and transmissibility - Typical isolators and mount types – vibration measuring instruments

UNIT - IV

Two degrees of freedom systems: Introduction – Principal modes of vibrations – Other cases of simple two degrees of freedom systems – Two masses fixed on a tightly stretched string - Double pendulum – Torsional system – Undamped forced vibrations with harmonic excitation -Undamped dynamic vibration absorber

UNIT - V

Multi degree of freedom systems - Exact analysis- Undamped free vibrations of a multi degree of freedom system – Influence coefficients – Flexibility coefficients and Maxwell reciprocal theorem – Torsional vibrations of multi rotor systems – Vibrations of geared systems - Numerical method – Determination of natural frequency of vibration by Rayleigh's method.

TEXT BOOK

1. G.K.Grover, Mechanical vibrations, Nem chand & Bros.
2. V.P.Singh, Mechanical vibrations, Dhanpat Rai & Sons.

REFERENCES

1. W.T.Thomson, Theory of vibrations, CBS Publishers.
2. William W.Seti, Mechanical vibrations, Schaum outline series
3. S.S.Rao, Mechanical Vibrations, Pearson Education

VII SEMESTER

S329 - OPERATIONS RESEARCH

(Common to AE, CSE, IT, ME)

Course Educational Objectives:

1. To learn the linear programming techniques
2. To learn the transportation techniques
3. To learn the game theory
4. To learn about the queuing theory
5. To learn the scheduling and sequencing techniques in the production plant

Course Outcomes:

CO1: To understand the usage Linear programming for the optimum allocation of limited resources such as men, machines, materials and capital.

CO2: To solve transportation problems to minimize cost and understand the principles of assignment of jobs and recruitment polices.

CO3: To Solve game theory problems.

CO4: To apply Queuing theory to solve problems of traffic congestion, counters in banks, railway bookings etc.

CO5: To solve problems of Scheduling and sequencing of production runs and develop proper inventory policies to control construction of dams, bridges, roads etc in a optimal way.

UNIT – I

INTRODUCTION: Operations Research, operations research models, applications, Linear Programming Problem Formulation, Graphical solution, Simplex method, Two Phase simplex

UNIT – II

TRANSPORTATION PROBLEM: Formulation, Optimal solution, unbalanced transportation problem, Degeneracy. Assignment problem, optimal solution, Variants of Assignment Problem-Traveling Salesman problem.

UNIT – III

THEORY OF GAMES: Minimax (maximin) Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, 2 X 2 games – dominance principle – m X 2 & 2 X n games, and graphical method.

INVENTORY CONTROL: EOQ model, Shortages not allowed, Deterministic models, Probabilistic models, Price breaks

UNIT – IV

THEORY OF REPLACEMENT: Introduction, Replacement of Equipment that Deteriorates Gradually, Replacement of Equipment that fails suddenly, Group Replacement.

WAITING LINES: Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT – V

Dynamic Programming: Bellman's Principle of optimality, Applications of dynamic programming, capital budgeting problem, linear programming problem.

IntroductiontoOptimization: Introduction, Engineering Applications of Optimization, Problem Statement – Design Vector, Design Constraints, Constraint surface, Objective function, Objective function Surfaces. Classification of optimization problems, Optimization Techniques – Introduction, Single-variableOptimization.

TEXT BOOKS

1. Kantiswarup. P.K.Gupta, Man Mohan, Operations Research, Sultan Chand& Sons, Educational Publications, New Delhi, 14th Edition, 2008.
2. Hiller, Libermann, Introduction to O.R (TMH), 9TH EDITION, 2009

REFERENCES

1. Singiresu S Rao, Engineering Optimization: Theory and Practice, A Wiley- Interscience Publication, 4th edition,2009.
2. A.M.Natarajan, P.Balasubramani, A. Tamilarasi,Operations Research, Pearson Education, 2nd edition, 2014.
3. Taha, Introduction to O.R .PHI, 9th edition, 2010.

VII SEMESTER

S275 - INSTRUMENTATION, MEASUREMENTS AND EXPERIMENTS IN FLUIDS

Course Educational Objectives:

1. To learn the need of experimentation and wind tunnel techniques
2. To learn about the theory of flow visualization techniques and analogue methods
3. To learn the working principle of various velocity measurement instruments
4. To learn the working of various pressure and temperature measurement instruments
5. To learn about principle data acquision and uncertainty estimation of measured data

Course Outcomes:

CO1: To employ the wind tunnels for aerodynamic testing of bodies
CO2: To employ the flow visualization techniques to analyze high-speed flow field
CO3: To employ different instruments to measure velocity of fluid flow
CO4: To employ pressure and temperature measurement instruments in fluid flow studies
CO5: To acquire the experimental data and to estimate uncertainty in measured values during experimentation

UNIT - I

Need and Objective of Experimental Study: Introduction, Measurement Systems, Performance Terms

Wind Tunnels: Introduction, Classification, Low-speed Wind Tunnels, Power Losses in Wind Tunnel, Energy Ratio, High-speed Wind Tunnels, Instrumentation and Calibration of Wind Tunnels, Wind Tunnel Balance-Wire Balance, Strut-Type, Platform Type, Yoke Type, Strain-Gauge Balance, Balance Calibration

UNIT - II

Flow Visualization and Analog Methods: Introduction, Classification of Visualization Techniques, Smoke Tunnel, Interferometer, Schlieren and Shadowgraph, Hele-Shaw Apparatus, Electrolytic Tank, Hydraulic Analogy, Hydraulic Jumps

UNIT - III

Velocity Measurement: Introduction, Velocity & Mach number from pressure measurements, Laser droplet anemometer- LDA Principle, Doppler shift equation, Reference beam system, Fringe system. Measurement of velocity by Hot-Wire Anemometer- Constant Current Hot-Wire Anemometer (CCA), Constant Temperature Hot-Wire Anemometer, Hot-Wire Probes, Limitations of Hot-Wire Anemometer, Measurement of velocity using vortex shedding Technique, Fluid Jet Anemometer

UNIT - IV

Pressure Measurement Techniques: Introduction, Barometers, Manometers, Dial type pressure gauge, Pressure Transducers, Pitot, Static, and Pitot-Static Tube and Its characteristics, Flow direction measurement probes and Low Pressure Measurement Gauges

Temperature measurement: Introduction, Types of thermometers, Thermocouples, RTD, Thermisters, Pyrometers, Temperature measurement in fluid flows

UNIT - V

Data Acquisition: Introduction, Data Acquisition Principle, Generation of Signal, Signal Conditioning, Multiplexing, Data Conversion, Data Storage and Display, Data Processing, Digital Interfacing, Data Acquisition using Personal Computers

Uncertainty Analysis: Introduction, Estimation of measurement errors, External estimation of errors, Internal estimate of the error, Uncertainty Analysis- Uses of uncertainty analysis, Uncertainty estimation, General procedure- Uncertainty in flow Mach number, Uncertainty calculation

TEXT BOOK

E. Rathakrishnan, Instrumentation, Measurements and Experiments in Fluids, CRC press, 2007.

REFERENCES

1. Jack Philip Holman, Walter J. Gajda, Experimental methods for Engineers, Edition: 4, McGraw-Hill, 1984.
2. Rae, W.H. and Pope, A., Low Speed Wind Tunnel Testing, John Wiley Publication,1984.
3. Pope, A., Goin, L., High Speed Wind Tunnel Testing, John Wiley, 1985.
4. Ernest Doebelin, Measurement Systems, McGraw Hill Professional, 2003.
5. Thomas G. Beckwith, Mechanical Measurements, Nelson Lewis Buck, Edition: 5, Addison- Wesley Pub. Co., 1961.

VII SEMESTER

S281 - INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS

Course Educational Objectives:

1. To learn the basic governing equations of fluid dynamics
2. To learn mathematical behaviour of partial differential equations
3. To learn the phenomena of various discretization techniques
4. To learn the techniques to solve the simple incompressible flow problems
5. To learn the basic techniques to solve simple heat transfer problems

Course Outcomes:

CO1: To formulate the basic fluid dynamics problem mathematically
CO2: To analyze the mathematical behaviour of partial differential equations
CO3: To apply the grid generation principles for different problems.
CO4: To solve elementary incompressible fluid problems using the CFD techniques
CO5: To solve the elementary heat transfer problems using the CFD techniques

UNIT - I

Introduction: Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics

Governing Equations of Fluid Dynamics: Introduction, Control Volume, Substantial Derivative, Divergence of Velocity, Continuity Equation, Momentum Equation and Energy Equation, Conservation and Non-conservation forms

UNIT - II

Mathematical Behavior of Partial Differential Equations:

Introduction, Classification of Quasi-Linear Partial Differential Equations, Eigen Value Method, Hyperbolic Equations, Parabolic Equations, Elliptic Equations

UNIT - III

Basics Aspects of Discretization: Introduction, Introduction of Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation

UNIT - IV

Incompressible Fluid Flow: Introduction, Implicit Crank-Nicholson Technique, Pressure Correction Method, Computation of Boundary Layer Flow

UNIT - V

Heat Transfer: Finite Difference Applications in Heat conduction and Convention – Heat conduction, steady heat conduction, in a rectangular geometry, transient heat conduction, Finite difference application in convective heat transfer.

TEXT BOOK

1. John. D. Anderson, Computational fluid dynamics - Basics with applications, Mc Graw Hill.

REFERENCES

1. Anderson, D.A.,Tannehill, I.I., and Pletcher, R.H.,Taylor and Francis, Computational Fluid Mechanics and Heat Transfer, CRC Press
2. Suhas V. Patankar, Numerical heat transfer and fluid flow, Butter-worth Publishers
3. T. K Sengupta, Fundamentals of Computational Fluid Dynamics, University Press

VII SEMESTER

S149 - BOUNDARY LAYER THEORY

Course Educational Objectives:

1. To learn the fundamental equations governing the viscous fluid flow phenomenon
2. To learn the solutions of various viscous flow problems
3. To learn the basic formulations of laminar boundary layer
4. To learn the basic aspects of turbulent boundary layer over objects
5. To learn the elementary aspects of compressible boundary layer

Course Outcomes:

CO1: To apply the viscous flow equations to solve fluid flow problems
CO2: To analyze laminar and turbulent boundary layer flow fields

UNIT - I

Fundamental Equations of Viscous Flow: Fundamental Equations of Viscous Flow, Conservation of Mass, Conservation of Momentum-Navier-Stokes Equations, Energy equation, Dimensional Parameters in Viscous Flow, Non dimensionalising the Basic Equations and Boundary conditions

UNIT - II

Solutions of Viscous Flow Equations: Couette Flows, Hagen-Poiseuille Flow, Flow between Rotating concentric Cylinders, Combined Couette-Poiseuille Flow between Parallel Plates, Creeping Motion, Stokes Solution for an Immersed Sphere, Development of boundary layer - Estimation of boundary layer thickness-Displacement thickness, momentum and energy thickness for two-dimensional flows

UNIT - III

Laminar Boundary Layer: Laminar boundary layer equations, Flat Plate Integral analysis of Energy equation, flow separation - Blasius solution for flat-plate flow –Falkner-Skan Wedge flows - Boundary layer temperature profiles for constant plate temperature – Integral equation of Boundary layer - Pohlhausen method - Thermal boundary layer calculations

UNIT - IV

Turbulent Boundary Layer: Turbulance-physical and mathematical description, Two-dimensional turbulent boundary layer equations - Velocity profiles - The law of the wall - The law of the wake - Turbulent flow in pipes and channels - Turbulent boundary layer on a flat plate - 'Boundary layers with pressure gradient, Eddy viscosity, Mixing length, Turbulence modeling

UNIT - V

Compressible Boundary Layer: Compressible boundary layer equation, Recovery factor, similarity solutions, laminar supersonic cone rule, shock-boundry layer interaction.

REFERENCES

1. White, F.M.,"Viscous Fluid Flow" , McGraw Hill Book Co.,Inc., New York, 1985
2. Reynolds, A.J., " Turbulent Flows in Engineering " , John Wiley & Sons, 1980.
3. Panton, R.L., " Incompressible Flow ", John Wiley and Sons, 1984.
4. Anderson, J.D., " Fundmentals of Aerodynamics " , McGraw Hill Book Co., Inc., New York, 1985.
5. Schlichting, H., " Boundary Layer Theory ", McGraw Hill New York, 1979.

VII SEMESTER

S358 - PROPELLANT TECHNOLOGY

Course Educational Objectives:

1. To know the properties of liquid fuels
2. To know the properties of various solid propellants
3. To learn the properties of liquid propellants
4. To learn the properties of cryogenic propellants
5. To know the testing procedures and facilities of propellants

Course Outcomes:

CO1: To analyze the characteristics of solid propellant composites used in rocket propulsion
CO2: To analyze the characteristics of liquid propellants used in rocket propulsion
CO3: To analyze the properties of cryogenic propellants
CO4: To test the propellants to estimates their characteristics

UNIT - I

LIQUID FUELS

Properties and tests for petroleum products - Motor gasoline - Aviation gasoline - Aviation turbine fuels – Requirements Of aviation fuels of kerosene type and high flash point type - Requirements for fuel oils.

UNIT - II

SOLID PROPELLANTS

Single base propellants - Double base propellants - Composite propellants – CMBD propellants - Metallized composite propellants, Introduction to different fuels and oxidizers of composite propellants – Brief introduction to composite theory of Composite and double base propellants, Combustion Instabilities and their classification,Classification of Solid Propellant Grains Shapes.

UNIT - III

LIQUID PROPELLANTS

Classification- Mono Propellants, Bi- Propellants, Non Hypergolic and Hypergolic Systems, Gel Propellants systems, Various Tank Configurations, Tank Ullage, Propellant Slosh, Ignition Delay, Performance of selected Bipropellant systems.

UNIT –IV

CRYOGENIC PROPELLANTS

Introduction to Cryogenic Propellants, Storage and Handling, Geysering Phenomenon, Elimination of Geysering Effect in Missiles

UNIT - V

PROPELLANT TESTING

Laboratory testing - Arc Image Furnace - Ignitability studies - Differential Thermal Analysis - Thermo-gravimetric Analysis - Particle size measurement Micro-merograph - Strand burner tests impulse bomb - Performance estimation.

TEXT BOOKS

1. Cornelissse, J.W., Rocket Propulsion and Space Dynamics, J.W. Freeman & Co., Ltd., London,1980.
2. Panrner, S.F. Propellant Chemistry, Reinhold Publishing Corp., N.Y 1985.
3. Sutton, G.P., Rocket Propulsion Elements, John Wiley, 1993.

REFERENCES

1. Sharma, S.P., Mohan .C., Fuels and Combustion, Tata McGraw Hill Publishing Co,Ltd., 1984
2. Mathur, M., Sharma, R.P., Gas Turbine and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1988.

VII SEMESTER

S124 - AIRFRAME REPAIR AND MAINTENANCE

Course Educational Objectives:

1. To learn the welding and sheet metal repair methodologies in aircraft structural components
2. To learn the maintenance and repair of plastic and composite components of aircraft
3. To learn the trouble shooting and maintenance practices of hydraulic and pneumatic systems in aircraft
4. To learn the safety practices followed in aircraft operation

Course Outcomes:

CO1: To employ the welding and sheet metal repair techniques for an aircraft
CO2: To employ the techniques to repair the plastics and composite components in an aircraft
CO3: To employ trouble shooting and maintenance practices of hydraulic and pneumatic systems in aircraft
CO4: To employ safety practices need in aircraft operation

UNIT - I

WELDING IN AIRCRAFT STRUCTURAL COMPONENTS: Equipments used in welding shop and their maintenance – Ensuring quality welds –Welding jigs and fixtures – Soldering and brazing.

SHEET METAL REPAIR AND MAINTENANCE: Inspection of damage – Classification – Repair or replacement – Sheet metal inspection – N.D.T. Testing – Riveted repair design, Damage investigation – reverse technology.

UNIT - II

PLASTICS AND COMPOSITES IN AIRCRAFT: Review of types of plastics used in airplanes – Maintenance and repair of plastic components – Repair of cracks, holes etc., various epair schemes – Scopes.Inspection and Repair of composite components – Special precautions – Autoclaves.

UNIT - III

AIRCRAFT JACKING, ASSEMBLY AND RIGGING: Airplane jacking and weighing and C.G. Location. Balancing of control surfaces –Inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

UNIT - IV

REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM: Trouble shooting and maintenance practices – Service and inspection. – Inspection and maintenance of landing gear systems. – Inspection and maintenance of air-conditioning and pressurisation system, water and waste system. Installation and maintenance of Instruments – handling – Testing – Inspection. Inspection and maintenance of auxiliary systems – Fire protection systems – Ice protection system – Rain removal system – Position and warning system – Auxiliary Power Units (APUs)

UNIT - V

SAFETY PRACTICES: Hazardous materials storage and handling, Aircraft furnishing practices – Equipments. Trouble shooting - Theory and practices.

REFERENCES

1. KROES, WATKINS, DELP, “Aircraft Maintenance and Repair”, McGraw-Hill, New York, 1992.
2. LARRY REITHMEIR, “Aircraft Repair Manual”, Palamar Books, Marquette, 1992.
3. BRIMM D.J. BOGGES H.E., “Aircraft Maintenance”, Pitman Publishing corp. New York, 1940

VII SEMESTER

S387 - SPACE MECHANICS

Course Educational Objectives:

1. To learn basic aspects of space and solar system
2. To learn the Satellite injection and its orbit perturbations
3. To learn the interplanetary trajectory issues
4. To learn the ballistic missile trajectories and material used of spacecraft

Course Outcomes:

CO1: To understand the basic aspects of space
CO2: To apply N-body aspects in space exploration issues
CO3: To know the general aspects satellite injection and orbit perturbations
CO4: To evaluate interplanetary trajectories of spacecrafts
CO5: To evaluate trajectory details of ballistic missiles

UNIT - I

BASIC CONCEPTS: 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: Lagrange – Jacobian Identity –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: 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: Two Dimensional Interplanetary rajectories –Fast Interplanetary Trajectories – Three Dimensional Interplanetary Trajectories – Launch if interplanetary Spacecraft – Trajectory about the Target Planet.

UNIT - V

BALLISTIC MISSILE TRAJECTORIES AND MATERIALS: 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.

TEXT BOOKS

1. W.E. Wiesel, "Spaceflight Dynamics", McGraw-Hill, 1997
2. Cornelisse, Schoyer HFR, Wakker KF, "Rocket Propulsion and Space Flight Dynamics", Pitman publications, 1984

REFERENCES

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley, 1993.
2. Van de Kamp, P., "Elements of Astro-mechanics", Pitman, 1979.
3. Parker E.R., "Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc.,1982.
4. Vladimir A. Chobotov, "Orbital Mechanics", AIAA Education Series, AIAA Education Series, Published by AIAA, 2002
5. David.A. Vellado, Microcosm, Kluwer, "Fundamentals of Astrodynamics and Applications", 2001

VII SEMESTER

S154 - CAD/CAM
(Common to AE, ME)

Course Educational Objectives

- To Learn about basic principles of CAD/CAM.
- To Known about geometrical modelling and representation of curves, surfaces and solids.
- To Gain the knowledge about part programming and CNC machines.
- To Learn about GT coding and Flexible manufacturing systems.
- To Learn about CAQC and computer integrated manufacturing.

Course Outcomes

- To understand requirement of CAD in design process.
- To design different types of models by using Geometrical modelling.
- To generate codes for part profiles and can accomplish machining.
- To analyze the part families by applying GT coding system.
- To apply CAQC techniques in manufacturing.

UNIT - I

Fundamentals of CAD: Introduction – The design process – The application of computers for design- Engineering data management– Benefits of CAD.

Computer Graphics: Raster scan graphics-Coordinate systems-Database structure for graphics modeling-Transformation of geometry: Translation, scaling, reflection, rotation, homogeneous transformations Concatenated transformations.

UNIT – II

Geometric Modeling: **Representation of curves**: Introduction, wireframe models, wireframe entities, curve representation, parametric representation of analytical curves, parametric representation of Bezier and B-Spline curves.

Representation of surfaces and solids: Introduction to surfaces, surface models surface entities. Introduction to solids, solid models, solid entities, Fundamentals of solid modeling, Boundary representation, CSG representation, sweep representation.

UNIT – III

Computer Numerical Control: Introduction – NC modes – NC elements -NC Coordinate systems – Structure of CNC Machine Tools – Spindle design –Spindle drives – Feed drives – actuation systems.

Part Programming: Part programming Fundamentals – Manual part programming- computer aided part programming: APT Language.

UNIT - IV

Group Technology: Introduction – part families – part classifications and coding – OPITZ system – MICLASS system – CODE system – GT Machine cells – Benefits of GT – CAPP: Retrieval type and generative type

Flexible Manufacturing system: Introduction – FMS components – Benefits of FMS – FMS planning and implementation Issues.

UNIT - V

Computer Aided Quality Control: Introduction –computers in QC – Contact Inspection methods – Non contact inspection methods: optical, non optical –Computer Aided Testing-Integration of CAQC with CAD/CAM.

Computer Integrated Manufacturing Systems: Introduction–Integration-CIM implementation – Benefits of CIM – Lean manufacturing.

TEXT BOOKS

1. Mikel P.Groover, Emory W.Zimmers, CAD/CAM- Prentice Hall of India private Ltd.New Delhi, 20th Edition, May 2010.
2. Ibrahim Zeid, Mastering CAD/CAM, TATA McGraw-Hill publishing CO.Ltd, New Delhi2011.

REFERENCES

1. PN Rao, CAD/CAM Principle and applications, Tata McGraw Hill Education Private Ltd,New Delhi,8th edition 2013.
2. P.Radhakrishnan, S.Subramanyam, V.Raju,CAD/CAM/CIM,New Age International Publishers, 3rd edition 2010.
3. Mikel P.Groover, Automaiton, Production Systems and Computer Integrated Manufacturing, Prentice Hall of India private Ltd.New Delhi, 3rd edition, May 2008.
4. Ibrahim Zeid, R. Sivasubramanian, CAD/CAM theory and practice, Tata McGraw Hill publishing Co. Ltd,New Delhi 2009.
5. Tien-Chien chang, Richard A.Wysk and HSU-Pin (Ben) Wang, "Computer Aided Manufacturing",3rd edition, 2006
6. Michael E.Mortenson,"Geometric Modelling", John Wiley and sons, Inc.
7. James D.Foley, Andries Van Dam, Steven K.Feiner, John F. Hughes, "Computer Graphics Principles and Practice", Addison-Wiley publishing Company,2nd Edition 2007.

VII SEMESTER

S289 - LINEAR CONTROL SYSTEMS

Course Educational Objectives:

The objective of this course is to introduce the principles and applications of control systems in day to day life, the basic concepts of block diagram, Signal flow graph, state space representation of system, time domain analysis, solutions to time invariant systems .It also deals with different aspects of stability analysis of systems in frequency and time domains.

Course Outcomes

After completion of the course, students will able to:

CO1. Analyze electromechanical systems by mathematical modeling.
CO2. Determine Transient and Steady State behavior of systems using standard test signals.
CO3. Analyze linear systems for steady state errors, absolute stability and relative stability
CO4. Identify and design a control system to satisfy given requirements.

UNIT – I

INTRODUCTION

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems, Effects of feedback. Mathematical models – Differential equations, Transfer functions – Translational and Rotational mechanical systems, - Block diagram representation of systems -Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT-II

TIME RESPONSE ANALYSIS

Standard test signals - Time response of first order systems – Time response of second order systems - Time domain specifications - Steady state errors and error constants.

UNIT-III

FREQUENCY RESPONSE ANALYSIS

Introduction, Frequency domain specifications, Polar Plots -Bode diagrams-Determination of Frequency domain specifications from the Bode Diagram- Nyquist Plots.

UNIT – IV

STABILITY ANALYSIS

The concept of stability – R-H Criteria, The root locus concept - construction of root loci- Stability Analysis from Bode Plots and Nyquist Plots. PID Controllers.

UNIT – V

STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability

TEXT BOOKS

1. B. C. Kuo , "Automatic Control Systems" John wiley and son's ,8th edition, 2003..
2. I. J. Nagrath, M. Gopal, "Control Systems Engineering", New Age International (P) Limited Publishers,2nd edition.

REFERENCES

1. Katsuhiko Ogata , "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. Richard C Dorf, Robert H Bishop, Modern Control Systems , 8th edition, Prentice Hall(Pearson education, Inc.), New Delhi 2003.

VII SEMESTER

S372 – ROBOTICS
(Common to AE, ME)

Course Educational Objectives:
To familiarize the students with
1. Basics of robots and various types of gripper
2. Rotation matrices and D-H representation
3. Fundamentals of robot dynamics
4. Path and trajectory planning of robots
5. Various sensors used in robots and industrial applications of robots

Course Outcomes:
CO1: To apply robot fundamentals in designing various types of end effectors
CO2: To design the end effectors required for different applications.
CO3: To formulate D-H matrices for forward kinematics problems & Develop dynamic equations for robot dynamic problems.
CO4: To determine the robot trajectory to robotic motion & Basics of Robot Language
CO5: To select the sensors depending upon robotic application & its uses in various areas.

UNIT - I
INTRODUCTION : Basic concepts – Robot anatomy –Components of robots- Robot motions – Number of D.O.F – Work volume – Robot drive systems – Classification of robots by control method – Specifications of robots..
End Effectors: Introduction – Types of end effectors – Mechanical grippers – Vacuum cups, magnetic grippers, adhesive gripers and others – Robot / End effectors interface – Considerations in gripper selection and design

UNIT - II
MANIPULATOR KINEMATICS: Introduction –Coordinate Frames, Description of Objects in space, Transformation of vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices, Problems- D-H representation – problems on forward kinematics.

UNIT - III
DYNAMICS: Introduction -Differential transformations- jacobian – problems –, Lagrange Euler formulation , Problems

UNIT - IV
TRAJECTORY PLANNING: Introduction – considerations on trajectory planning – joint Interpolated trajectory – Cartesian path trajectory – problems
ROBOT PROGRAMMING :- Methods of robot programming – Lead through method.-Textual robot languages – Generations of programming languages – Robot language structure – Motion commands – End effector and sensor commands – VAL II programming language.

UNIT - V
ACTUATORS: Pneumatic, Hydraulic actuators, Servo motors, Stepper motors.
Sensors: Position sensors: Potentiometers, resolvers, encoders – velocity sensors
Robot Application in Manufacturing: Material transfer and machine loading/ unloading applications – Processing operations – Assembly and inspection – Future applications.

TEXT BOOKS

1. Mikell P.Groover, MITCHELL WEISS, ROGER N. Nagel& NICHOLAS G. Odrey; Industrial Robotics, McGraw- HILL International Editions,1986
2. R.K.Mittal, IJ Nagrath, Robotics and Control ,Tata Mc Graw – Hill publishing company Limited, New Delhi,2003

REFERENCES

1. Robert J.Schilling, Fundamentals of robotics analysis & control, PHI learning private limited, New Delhi, 4th edition 2002
2. Saeed B.Niku, Introduction to robotics analysis systems Application, PHI learning private limited, New Delhi, 2002
3. K.S.Fu, R.C Gonzalez, C.S.G.Lee, Robotics control, Sensing, vision, and intelligence; Mc Graw HILL International Editions, 3rd edition 2008

VII SEMESTER

S180 - DATABASE MANAGEMENT SYSTEMS

(Common to AE, CSE, EEE, EIE, IT)

Prerequisite: Elementary set theory, concepts of relations and functions, propositional logic data structures (trees, Graphs, dictionaries) & File Concepts.

Course Educational Objectives:

This course enables the students to know about

- DBMS basic concepts, Database Languages.
- Data base Design.
- Normalization process and Transaction processing.
- Indexing.

Course Outcomes:

After the completion of the course, students should be able to

CO1: Understand DBMS concepts, architecture, Database languages, data models and design of database.

CO2: Applying the concepts of relational algebra, calculus, and also SQL.

CO3: Applying the normalization process for data base design.

CO4: Understand the issues in transaction processing, Analyzing different Concurrency and recovery strategies of DBMS

CO5:Analyzing different file organization techniques & Indexing Techniques.

UNIT – I

Introduction: An overview of database management system, database system Vs file system, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.

Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.

UNIT - II

Relational data Model and Language: Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra.

Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL data types and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations. Joins, Unions, Intersection, Minus, Cursors in SQL.

UNIT – III

Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependences, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

UNIT – IV

Transaction Processing Concepts*:* Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, log based recovery, checkpoints, ARIESalgorithm,deadlock handling.**Concurrency Control Techniques:** Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Recovery with concurrent transactions.

UNIT – V

Storage and Indexing: RAID levels, page formats, record formats, file types and organization, ISAM, B-tree,B+-tree.

TEXT BOOK

1. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill.
2. Elmasri, Navathe, "Fundamentals Of Database Systems", Addision Wesley.

REFERENCES

1. Raghu Ramakrishnan, "Database Management System", McGraw Hill
2. Maheshwari Jain, "DBMS: Complete Practical Approach", Firewall Media, New Delhi.
3. Date C J, "An Introduction To Database System", Addision Wesley.

VII SEMESTER

L102 - AIRCRAFT COMPONENT MODELING AND ANALYSIS LAB

Course Educational Objectives:

1. To learn surface modeling package (CATIA) to draw 2D sketches, 3D parts, various aircraft components and assembly drawing
2. To learn the finite element package (ANSYS) to analyze the behavior of simple structural elements under static loading system.

Course Outcomes:

CO1: To draw aircraft components in 2D and 3D geometric modeling

CO2: To solve and analyze the structural components of aircraft for deformations and stresses using a numerical tool.

Any ten experiments are to be performed:

1. Design of joints-bolted, riveted and welded joints
2. Design and Drafting Control Components Cam
3. Design and Drafting Control Components Bell Crank
4. Design and Drafting Control Components Gear
5. Design and Drafting Control Components Push-pull rod
6. Drafting of aircraft wing structural elements
7. Drafting of aircraft fuselage structural elements
8. Three view diagram of a typical aircraft
9. Layout of Control System
10. Estimation of forces and design of members in plane and space trusses using C- program
11. Estimation of forces and design of members in plane and space trusses using software package
12. Static analysis of beams using software packages
13. Static analysis of plates
14. Static analysis of shells
15. Dynamic analysis of beams
16. Thermal analysis of structures

VII SEMESTER

L103 - AIRCRAFT DESIGN LAB

Course Educational Objectives:
To learn the aircraft design methodologies
Course Outcomes:
CO1: To design an aircraft system, component, or process as per the requirement
CO2: To design an aircraft as per the assigned specifications

Experiment1 : Aircraft conceptual sketch and its gross weight estimation algorithm

Experiment2 : Preliminary weight estimation

Experiment3 : Trade off study on range

Experiment4 : Trade off study on payload

Experiment5 : Fixed sizing

Experiment6 : Load or Induced Drag Estimation

Experiment7 : Preliminary design of an aircraft fuselage

Experiment8 : Preliminary design of load distribution on a fuselage

Experiment9 : Estimate the Critical Mach number for an Airfoil

Experiment10 : Static Performance: Thrust required curve

Experiment11 : Static Performance: Power required curve

Experiment12 : Drawing all the 3 views of a new Aircraft

VIII SEMESTER

S349 - PRINCIPLES OF MANAGEMENT

Course Educational Objectives:

1. To learn the basics of management strategies and its historical developments
2. To learn about the planning and its importance
3. To learn about the issues related to organizing
4. To learn about the leadership strategies

Course Outcomes:

CO1: To apply the conceptual knowledge of management and organization in work environment
CO2: To develop decision making quality in the organizations
CO3: To manage human resources efficiently and effectively with best HR practices
CO4: To develop leadership qualities suitable for organizations
CO5: To asses and compare the planned output with the actual output

Course Educational Objectives:

1. To learn the basics of management strategies and its historical developments
2. To learn about the planning and its importance
3. To learn about the issues related to organizing
4. To learn about the leadership strategies

Course Outcomes:

CO1: To apply the conceptual knowledge of management and organization in work environment
CO2: To develop decision making quality in the organizations
CO3: To manage human resources efficiently and effectively with best HR practices
CO4: To develop leadership qualities suitable for organizations
CO5: To asses and compare the planned output with the actual output

UNIT - I

Management: definition, nature and importance, Goals, Levels of management; Managerial roles and functions; Administration vs. Management; Early management thoughts - Modern approaches to management- Recent Developments; Managing people and organizations in the context of New Era- Managing for competitive advantage - the Challenges of Management - Relevant Cases.

UNIT - II

Planning: Nature and Importance, Steps in planning, Types of planning, Levels of planning – The Planning Process – MBO: Process – Advantages and Disadvantages – MBO in Indian Context; Decision making – Significance - Types - Decision making process - Modern Approaches- Evaluating Decisions; Relevant Cases.

UNIT - III

Organizing: Nature of organizing- Formal and Informal – Organization levels and span of management- Organizational structure and Process; Departmentation - Modern Organisational Structures – Characteristics; Line and Staff concepts - Delegation, Centralization and Decentralization of authority; **Staffing:** Definition – Human Resource Planning - Principles, Process – Employee Turnover – Recruitment and Selection – Performance Appraisal - Relevant Cases.

UNIT - IV

Directing: Meaning, Assumptions of Human Behaviour, Theory X and Theory Y; Leadership: Definition, Dimensions – Leader Vs Manager – Trait approaches to leadership – leadership behavior and styles – Recent approaches to leadership; Managerial Grid; Communication: Process, Methods – Relevant Cases.

UNIT - V

Controlling: Nature and importance – Process – Feedback system – Requirements for effective control – Control techniques - Relevant Cases.

Relevant case study discussions in all units

TEXT BOOKS

1. Koontz, Weihrich , Aryasri: "Principles of Management", Tata McGraw Hill, New Delhi, 2008.
2. Meeenakshi Gupta: "Principles of Management", PHI Private Limited, New Delhi, 2009.

REFERENCES

1. John F. Wilson, The Making of Modern Manaement, Oxford University Press.
2. Daft, "The New Era of Management", Cengage Learning, New Delhi, 2009.
3. Stoner, Free man, Gilbert: "Management", Pearson Education, New Delhi, 2002
4. Schermerhorn Jr.: "Management ", Wiley-India, New Delhi, 2008.
5. Prasad LM, Principles and Practices of Management, Sultan Chand & Sons, New Delhi.

VIII SEMESTER

S287 - LAUNCH VEHICLE AERODYNAMICS

Course Educational Objectives:

1. To learn the various launch vehicle configurations
2. To learn the aerodynamics of slender and blunt bodies
3. To learn the basic aspects of hypersonic aerodynamics
4. To learn the aerodynamic aspects of launching phase
5. To learn the issues in launching

Course Outcomes:

CO1: To analyze the forces acting on rockets and missile
CO2: To analyze the aerodynamic properties of slender and blunt bodies
CO3: To know the basics of hypersonic flow characteristics
CO4: To evaluate missile behavior during launching
CO5: To examine the problem during the launching

UNIT - I

LAUNCH VEHICLE CONFIGURATIONS AND DRAG ESTIMATION: Types of Rockets and missiles-various configurations-components-forces on the vehicle during atmospheric flight-nose cone design and drag estimation

UNIT - II

AERODYNAMICS OF SLENDER AND BLUNT BODIES: Aerodynamics of slender and blunt bodies, wing-body interference effects-Asymmetric flow separation and vortex shedding-unsteady flow characteristics of launch vehicles- determination of aero elastic effects, Slender Bodies of Revolution**,** non circular shapes, lifting surfaces, low Aspect Ratio characteristics, wing-body-tail interference, prediction of overall characteristics of body dominated configurations and lifting surface dominated configurations, high angle of attack aerodynamics

UNIT - III

HYPERSONIC AERODYNAMICS: Introduction to hypersonic aerodynamics, concept of thin shock layers-hypersonic flight paths-hypersonic similarity parameters-shock wave and expansion wave relations of in viscid hypersonic flows, Shock wave -boundary layer interactions, aerodynamic heating

UNIT - IV

AERODYNAMIC ASPECTS OF LAUNCHING PHASE: Booster separation-cross wind effects-specific considerations in missile launching-missile integration and separation-methods of evaluation and determination- Stability and Control Characteristics of Launch Vehicle Configuration- Wind tunnel tests – CFD Analysis.

UNIT - V

AERODYNAMIC LAUNCHING PROBLEMS: Introduction, Safety of parent Aircraft, Launch Boundaries-Launch-Aircraft Trajectory, Parent Aircraft Performance, Ground Launch

REFERENCES

1. Chin SS, Missile Configuration Design, Mc Graw Hill, New York, 1961.
2. Anderson, J.D., Hypersonic and High Temperature Gas Dynamics, AIAA Education Series.
3. Nielson, Jack N, Stever, Gutford, Missile Aerodynamics, Mc Graw Hill, New York, 1960.
4. Anderson Jr., D., Modern compressible flows, McGraw-Hill Book Co., New York 1999.
5. Charles D.Brown, Spacecraft Mission Design, AIAA Education Series, Published by AIAA, 1998
6. Meyer Rudolph X, Elements of Space Technology for Aerospace Engineers, Academic Press, 1999

VIII SEMESTER

S106 - ADVANCED PROPULSION SYSTEMS

Course Educational Objectives:

1. To learn the fundamentals scramjet propulsion systems
2. To learn the functions of nuclear propulsion systems
3. To learn the basics of electrical propulsion systems
4. To learn about the micro propulsion
5. To lean the propellant-less and advanced propulsion systems

Course Outcomes:

CO1: To analyze the scram jet engine performance
CO2: To analyze the performance nuclear prolusion systems
CO3: To apply the electric propulsion for space applications
CO4: To understand the various advanced propulsion systems

UNIT- I

Scramjet Propulsion:

Fundamental considerations of hypersonic air breathing vehicles, Scramjet inlets, Supersonic flow Combustors, Scramjet Performance, Scramjet and Ram rocket propulsion system, Dual mode combustion system

UNIT - II

Nuclear Propulsion System:

Types of Nuclear propulsion systems, Heat Transfer nuclear rockets, Gaseous core nuclear rockets, pure nuclear propulsion systems, Performance and application areas, Nuclear Hazards

UNIT -III

Electric Propulsion system:

Overview of application areas, Ideal flight performance, Electro thermal thrusters- Resisto jets and Arcjets, Pure Electric Thrusters- Electric, Electromagnetic and Hall effect thrusters, Electric power generation In space.

UNIT - IV

Micro Propulsion:

Introduction to Micro Propulsion, Micro mono propellant thrusters, Micro Bi-propellant thruster, Micro cold gas thrusters, Micro ion thruster, Micro PPT Thruster

UNIT – V

Propellant-less & Advanced Chemical Propulsion System:

High performance chemical propulsion systems, Metalized propellants, Solar Sail, Tether propulsion, Photon rockets

REFERENCES

1. Sutton, G.P., Rocket Propulsion Elements, John Wiley, 1993
2. Martin Tajma, Advanced space propulsion systems, Springer
3. Claudio Bruno, Antonio G,.Accettura Advanced propulsion systems and technologies, today to 2020
4. Martin J.L. Turner, Rocket and Space propulsion : Principles, practice and new developments Springer

VIII SEMESTER

S416 - VIRTUAL INSTRUMENTATION

(Common to AE, EIE)

Course Educational Objectives:

Students will learn about:

1. Principle of virtual Instrumentation.
2. How Build an engineering application in lab view, install and configure data acquisition hardware.
3. User interface, program control, data structures, file input output, hardware interfacing, data analysis and signal processing

Course Outcomes:

After successfully completing this course, students should be able to

1. Develop software programs called virtual instruments that apply user interface, program control, data structures, file input output, hardware interfacing, data analysis and signal processing
2. Experiment with, analyze and document proto type measurement systems using a computer, plug in DAQ interfaces and bench level instruments.
3. Build an engineering application in lab view, install and configure data acquisition hardware.

UNIT - I

Introduction to Virtual Instrumentation: History of Instrumentation. Systems, Evolution of Virtual Instrumentation, Premature Challenges, Programming Requirements, Drawbacks of Recent Approaches, Conventional Virtual Instrumentation, Distributed Virtual Instrumentation, Virtual Instrumentation Versus Traditional Instruments, Advantages

Introduction to Lab VIEW: History of Lab VIEW, Growth of Lab VIEW, Development of Virtual Instruments using Lab VIEW, Evolution of Virtual Instruments in Engineering, Advantages of Lab VIEW

UNIT - II

Programming Concept Of VI: VI& Sub Vis, loop, nodes, case and sequence structures, formula nodes, arrays, clusters

UNIT - III

Error handling, graphs, charts, local and global variables, string, files I/O, Tables, List Box

UNIT - IV

Data Acquisition Systems: Introduction to data acquisition, Data Acquisition in Lab VIEW, Hardware Installation And Configuration, Components of DAQ ,DAQ Assistant, DAQ Hardware.

UNIT – V

Standard Instrument Interfaces: RS232 Standard, RS422 and RS485, GPIB

LabVIEW based virtual instrumentation application: Data acquisition & user interface,

TEXT BOOK

S.Sumathi, P.Surekha "Virtual Instrumentation with LabVIEW" , ACME LEARNING Pvt. Ltd.

REFERENCES

1. Rick Bitter,Taqi Mohiuddin,Matt nawrocki "LABVIEW Advanced Programming Technique",2nd Edition.
2. Lisa K. wells, Jeffrey Travis, "LabVIEW for everyone", Prentice Hall, New Jersey, 1997
3. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes,2000

VIII SEMESTER

S115 - AERO ENGINE REPAIR AND MAINTENANCE

Course Educational Objectives:

1. To learn the function of various components of piston engine
2. To learn the inspection, maintenance and trouble shooting of piston engine
3. To learn the overhauling procedures of piston engines
4. To lean the function of jet engine components
5. To learn the overhauling procedures of Gas turbine components

Course Outcomes:

CO1: To analyze the performance of piston engine components
CO2: To inspect and troubleshoot the piston engines components
CO3: To prepare the piston engine testing procedures
CO4: To analyze the performance of jet engine components
CO5: To prepare overhaul procedures for jet engine components

UNIT - I

CLASSIFICATION OF PISTON ENGINE COMPONENTS : Types of piston engines – Principles of operation – Function of components – Materials used – Details of starting the engines – Details of carburetion and injection systems for small and large engines – Ignition system components – Spark plug details – Engine operating conditions at various altitudes – Maintenance and inspection check to be carried out.

UNIT - II

INSPECTIONS OF PISTON ENGINES: Inspection and maintenance and trouble shooting – Inspection of all engine components – Daily and routine checks – Overhaul procedures – Compression testing of cylinders – Special inspection schedules – Engine fuel, control and exhaust systems – Engine mount and super charger – Checks and inspection procedures.

UNIT - III

OVERHAULING OF PISTON ENGINES: Symptoms of failure – Fault diagnostics – Case studies of different engine systems –Tools and equipment requirements for various checks and alignment during overhauling – Tools for inspection – Tools for safety and for visual inspection – Methods and instruments for non destructive testing techniques – Equipment for replacement of part and their repair. Engine testing: Engine testing procedures and schedule preparation – Online maintenance

UNIT - IV

CLASSIFICATION OF JET ENGINE COMPONENTS: Types of jet engines – Principles of operation – Functions of components – Materials used – Details of starting and operating procedures – Gas turbine engine inspection & checks – Use of instruments for online maintenance – Special inspection procedures : Foreign Object Damage – Blade damage – etc. Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures – Component maintenance procedures – Systems maintenance procedures. Gas turbine testing procedures – test schedule preparation – Storage of Engines –Preservation and de-preservation procedures

UNIT - V

OVERHAUL PROCEDURES: Engine Overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of Gas turbine components. Trouble Shooting - Procedures for rectification – Condition monitoring of the engine on ground and at altitude – engine health monitoring and corrective methods.

REFERENCES

1. KROES & WILD, Aircraft Power plants, 7th Edition – McGraw Hill, New York, 1994.
2. Gas Turbine Engines, TURBOMECA, The English Book Store, New Delhi, 1993.
3. The Aircraft Gas turbine Engine and its Operation, (latest edition), UNITED TECHNOLOGIES PRATT & WHITNEY The English Book Store, New Delhi.

VIII SEMESTER

S376 - SATELLITE TECHNOLOGY

Course Educational Objectives

- To learn basics of satellite systems.
- To learn the basics of orbital mechanics
- To learn the satellite structures and its thermal control systems
- To learn the various aspects of spacecraft control.
- To learn the satellite power systems.

Course Outcomes

At the end of this course student will be able to

- Know the mechanism and parameters of satellite communication in space.
- Have the idea about how uplink/downlink signals can be processed using different techniques and parameters.
- Can understand the internal and external design issues of a spacecraft and the technique of launching.
- Learn different techniques of satellite applications in real time and appreciate the further scope of the subject.

UNIT - I

INTRODUCTION TO SATELLITE SYSTEMS: Common satellite applications and missions. Types of spacecraft orbits- Definitions of spin- Three axis stabilization- Space environment- Launch vehicles-Satellite system and their functions (structure, thermal, mechanisms, power, propulsion, guidance and control, bus electronics)

UNIT - II

ORBITAL MECHANICS: Fundamentals of orbital dynamics – Kepler's laws. Co-ordinate systems-Orbital parameters and determination-Orbital maneuvers-Need for station keeping.GPS Systems and application for satellite/Orbit determination.Ground/Earth station network requirements

UNIT - III

SATELLITE STRUCTURES AND THERMAL CONTROL: Satellite mechanical and structural configuration: satellite configuration choices, launch loads, separation induced loads, deployment requirements-Design and analysis of satellite structures-Structural materials and fabrication-The need of thermal control: externally induced thermal environment-Internally induced thermal environment-Heat transfer mechanism: internal to the spacecraft and external heat load variations –Thermal control systems, active and passive methods.

UNIT - IV

SPACECRAFT CONTROL: Control requirements: attitude control and station keeping functions type of control maneuvers-Stabilization schemes: spin stabilization, gravity gradient methods, 3 axis stabilization-Commonly used control systems: mass expulsion systems, Momentum exchange Systems. Gyro and magnetic torque-sensors,star and sun sensor, earth sensor, magnetometers and inertial sensors.

UNIT - V

POWER SYSTEM AND BUS ELECTRONICS: Solar panels: Silicon and Ga-As cells, power generation capacity, efficiency-Space battery systems-battery types, characteristics and efficiency parameters-Power electronics. Telemetry, Tracking and command control functions.(TT&C).Generally employed communication bands (UHF/VHF, S,L,Ku, Ka etc), their characteristics and applications-Coding systems –Onboard computer –Ground checkout systems.

TEXT BOOKS

1. Trimothy Pratt, Charles Bostian, J Allnut , 'Satellite Communication', John Wiley & Sons, 2/e,2003.
2. Richard.F, Filipowsky Eugan I Muehllorf, 'Space Communication Systems', Prentice Hall 1995.

REFERENCES

1. M.Richharia , 'Satellite Communications Systems: Design principles' , BS Publications,2/e, 2003.
2. D.C Agarwal , 'Satellite Communications', Khanna Publications,5/e,2006.
3. Dennis Roddy , 'Satellite Communications', Tata McGraw Hills,4/e, 2009.

VIII SEMESTER

S311 - MICRO ELECTRO MECHANICAL SYSTEMS

(Common to AE, ECE, EIE, ME)

Course Educational Objectives:

In this course student will learn about

1. Fundamentals of Micro-Electro-Mechanical-Systems and Microsystems and their examples.
2. The benefits of miniaturization and the advantages of MEMS devices
3. Scaling Laws in miniaturization, scaling in geometry, electro statistics, electromagnetic, fluid mechanics and heat transfer.
4. Fabrication process of MEMS, Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison, Surface Micromachining and LIGA Process.
5. The application of MEMS in various fields, example Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors, Micro grippers, Micro motors, Micro gears, Micro pumps.

Course Outcomes:

At the end of this course student will be able to

1. Understand the operation of a wide range of sensors and actuators appropriate for micro scale systems encompassing different energy domains.
2. Explain the technological and economical requirements that can make a micro system a commercial success and list successful examples.
3. Choose micro fabrication methods suited for the fabrication of a given micro system and explain how the various processes can be integrated.
4. Evaluate and choose transduction principles (e.g., electrostatic or magnetic) for actuation in a micro system and perform analytical calculations for a simple actuator based on them.
5. Describe, analyze and solve a concrete problem involving micro technology

UNIT – I

Overview of MEMS

MEMS and Microsystems definitions and examples, Difference between Microsystems and Microelectronics, Benefits of miniaturization, Applications: Industrial/automotives sensors, Medical systems, aircraft sensors, Structural health monitoring, Telecommunication etc, Materials for MEMS.

UNIT – II

Scaling Laws In Miniaturization

Introduction to Scaling, Scaling in Geometry, Scaling in Electrostatic forces. MEMS Design Considerations.

UNIT – III

Micro Fabrication –I

Introduction, Photolithography, Photo resists and Application, Light Sources, Photo resist Removal, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition (CVD), Sputtering, Deposition by Epitaxy, Etching.

UNIT – IV

Micro Fabrication – II

Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison.

Surface Micromachining: Process, associated Mechanical problems (Adhesion, Interfacial stresses, Stiction), LIGA process, MEMS Packaging.

UNIT – V

MEMS Devices and Structures

Micro sensors: Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors.

Micro actuation: Actuation using thermal forces, Piezoelectric crystals, Electrostatic forces, MEMS with micro actuators: Micro grippers, Micro motors, Micro gears, Micro pumps.

TEXT BOOK

Tai-Ran Hsu, MEMS & Microsystems Design and Manufacture, Tata McGraw Hill.

REFERENCES

1. Marc Madou , “Fundamentals of Micro Fabrication.”, , CRC Press
2. Mohamed Gad-el-Hak , “The MEMS Handbook” , CRC Press
3. G.K.Anantha Suresh , “Micro and Smart Systems.”, Wiley India

VIII SEMESTER

S319 - NANO TECHNOLOGY

(Common to AE, EIE, ME)

Course Educational Objectives:

In this course student will learn about

1. The basics of Nanoscience and Technology.
2. Various process techniques available for the processing of Nanostructured materials.
3. The exotic properties of nanostructured materials at their nanoscale lengths.
4. Different nanoparticles synthesis methods and their skills.
5. The reactive merits of various process techniques.

Course Outcomes:

At the end of this course student will be able to

1. Have a sound grounding and expert knowledge in multidisciplinary areas of nanoscience
2. Understand the basic scientific concepts underpinning nanoscience
3. Understand the properties of materials at the atomic/molecular level and the scaling laws governing their properties
4. Understand the relationships and connections across the sciences and non-science disciplines that are core to nanotechnology
5. Understand the current frontier developments in nanotechnology.

UNIT – I
INTRODUCTION TO NANOTECHNOLOGY

Definition of Nano-Science and Nano Technology, Applications of Nano-Technology. Introduction to Physics of Solid State: Structure: Size dependence of properties; crystal structures, face centred cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations. Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces.

UNIT – II
SYNTHESIS METHODS & METHODS OF MEASURING PROPERTIES

Various nanomaterial synthesis approaches, RF plasma, sputtering, chemical methods, thermolysis, Pulsed Laser Methods.

Structure: Crystallography, particle size determination, surface structure, Microscopy: Scanning Prob Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy (TEM)

Spectroscopy: Infrared and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luminescence.

UNIT – III
CARBON NANOSTRUCTURES

Carbon molecules, nature of the carbon bond, new carbon structures, Carbon nanotubes, fabrication, types, electrical, vibrational and mechanical properties, Applications of carbon nanotubes: computers, fuel cells, chemical sensors.

UNIT - IV

QUANTUM WELLS, WIRES AND DOTS

Preparation of quantum nanostructures, size and dimensionality effects, size effects, conduction electrons and dimensionality, fermi gas and density of states, potential wells, particle confinement, Properties dependent on density of states, Excitons, Single electron tunneling, Applications: Infrared detectors, Quantum dot lasers.

UNIT – V

NANOMACHINES AND NANODEVICES

Micro-electro-mechanical systems (MEMS), characteristics, Nano-electro-mechanical systems (NEMS), fabrication techniques, nanodevices and nanomachines, Molecular and supramolecular switches.

TEXT BOOKS

1. Charles P. Poole, Frank J. Owens, "Introduction to Nanotechnology", Wiley Inter Science, 2003.
2. Mark A. Ratner, Daniel Ratner, "Nanotechnology: A gentle introduction to the next Big Idea", Prentice Hall P7R:1st Edition, 2002.

REFERENCES

1. Mick Wilson, Kamali Kannargare., Geoff Smith, "Nano technology: Basic Science and Emerging Technologies", Overseas Press, 2005.
2. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2002.
3. T. Pradeep, "Nano: The Essentials, Understanding of Nanoscience and Nanotechnology," Tata McGraw-Hill, 2007.
4. Karkare Manasi, "Nanotechnology Fundamentals and Applications" I.K. International, 2008.

VIII SEMESTER

S325 - OBJECT ORIENTED PROGRAMMING USING JAVA

(Common to AE, EIE, IT)

Course Educational Objectives:

- Understanding Object Oriented Paradigm and implementation.
- Understanding the advantage of bottom up design over top down approach.
- An understanding of comprehensiveness of a Object Oriented Programming approach to a real world problem and the limitations of procedural approach.

Course Outcomes:

After completion of the course students will

- Have sound knowledge in object oriented concepts and how they are implemented in JAVA.
- Appreciates the difference between procedure oriented, object based and object oriented programming languages.
- The student will be able to understand the platform independency of JAVA.

UNIT – I

Basics of Object Oriented Programming (OOP):

Need for OO paradigm, A way of viewing world – Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of oop concepts, coping with complexity, abstraction mechanisms.

Java Basics:

Data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

UNIT – II

Inheritance: Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes. **Packages and Interfaces:** Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT – III

Exception handling and Multithreading: Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

UNIT – IV

Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. Applet to applet communication, secure applet**,Event Handling:**Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes.

The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scrollpane, dialogs, menubar, graphics, layout manager – layout manager types – boarder, grid, flow, card and grid bag.

UNIT – V

Swings: Introduction, limitations of AWT, MVC architecture, components, containers,
exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS

1. Herbert Schildt, Java: The complete reference, 7/e, TMH.
2. N.B Venkateswarlu, E V Prasad, S. Chand. Learn Object Oriented Programming using Java, Java: How to Program, 8/e, Dietal, Dietal, PHI

REFERENCES

1. Dr K Somasundaram, Programming in Java2, JAICO Publishing house
2. P. Radha Krishna, Object Oriented Programming through Java, University Press.