COURSE STRUCTURE & SYLLABUS

For

AERONAUTICAL ENGINEERING

(Applicable for batches admitted from 2016-2017)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

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I Year - I Semester

S.No.	Subjects	L	T	P	Credits
1-HS	English – I	4	--	--	3
2-BS	Mathematics - I	4	--	--	3
3-ES	Engineering Chemistry	4	--	--	3
4-BS	Engineering Mechanics	4	--	--	3
5-BS	Computer Programming	4	--	--	3
6-ES	Environmental Studies	4	--	--	3
7-HS	Engineering /Applied Chemistry Laboratory	--	--	3	2
8-BS	English- Communication Skills Lab - I	--	--	3	2
9-ES	Computer Programming Lab	--	--	3	2
	Total Credits				**24**

I Year - II SEMESTER

S.No.	Subjects	L	T	P	Credits
1-HS	English – II	4	--	--	3
2-BS	Mathematics – II (Mathematical Methods)	4	--	--	3
3-BS	Mathematics – III	4	--	--	3
4-ES	Engineering Physics	4	--	--	3
5-HS	Basic Electrical and Electronics Engineering	4	--	--	3
6-ES	Engineering Drawing	4	--	--	3
7-BS	English - Communication Skills Lab - II	--	--	3	2
8-HS	Engineering /Applied Physics Lab	--	--	3	2
9-ES	Engineering /Applied Physics – Virtual Labs - Assignments	--	--	2	--
10	Engg., Workshop & IT Workshop	--	--	3	2
	Total Credits				**24**

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II Year - I Semester

S.No.	Subjects	L	T	P	Credits
1	Elements of Aerospace Engineering	4	--	--	3
2	Thermodynamics	4	--	--	3
3	Mechanics of Fluids	4	--	--	3
4	Computer aided Engineering and Drawing Practice	4	--	--	3
5	Mechanics of Solids	4	--	--	3
6	Managerial Economic & Financial Analysis	4	--	--	3
7	Fluid Mechanics & Strength of Materials Lab	--	--	3	2
8	Electrical & Electronics Engineering Lab	--	--	3	2
	Total Credits				**22**

II Year - II Semester

S.No.	Subjects	L	T	P	Credits
1	Aerodynamics - I	4	--	--	3
2	Manufacturing Technology	4	--	--	3
3	Aircraft System and Instruments	4	--	--	3
4	Elements of Heat Transfer	4	--	--	3
5	Applied Thermodynamics	4	--	--	3
6	Industrials Engineering and Management	4	--	--	3
7	Applied Thermodynamics Lab	--	--	3	2
8	Manufacturing Technology Lab	--	--	3	2
	Total Credits				**22**

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III Year - I Semester

S.No.	Subjects	L	T	P	Credits
1	Aircraft Performance	4	--	--	3
2	Aerodynamics – II	4	--	--	3
3	Aircraft Structures – I	4	--	--	3
4	Propulsion – I	4	--	--	3
5	Theory of Machines	4	--	--	3
6	CAD/CAM Lab	--	--	3	2
7	Aerodynamics Lab	--	--	3	2
8	Propulsion Lab	--	--	3	2
7	IPR & Patents	--	2	--	--
	Total Credits				**21**

III Year - II Semester

S.No.	Subjects	L	T	P	Credits
1	Aircraft stability and control	4	--	--	3
2	Aircraft Structures –II	4	--	--	3
3	Propulsion – II	4	--	--	3
4	Finite Element Method	4	--	--	3
5	**OPEN ELECTIVE** 1. DBMS 2. Waste Water Management 3. Entrepreneurship 4. Satellite Technology 5. Industrial Aerodynamics 6. Theory of Elasticity	4	--	--	3
6	Aircraft Structures Lab	--	--	3	2
7	Aircraft Design Lab	--	--	3	2
8	Aero Modelling Lab	--	--	3	2
MC	Professional Ethics & Human Values	--	3	--	--
	Total Credits				**21**

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IV Year - I Semester

S.No.	Subjects	L	T	P	Credits
1	Theory of Vibrations	4	--	--	3
2	Computational Fluid Dynamics	4	--	--	3
3	Instrumentation Measurements and Experiments in Fluids	4	--	--	3
4	Helicopter Engineering	4	--	--	3
5	**Elective I** 1.Airframe Repair and Maintenance 2.Boundary Layer Theory 3.Fatigue and Fracture Mechanics	4	--	--	3
6	**Elective II** 1.Elements of Combustion 2.Quality and reliability Engineering 3. Hypersonic Aerodynamics	4	--	--	3
7	Computational Fluid Dynamics Lab	--	--	2	2
8	Finite Element Method Lab	--	--	2	2
	Total Credits				**22**

IV Year - II Semester

S.No.	Subjects	L	T	P	Credits
1	Rocketry and Space Mechanics	4	--	--	3
2	Mechanics of Composites	4	--	--	3
3	Aerospace Materials	4	--	--	3
4	**Elective III** 1.Avionics 2.Propellant Technology 3.Aero Elasticity	4	--	--	3
5	Seminar	--	3	--	2
6	Project	--	--	--	10
	Total Credits				**24**

Total Course Credits = 48+44 + 42 + 46 = 180

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SYLLABUS

I Year - I Semester	L	T	P	C
	4	0	0	3

ENGLISH - I

Introduction:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training the students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of the students of Engineering.

As far as the detailed Textbooks are concerned, the focus should be on the skills of listening, speaking, reading and writing. The nondetailed Textbooks are meant for extensive reading for pleasure and profit.

Thus the stress in the syllabus in primarily on the development of communicative skills and fostering of ideas.

Objectives:

- To imporve the language proficiency of the students in English with emphasis on LSRW skills.
- To enable the students to study and comprehend the prescribed lessons and subjects more effectively relating to their theoretical and practical components.
- To develop the communication skills of the students in both formal and informal situations.

LISTENING SKILLS:

Objectives:

- To enable the students to appreciate the role of listening skill and improve their pronounciation.
- To enable the students to comprehend the speech of people belonging to different backgrounds and regions.
- To enable the students to listen for general content, to fill up information and for specific information.

SPEAKING SKILLS:

Objectives:

1. To make the students aware of the importance of speaking for their personal and professional communication.
2. To enable the students to express themselves fluently and accurately in social and professional success.
3. To help the students describe objects, situations and people.
4. To make the students participate in group activities like role plays, discussions and debates.
5. To make the students participate in Just a Minute talks.

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READING SKILLS:

Objectives:

1. To enable the students to comprehend a text through silent reading.
2. To enable the students to guess the meanings of words, messages and inferences of texts in given contexts.
3. To enable the students to skim and scan a text.
4. To enable the students to identify the topic sentence.
5. To enable the students to identify discourse features.
6. To enable the students to make intensive and extensive reading.

WRITING SKILLS:

Objectives:

1. To make the students understand that writing is an exact formal skills.
2. To enable the students to write sentences and paragraphs.
3. To make the students identify and use appropriate vocabulary.
4. To enable the students to narrate and describe.
5. To enable the students capable of note-making.
6. To enable the students to write coherently and cohesively.
7. To make the students to write formal and informal letters.
8. To enable the students to describe graphs using expressions of comparison.
9. To enable the students to write technical reports.

Methodology:

1. The class are to be learner-centered where the learners are to read the texts to get a comprehensive idea of those texts on their own with the help of the peer group and the teacher.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The tasks/exercises at the end of each unit should be completed by the learners only and the teacher interventions permitted as per the complexity of the task/exercise.
4. The teacher is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The teacher is permitted to use lecture method when a completely new concept is introduced in the class.

Assessment Procedure: Theory

1. The formative and summative assessment procedures are to be adopted (mid exams and end semester examination).
2. Neither the formative nor summative assessment procedures should test the memory of the content of the texts given in the textbook. The themes and global comprehension of the units in the present day context with application of the langauge skills learnt in the unit are to be tested.

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3. Only new unseen passages are to be given to test reading skills of the learners. Written skills are to be tested from sentence level to essay level. The communication formats—emails, letters and reports-- are to be tested along with appropriate language and expressions.
4. Examinations:
   I mid exam + II mid exam (15% for descriptive tests+10% for online tests)= 25%
   (80% for the best of two and 20% for the other)
   Assignments= 5%
   End semester exams=70%
5. Three take home assignments are to be given to the learners where they will have to read texts from the reference books list or other sources and write their gist in their own words.

The following text books are recommended for study in I B.Tech I Semester (Common for all branches)and I B.Pharma I Sem of JNTU Kakinada from the academic year 2016-17
(R-16 Regulations)

DETAILED TEXTBOOK:
ENGLISH FOR ENGINEERS AND TECHNOLOGISTS, Published by **Orient Blackswan Pvt Ltd**
NON-DETAILED TEXTBOOK:
PANORAMA: A COURSE ON READING, Published by **Oxford University Press India**
The course content along with the study material is divided into six units.
UNIT I:
1. 'Human Resources' from English for Engineers and Technologists.
OBJECTIVE:
To develop human resources to serve the society in different ways.
OUTCOME:
The lesson motivates the readers to develop their knowledge different fields and serve the society accordingly.
2. 'An Ideal Family' from Panorama: A Course on Reading
OBJECTIVE:
To develop extensive reading skill and comprehension for pleasure and profit.
OUTCOME:
Acquisition of writing skills

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UNIT 2:

1. ' Transport: Problems and Solutions' from English for Engineers and Technologists.

OBJECTIVE:

To highlight road safety measures whatever be the mode of transport.

OUTCOME:

The lesson motivates the public to adopt road safety measures.

2. 'War' from 'Panorama : A Course on Reading'

OBJECTIVE:

To develop extensive reading skill and comprehension for pleasure and profit.

OUTCOME:

Acquisition of writing skills

UNIT 3:

1. 'Evaluating Technology' from English for Engineers and Technologists.

OBJECTIVE:

To highlight the advantages and disadvantages of technology.

OUTCOME:

The lesson creates an awareness in the readers that mass production is ultimately detrimental to biological survival.

2. 'The Verger' from 'Panorama : A Course on Reading'

OBJECTIVE:

To develop extensive reading skill and comprehension for pleasure and profit.

OUTCOME:

Acquisition of writing skills

UNIT 4:

1. 'Alternative Sources of Energy' from English for Engineers and Technologists.

OBJECTIVE:

To bring into focus different sources of energy as alternatives to the depleting sources.

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OUTCOME:
The lesson helps to choose a source of energy suitable for rural India.
2. ' The Scarecrow' from Panorama : A Course on Reading
OBJECTIVE:
To develop extensive reading skill and comprehension for pleasure and profit.
OUTCOME:
Acquisition of writing skills
UNIT 5:
1. 'Our Living Environment' from English for Engineers and Technologists.
OBJECTIVE:
To highlight the fact that animals must be preserved because animal life is precious.
OUTCOME:
The lesson creates an awareness in the reader as to the usefulness of animals for the human society.
2. 'A Village Host to Nation' from Panorama: A Course on Reading
OBJECTIVE:
To develop extensive reading skill and comprehension for pleasure and profit.
OUTCOME:
Acquisition of writing skills
UNIT 6:
1. ' Safety and Training' from English for Engineers and Technologists.
OBJECTIVE:
To highlight the possibility of accidents in laboratories, industries and other places and to follow safety measures.
OUTCOME:
The lesson helps in identifying safety measures against different varieties of accidents at home and in the workplace.
2. 'Martin Luther King and Africa' from Panorama : A Course on Reading
OBJECTIVE:
To develop extensive reading skill and comprehension for pleasure and profit.
OUTCOME:
Acquisition of writing skills
NOTE:
All the exercises given in the prescribed lessons in both detailed and non-detailed textbooks relating to the theme and language skills must be covered.
OVERALL COURSE OUTCOME:

1. Using English languages, both written and spoken, competently and correctly.
2. Improving comprehension and fluency of speech.
3. Gaining confidence in using English in verbal situations.

MODEL QUESTION PAPER FOR THEORY

PART- I
Six short answer questions on 6 unit themes
One question on eliciting student's response to any of the themes
PART-II
Each question should be from one unit and the last question can be a combination of two or more units.
Each question should have 3 sub questions: A,B & C
A will be from the main text: 5 marks
B from non-detailed text: 3 marks
C on grammar and Vocabulary: 6 marks

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I Year - I Semester

L	T	P	C
4	0	0	3

MATHEMATICS-I

(Common to ALL branches of First Year B.Tech.)

Course Objectives:

1. The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2. The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.

Course Outcomes: At the end of the Course, Student will be able to:

1. Solve linear differential equations of first, second and higher order.
2. Determine Laplace transform and inverse Laplace transform of various functions and use Laplace transforms to determine general solution to linear ODE.
3. Calculate total derivative, Jocobian and minima of functions of two variables.

UNIT I: Differential equations of first order and first degree:
Linear-Bernoulli-Exact-Reducible to exact.
Applications: Newton's Law of cooling-Law of natural growth and decay-Orthogonal trajectories- Electrical circuits- Chemical reactions.

UNIT II: Linear differential equations of higher order:
Non-homogeneous equations of higher order with constant coefficients with RHS term of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} V(x), xV(x)- Method of Variation of parameters.
Applications: LCR circuit, Simple Harmonic motion.

UNIT III: 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 (with out proof).
Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT IV: Partial differentiation:
Introduction- Homogeneous function-Euler's theorem-Total derivative-Chain rule-Generalized Mean value theorem for single variable (without proof)-Taylor's and Mc Laurent's series expansion of functions of two variables– Functional dependence- Jacobian.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

UNIT V: First order Partial differential equations:
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

UNIT VI: Higher order Partial differential equations:
Solutions of Linear Partial differential equations with constant coefficients. RHS term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$. Classification of second order partial differential equations.

Text Books:

1. **B.S.Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **N.P.Bali**, Engineering Mathematics, Lakshmi Publications.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India
2. **Micheael Greenberg,** Advanced Engineering Mathematics, 9th edition, Pearson edn
3. **Dean G. Duffy,** Advanced engineering mathematics with MATLAB, CRC Press
4. **Peter O'neil,** Advanced Engineering Mathematics, Cengage Learning.
5. **Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
6. **Dass H.K., Rajnish Verma. Er.,** Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

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I Year - I Semester

L	T	P	C
4	0	0	3

ENGINEERING CHEMISTRY

(CE, ME, PCE, PE, Met.E, Mining, Automobile, Aeronautical, Chemical, Bio.Tech.)

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

Learning Objectives:

- Plastics are nowadays used in household appliances; also they are used as composites (FRP) in aerospace and automotive industries.
- Fuels as a source of energy are a basic need of any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence they are introduced.
- The basics for the construction of galvanic cells are introduced. Also if corrosion is to be controlled, one has to understand the mechanism of corrosion which itself is explained by electrochemical theory.
- With the increase in demand, a wide variety of materials are coming up; some of them have excellent engineering properties and a few of these materials are introduced.
- Water is a basic material in almost all the industries, more so where steam is generated and also where it is supplied for drinking purposes.
- Materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries are introduced. Also lubrication is introduced.

UNIT I: HIGH POLYMERS AND PLASTICS

Polymerisation:- Introduction- Mechanism of polymerization - Stereo regular polymers – methods of polymerization (emulsion and suspension) -Physical and mechanical properties – ***Plastics*** as engineering materials : advantages and limitations – Thermoplastics and Thermosetting plastics – Compounding and fabrication (4/5 techniques)- Preparation, properties and applications of polyethene, PVC, Bakelite Teflon and polycarbonates

Elastomers :- Natural rubber- compounding and vulcanization – Synthetic rubbers : Buna S, Buna N, Thiokol and polyurethanes – Applications of elastomers.

Composite materials & Fiber reinforced plastics – Biodegradable polymers – Conducting polymers.

UNIT II: FUEL TECHNOLOGY

Fuels – Introduction – Classification – Calorific value - HCV and LCV – Dulong's formula – Bomb calorimeter – Numerical problems – Coal — Proximate and ultimate analysis – Significance of the analyses – Liquid fuels – Petroleum- Refining – Cracking – Synthetic petrol –Petrol knocking – Diesel knocking - Octane and Cetane ratings – Anti-knock agents – Power alcohol – Bio-diesel – Gaseous fuels – Natural gas, LPG and CNG – Combustion – Calculation of air for the combustion of a fuel – Flue gas analysis – Orsat apparatus – Numerical problems on combustion.

Explosives:- Rocket fuels

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UNIT III: ELECTROCHEMICAL CELLS AND CORROSION

Galvanic cells - Reversible and irreversible cells – Single electrode potential – Electro chemical series and uses of this series- Standard electrodes (Hydrogen and Calomel electrodes) - Concentration Cells – Batteries: Dry Cell - Ni-Cd cells - Ni-Metal hydride cells - Li cells - Zinc – air cells.

Corrosion :- Definition – Theories of Corrosion (chemical & electrochemical) – Formation of galvanic cells by different metals, by concentration cells, by differential aeration and waterline corrosion – Passivity of metals – Pitting corrosion - Galvanic series – Factors which influence the rate of corrosion - Protection from corrosion – Design and material selection – Cathodic protection - Protective coatings: – Surface preparation – Metallic (cathodic and anodic) coatings - Methods of application on metals (Galvanizing, Tinning, Electroplating, Electroless plating).

UNIT IV: CHEMISTRY OF ADVANCED MATERIALS

Nano materials:- Introduction – Sol-gel method & chemical reduction method of preparation – Characterization by BET method and TEM methods - Carbon nano tubes and fullerenes: Types, preparation, properties and applications

Liquid crystals:- Introduction – Types – Applications

Super conductors:-Type –I, Type II – Characteristics and applications

Green synthesis:- Principles - 3or 4 methods of synthesis with examples – R_4M_4 principles

UNIT V: WATER TECHNOLOGY

Hard water:- Reasons for hardness – units of hardness - determination of hardness and alkalinity - Water for steam generation - Boiler troubles – Priming and Foaming, Scale formation, Boiler corrosion, Caustic embrittlement - Internal treatments - Softening of Hard water : Lime – Soda process, Zeolite process and numerical problems based on these processes and Ion Exchange process - Water for drinking purposes- Purification – Sterilization and disinfection : Chlorination, Break point chlorination and other methods – Reverse Osmosis and Electro Dialysis.

UNIT VI: CHEMISTRY OF ENGINEERING MATERIALS AND FUEL CELLS

Refractories: - Definition, characteristics, classification, properties, failure of refractories

Lubricants: - Definition, function, Theory and mechanism of lubricants, properties (Definition and importance)

Cement: - Constituents, manufacturing, hardening and setting, deterioration of cement

Insulators: - Thermal and electrical insulators

Fuel cells: - Hydrogen Oxygen fuel cells – Methanol Oxygen fuel cells

Outcome: The advantages and limitations of plastic materials and their use in design would be understood. Fuels which are used commonly and their economics, advantages and limitations are discussed. Reasons for corrosion and some methods of corrosion control would be understood. The students would be now aware of materials like nano materials and fullerenes and their uses. Similarly liquid crystals and superconductors are understood. The importance of green synthesis is well understood and how they are different from conventional methods is also explained. The impurities present in raw water, problems associated with them and how to avoid them are understood. The advantages and limitations of plastic materials and their use in design would be understood. The commonly used industrial materials are introduced.

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Standard Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

Reference Books:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
2. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
4. Applied Chemistry by H.D. Gesser, Springer Publishers
5. Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press, IIM

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I Year - I Semester

L	T	P	C
4	0	0	3

ENIGINEERING MECHANICS

(Common to all branches)

Objectives: The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, Forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

UNIT – I

Objectives: The students are to be exposed to the concepts of force and friction, direction and its application.

Introduction to Engg. Mechanics – Basic Concepts.

Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Friction: Introduction**,** limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction

UNIT II

Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium, analysis of plane trusses.

UNIT – III

Objectives : The students are to be exposed to concepts of centre of gravity.

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

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UNIT IV

Objective: The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **Mass Moment of Inertia:** Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – V

Objectives: The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.

Kinematics: Rectilinear and Curvelinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion. **Kinetics:** Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

UNIT – VI

Objectives: The students are to be exposed to concepts of work, energy and particle motion

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

Text Books :

1. Engg. Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.

References :

1. Engineering Mechanics statics and dynamics – R.C.Hibbeler, 11th Edn – Pearson Publ.
2. Engineering Mechanics, statics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
3. Engineering Mechanics, statics and dynamics – I.H.Shames, – Pearson Publ.
4. Mechanics For Engineers, statics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
5. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston –5th Edn Mc Graw Hill Publ.
6. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best & W.G. McLean, 5th Edn – Schaum's outline series - Mc Graw Hill Publ.
7. Singer's Engineering Mechanics: Statics And Dynamics, K. Vijay Kumar Reddy, J. Suresh Kumar, Bs Publications
8. Engineering Mechanics, Fedinand . L. Singer, Harper – Collins.
9. Engineering Mechanics statics and dynamics , A Nelson , Mc Graw Hill publications

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I Year - I Semester

L	T	P	C
4	0	0	3

COMPUTER PROGRAMMING

Learning objectives:

Formulating algorithmic solutions to problems and implementing algorithms in C.

- Notion of Operation of a CPU, Notion of an algorithm and computational procedure, editing and executing programs in Linux.
- Understanding branching, iteration and data representation using arrays.
- Modular programming and recursive solution formulation.
- Understanding pointers and dynamic memory allocation.
- Understanding miscellaneous aspects of C.
- Comprehension of file operations.

UNIT-I:

History and Hardware - Computer Hardware, Bits and Bytes, Components, Programming Languages - Machine Language, Assembly Language, Low- and High-Level Languages, Procedural and Object-Oriented Languages, Application and System Software, The Development of C Algorithms The Software Development Process.

UNIT-II:

Introduction to C Programming- Identifiers, The main () Function, The printf () Function

Programming Style - Indentation, Comments, Data Types**,** Arithmetic Operations, Expression Types, Variables and Declarations, Negation, Operator Precedence and Associativity, Declaration Statements, Initialization.

Assignment - Implicit Type Conversions, Explicit Type Conversions (Casts), Assignment Variations, Mathematical Library Functions, Interactive Input, Formatted Output, Format Modifiers.

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UNIT -III:

Control Flow-Relational Expressions - Logical Operators:

Sélection: if-else Statement, nested if, examples, Multi-way selection: switch, else-if, examples.

Repetition: Basic Loop Structures, Pretest and Posttest Loops, Counter-Controlled and Condition-Controlled Loops, The while Statement, The for Statement, Nested Loops, The do-while Statement.

UNIT-IV

Modular Programming: Function and Parameter Declarations, Returning a Value, Functions with Empty Parameter Lists, Variable Scope, Variable Storage Class, Local Variable Storage Classes, Global Variable Storage Classes, Pass by Reference, Passing Addresses to a Function, Storing Addresses, Using Addresses, Declaring and Using Pointers, Passing Addresses to a Function.

Case Study: Swapping Values, Recursion - Mathematical Recursion, Recursion versus Iteration.

UNIT-V:

Arrays & Strings

Arrays: One-DimensionalArrays, Input and Output of Array Values, Array Initialization, Arrays as Function Arguments, Two-Dimensional Arrays, LargerDimensionalArrays- Matrices

Strings: String Fundamentals, String Input and Output, String Processing, Library Functions

UNIT-VI:

Pointers, Structures, Files

Pointers: Concept of a Pointer, Initialisation of pointer variables, pointers as function arguments, passing by address, Dangling memory, address arithmetic, character pointers and functions, pointers to pointers, Dynamic memory management functions, command line arguments.

Structures: Derived types, Sstructures declaration, Initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit-fields.

Data Files: Declaring, Opening, and Closing File Streams, Reading from and Writing to Text Files, Random File Access

Outcomes:

- Understand the basic terminology used in computer programming
- Write, compile and debug programs in C language.
- Use different data types in a computer program.
- Design programs involving decision structures, loops and functions.
- Explain the difference between call by value and call by reference
- Understand the dynamics of memory by the use of pointers
- Use different data structures and create/update basic data files.

Text Books:

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1. ANSI C Programming, Gary J. Bronson, Cengage Learning.
2. Programming in C, Bl Juneja Anita Seth, Cengage Learning.
3. The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education.

Reference Books:

1. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.
2. Programming with C, Bichkar, Universities Press.
3. Programming in C, ReemaThareja, OXFORD.
4. C by Example, Noel Kalicharan, Cambridge.

I Year - I Semester

L	T	P	C
4	0	0	3

ENVIRONMENTAL STUDIES

Course Learning Objectives:

The objectives of the course is to impart

- Overall understanding of the natural resources
- Basic understanding of the ecosystem and its diversity
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities
- An understanding of the environmental impact of developmental activities
- Awareness on the social issues, environmental legislation and global treaties

Course Outcomes:

The student should have knowledge on

- The natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources
- The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web
- The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
- Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
- Social issues both rural and urban environment and the possible means to combat the challenges
- The environmental legislations of India and the first global initiatives towards sustainable development.
- About environmental assessment and the stages involved in EIA and the environmental audit.
- Self Sustaining Green Campus with Environment Friendly aspect of – Energy, Water and Wastewater reuse Plantation, Rain water Harvesting, Parking Curriculum.

Syllabus:

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UNIT – I Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance –Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, Carbon Credits, acid rains, ozone layer depletion, population growth and explosion, effects. Role of information Technology in Environment and human health.

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT – II Natural Resources: Natural resources and associated problems

Forest resources – Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people

Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Sustainable mining of Granite, Literate, Coal, Sea and River sands.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources Vs Oil and Natural Gas Extraction.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT – III Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity- classification - Value of biodiversity: consumptive use, productive use, social- Biodiversity at national and local levels. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT – IV Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his well being.

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Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT – V Social Issues and the Environment: Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

UNIT – VI Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.

The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:

1. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
2. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
3. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

Reference:

1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014

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I Year - I Semester

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ENGINEERING / APPLIED CHEMISTRY LABORATORY

1. Introduction to Chemistry laboratory – Molarity, Normality, Primary, secondary standard solutions, Volumetric titrations, Quantitative analysis, Qualitative analysis, etc.
2. Trial experiment - Determination of HCl using standard Na_2CO_3 solution.
3. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
4. Determination of $KMnO_4$ using standard Oxalic acid solution.
5. Determination of Ferrous iron using standard $K_2Cr_2O_7$ solution.
6. Determination of Copper using standard $K_2Cr_2O_7$ solution.
7. Determination of temporary and permanent hardness of water using standard EDTA solution.
8. Determination of Copper using standard EDTA solution.
9. Determination of Iron by a Colorimetric method using thiocynate as reagent.
10. Determination of pH of the given sample solution using pH meter.
11. Conductometric titration between strong acid and strong base.
12. Conductometric titration between strong acid and weak base.
13. Potentiometric titration between strong acid and strong base.
14. Potentiometric titration between strong acid and weak base.
15. Determination of Zinc using standard EDTA solution.
16. Determination of Vitamin – C.

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Outcomes: The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

Reference Books

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Dr. Jyotsna Cherukuris (2012) *Laboratory Manual of engineering chemistry-II,* VGS Techno Series
3. Chemistry Practical Manual, Lorven Publications
4. K. Mukkanti (2009) *Practical Engineering Chemistry,* B.S. Publication

I Year - I Semester

L	T	P	C
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ENGLISH - COMMUNICATION SKILLS LAB- I

PRESCRIBED LAB MANUAL FOR SEMESTER I:
'INTERACT: English Lab Manual for Undergraduate Students' Published by **Orient Blackswan Pvt Ltd.**
OBJECTIVES:
To enable the students to learn through practice the communication skills of listening, speaking, reading and writing.
OUTCOME:
A study of the communicative items in the laboratory will help the students become successful in the competitive world.
The course content along with the study material is divided into six units.

UNIT 1:
1. WHY study Spoken English?
2. Making Inqueries on the phone, thanking and responding to Thanks
   Practice work.

UNIT 2:
1. Responding to Requests and asking for Directions
   Practice work.

UNIT 3:
1. Asking for Clarifications, Inviting, Expressing Sympathy, Congratulating
2. Apologising, Advising, Suggesting, Agreeing and Disagreeing
   Practice work.

UNIT 4:
1. Letters and Sounds
   Practice work.

UNIT 5:
1. The Sounds of English
   Practice work.

UNIT 6:
1. Pronunciation
2. Stress and Intonation
   Practice work.

Assessment Procedure: Laboratory
1. Every lab session (150 minutes) should be handled by not less than two teachers (three would be ideal) where each faculty has to conduct a speaking activity for 20/30 students.
2. The teachers are to assess each learner in the class for not less than 10 speaking activities, each one to be assessed for 10 marks or 10%. The average of 10 day-to-day activity assessments is to be calculated for 10 marks for internal assessment.

The rubric given below has to be filled in for all the students for all activities.

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The rubric to assess the learners:

	Body language		Fluency & Audibility	Clarity in Speech	Neutralization of accent	Appropriate Language		Total 10 marks	Remarks
	Gestures & Postures	Eye Contact				Grammar	Vocabulary & expressions		

- **Lab Assessment: Internal (25 marks)**
    1. Day-to-Day activities: 10 marks
    2. Completing the exercises in the lab manual: 5 marks
    3. Internal test (5 marks written and 5 marks oral)
- **Lab Assessment: External (50 marks)**
    1. Written test: 20 marks (writing a dialogue, note-taking and answering questions on listening to an audio recording.
    2. Oral: Reading aloud a text or a dialogue- 10 marks
    3. Viva-Voce by the external examiner: 20 marks

Reference Books:

1. Strengthen your communication skills by Dr M Hari Prasad, Dr Salivendra Raju and Dr G Suvarna Lakshmi, Maruti Publications.
2. English for Professionals by Prof Eliah, B.S Publications, Hyderabad.
3. Unlock, Listening and speaking skills 2, Cambridge University Press
4. Spring Board to Success, Orient BlackSwan
5. A Practical Course in effective english speaking skills, PHI
6. Word power made handy, Dr shalini verma, Schand Company
7. Let us hear them speak, Jayashree Mohanraj, Sage texts
8. Professional Communication, Aruna Koneru, Mc Grawhill Education
9. Cornerstone, Developing soft skills, Pearson Education

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I Year - I Semester

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COMPUTER PROGRAMMING LAB

OBJECTIVES:

- Understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming.

- Acquire knowledge about the basic concept of writing a program.

- Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.

- Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.

- Role of Functions involving the idea of modularity.

Programming

Exercise - 1 Basics
a) What is an OS Command, Familiarization of Editors - vi, Emacs
b) Using commands like mkdir, ls, cp, mv, cat, pwd, and man
c) C Program to Perform Adding, Subtraction, Multiplication and Division of two numbers From Command line

Exercise - 2 Basic Math
a) Write a C Program to Simulate 3 Laws at Motion
b) Write a C Program to convert Celsius to Fahrenheit and vice versa

Exercise - 3 Control Flow - I
a) Write a C Program to Find Whether the Given Year is a Leap Year or not.
b) Write a C Program to Add Digits & Multiplication of a number

Exercise – 4 Control Flow - II
a) Write a C Program to Find Whether the Given Number is
i) Prime Number
ii) Armstrong Number
b) Write a C program to print Floyd Triangle
c) Write a C Program to print Pascal Triangle

Exercise – 5 Functions

a) Write a C Program demonstrating of parameter passing in Functions and returning values.
b) Write a C Program illustrating Fibonacci, Factorial with Recursion without Recursion

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Exercise – 6 Control Flow - III

a) Write a C Program to make a simple Calculator to
Add, Subtract, Multiply or Divide Using switch…case

b) Write a C Program to convert decimal to binary and hex (using switch call function the function)

Exercise – 7 Functions - Continued

Write a C Program to compute the values ofsin x and cos x and e^x values using Series expansion. (use factorial function)

Exercise – 8 Arrays

Demonstration of arrays

a) Search-Linear.
b) Sorting-Bubble, Selection.
c) Operations on Matrix.

Exercises - 9 Structures

a) Write a C Program to Store Information of a Movie Using Structure

b) Write a C Program to Store Information Using Structures with Dynamically Memory Allocation

c) Write a C Program to Add Two Complex Numbers by Passing Structure to a Function

Exercise - 10 Arrays and Pointers

a) Write a C Program to Access Elements of an Array Using Pointer

b) Write a C Program to find the sum of numbers with arrays and pointers.

Exercise – 11 Dynamic Memory Allocations

a) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.

b) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

Understand the difference between the above two programs

Exercise – 12 Strings

a) Implementation of string manipulation operations **with** library function.
   i) copy
   ii) concatenate
   iii) length
   iv) compare

b) Implementation of string manipulation operations **without** library function.
   i) copy
   ii) concatenate
   iii) length
   iv) compare

Exercise -13 Files

a) Write a C programming code to open a file and to print it contents on screen.

b) Write a C program to copy files

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Exercise - 14 Files Continued
a) Write a C program merges two files and stores their contents in another file.
b) Write a C program to delete a file.

OUTCOMES:

- Apply and practice logical ability to solve the problems.
- Understand C programming development environment, compiling, debugging, and linking and executing a program using the development environment
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs
- Understand and apply the in-built functions and customized functions for solving the problems.
- Understand and apply the pointers, memory allocation techniques and use of files for dealing with variety of problems.
- Document and present the algorithms, flowcharts and programs in form of user-manuals
- Identification of various computer components, Installation of software

Note:

a) All the Programs must be executed in the Linux Environment. (Mandatory)
b) The Lab record must be a print of the LATEX (.tex) Format.

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I Year - II Semester

L	T	P	C
4	0	0	3

ENGLISH -II

Introduction:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training the students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of the students of Engineering.

As far as the detailed Textbooks are concerned, the focus should be on the skills of listening, speaking, reading and writing. The nondetailed Textbooks are meant for extensive reading for pleasure and profit.

Thus the stress in the syllabus in primarily on the development of communicative skills and fostering of ideas.

Objectives:

1. To imporve the language proficiency of the students in English with emphasis on LSRW skills.
2. To enable the students to study and comprehend the prescribed lessons and subjects more effectively relating to their theorotical and practical components.
3. To develop the communication skills of the students in both formal and informal situations.

LISTENING SKILLS:

Objectives:

1. To enable the students to appreciate the role of listening skill and improve their pronounciation.
2. To enable the students to comprehend the speech of people belonging to different backgrounds and regions.
3. To enable the students to listen for general content, to fill up information and for specific information.

SPEAKING SKILLS:

Objectives:

1. To make the students aware of the importance of speaking for their personal and professional communication.
2. To enable the students to express themselves fluently and accurately in social and professional success.
3. To help the students describe objects, situations and people.
4. To make the students participate in group activities like roleplays, discussions and debates.
5. To make the students particiapte in Just a Minute talks.

READING SKILLS:

Objectives:

1. To enable the students to comprehend a text through silent reading.
2. To enable the students to guess the meanings of words, messages and inferences of texts in given contexts.
3. To enable the students to skim and scan a text.
4. To enable the students to identify the topic sentence.
5. To enable the students to identify discourse features.
6. To enable the students to make intensive and extensive reading.

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WRITING SKILLS:

Objectives:

1. To make the students understand that writing is an exact formal skills.
2. To enable the students to write sentences and paragraphs.
3. To make the students identify and use appropriate vocabulary.
4. To enable the students to narrate and describe.
5. To enable the students capable of note-making.
6. To enable the students to write coherently and cohesively.
7. To make the students to write formal and informal letters.
8. To enable the students to describe graphs using expressions of comparision.
9. To enable the students to write techincal reports.

Methodology:

1. The class are to be learner-centered where the learners are to read the texts to get a comprehensive idea of those texts on their own with the help of the peer group and the teacher.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The tasks/exercises at the end of each unit should be completed by the learners only and the teacher interventions permitted as per the complexity of the task/exercise.
4. The teacher is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The teacher is permitted to use lecture method when a completely new concept is introduced in the class.

Assessment Procedure: Theory

1. The formative and summative assessment procedures are to be adopted (mid exams and end semester examination).
2. Neither the formative nor summative assessment procedures should test the memory of the content of the texts given in the textbook. The themes and global comprehension of the units in the present day context with application of the language skills learnt in the unit are to be tested.
3. Only new unseen passages are to be given to test reading skills of the learners. Written skills are to be tested from sentence level to essay level. The communication formats—emails, letters and reports-- are to be tested along with appropriate language and expressions.
4. Examinations:

   I mid exam + II mid exam (15% for descriptive tests+10% for online tests)= 25%
   (80% for the best of two and 20% for the other)
   Assignments= 5%
   End semester exams=70%
5. Three take home assignments are to be given to the learners where they will have to read texts from the reference books list or other sources and write their gist in their own words.

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The following text books are recommended for study in I B.Tech II Semester (Common for all branches)and I B.Pharma II Sem of JNTU Kakinada from the academic year 2016-17 **(R-16 Regulations)**

DETAILED TEXTBOOK: ENGLISH ENCOUNTERS Published by **Maruthi Publishers**.

DETAILED NON-DETAIL:THE GREAT INDIAN SCIENTISTS Published by **Cenguage learning**

The course content along with the study material is divided into six units.

UNIT 1:

1. ' The Greatest Resource- Education' from English Encounters

OBJECTIVE:

Schumacher describes the education system by saying that it was mere training, something more than mere knowledge of facts.

OUTCOME:

The lesson underscores that the ultimate aim of Education is to enhance wisdom.

2. ' A P J Abdul Kalam' from The Great Indian Scientists.

OBJECTIVE:

The lesson highlights Abdul Kalam's contributions to Indian science and the awards he received.

OUTCOME:

Abdul Kalam's simple life and service to the nation inspires the readers to follow in his footsteps.

UNIT 2:

1. ' A Dilemma' from English Encounters

OBJECTIVE: The lesson centres on the pros and cons of the development of science and technology.

OUTCOME: The lesson enables the students to promote peaceful co-existence and universal harmony among people and society.

2. 'C V Raman' from The Great Indian Scientists.

OBJECTIVE:

The lesson highlights the dedicated research work of C V Raman and his achievements in Physics.

OUTCOME:

The Achievements of C V Raman are inspiring and exemplary to the readers and all scientists.

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UNIT 3:

1. 'Cultural Shock': Adjustments to new Cultural Environments from English Encounters.

OBJECTIVE: The lesson depicts of the symptoms of Cultural Shock and the aftermath consequences

OUTCOME:

The lesson imparts the students to manage different cultural shocks due to globalization.

2. 'Homi Jehangir Bhabha' from The Great Indian Scientists.

OBJECTIVE:

The lesson highlights Homi Jehangir Bhabha's contributions to Indian nuclear programme as architect.

OUTCOME:

The seminal contributions of Homi Jehangir Bhabha to Indian nuclear programme provide an aspiration to the readers to serve the nation and strengthen it.

UNIT 4:

1. 'The Lottery' from English Encounters.

OBJECTIVE:

The lesson highlights insightful commentary on cultural traditions.

OUTCOME:

The theme projects society's need to re examine its traditions when they are outdated.

2. 'Jagadish Chandra Bose' from The Great Indian Scientists.

OBJECTIVE:

The lesson gives an account of the unique discoveries and inventions of Jagadish Chandra Bose in Science.

OUTCOME: The Scientific discoveries and inventions of Jagadish Chandra Bose provide inspiration to the readers to make their own contributions to science and technology, and strengthen the nation.

UNIT 5:

1. ' The Health Threats of Climate Change' from English Encounters.

OBJECTIVE:

The essay presents several health disorders that spring out due to environmental changes

OUTCOME:

The lesson offers several inputs to protect environment for the sustainability of the future generations.

2. ' Prafulla Chandra Ray' from The Great Indian Scientists.

OBJECTIVE:

The lesson given an account of the experiments and discoveries in Pharmaceuticals of Prafulla Chandra Ray.

OUTCOME:

Prafulla Chandra Ray's scientific achievements and patriotic fervour provide inspiration to the reader.

UNIT 6:

1. ' The Chief Software Architect' from English Encounters

OBJECTIVE:

The lesson supports the developments of technology for the betterment of human life.

OUTCOME:

Pupil get inspired by eminent personalities who toiled for the present day advancement of software development.

2. ' Srinivasa Ramanujan' from The Great Indian Scientists.

OBJECTIVE:

The lesson highlights the extraordinary achievements of Srinivasa Ramanujan, a great mathematician and the most romantic figure in mathematics.

OUTCOME:

The lesson provides inspiration to the readers to think and tap their innate talents.

NOTE:

All the exercises given in the prescribed lessons in both detailed and non-detailed textbooks relating to the theme and language skills must be covered.

MODEL QUESTION PAPER FOR THEORY

PART- I

Six short answer questions on 6 unit themes

One question on eliciting student's response to any of the themes

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PART-II

Each question should be from one unit and the last question can be a combination of two or more units.

Each question should have 3 sub questions: A,B & C

A will be from the main text: 5 marks

B from non-detailed text: 3 marks

C on grammar and Vocabulary: 6 marks

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I Year - II Semester

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MATHEMATICS – II (MATHEMATICAL METHODS)

Course Objectives:

1. The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2. The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.
3. Understand the most basic numerical methods to solve simultaneous linear equations.

Course Outcomes: At the end of the Course, Student will be able to:

1. Calculate a root of algebraic and transcendental equations. Explain relation between the finite difference operators.
2. Compute interpolating polynomial for the given data.
3. Solve ordinary differential equations numerically using Euler's and RK method.
4. Find Fourier series and Fourier transforms for certain functions.
5. Identify/classify and solve the different types of partial differential equations.

UNIT I: Solution of Algebraic and Transcendental Equations:

Introduction- Bisection method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations).

UNIT II: Interpolation:

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

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UNIT III: Numerical Integration and solution of Ordinary Differential equations:

Trapezoidal rule- Simpson's $1/3^{rd}$ and $3/8^{th}$ rule-Solution of ordinary differential equations by Taylor's series-Picard's method of successive approximations-Euler's method - Runge-Kutta method (second and fourth order).

UNIT IV: Fourier Series:

Introduction- Periodic functions – Fourier series of -periodic function - Dirichlet's conditions – Even and odd functions –Change of interval– Half-range sine and cosine series.

UNIT V: Applications of PDE:

Method of separation of Variables- Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

UNIT VI: Fourier Transforms:

Fourier integral theorem (without proof) – Fourier sine and cosine integrals - sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

Text Books:

1. **B.S.Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **N.P.Bali**, Engineering Mathematics, Lakshmi Publications.

Reference Books:

1. **Dean G. Duffy,** Advanced engineering mathematics with MATLAB, CRC Press
2. **V.Ravindranath and P.Vijayalakshmi,** Mathematical Methods, Himalaya Publishing House.
3. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India
4. **David Kincaid, Ward Cheney**, Numerical Analysis-Mathematics of Scientific Computing, 3rd Edition, Universities Press.
5. **Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
6. **Dass H.K., Rajnish Verma. Er.,** Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

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I Year - II Semester

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MATHEMATICS-III

Course Objectives:

1. The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2. The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.
3. Understand the most basic numerical methods to solve simultaneous linear equations.

Course Outcomes: At the end of the Course, Student will be able to:

1. Determine rank, Eigen values and Eigen vectors of a given matrix and solve simultaneous linear equations.
2. Solve simultaneous linear equations numerically using various matrix methods.
3. Determine double integral over a region and triple integral over a volume.
4. Calculate gradient of a scalar function, divergence and curl of a vector function. Determine line, surface and volume integrals. Apply Green, Stokes and Gauss divergence theorems to calculate line, surface and volume integrals.

UNIT I: Linear systems of equations:

Rank-Echelon form-Normal form – Solution of linear systems – Gauss elimination - Gauss Jordon- Gauss Jacobi and Gauss Seidal methods. Applications: Finding the current in electrical circuits.

UNIT II: Eigen values - Eigen vectors and Quadratic forms:

Eigen values - Eigen vectors– Properties – Cayley-Hamilton theorem - Inverse and powers of a matrix by using Cayley-Hamilton theorem- Diagonalization- Quadratic forms- Reduction of quadratic form to canonical form – Rank - Positive, negative and semi definite - Index – Signature.

Applications: Free vibration of a two-mass system.

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UNIT III: Multiple integrals:

Curve tracing: Cartesian, Polar and Parametric forms.

Multiple integrals: Double and triple integrals – Change of variables – Change of order of integration.

Applications: Finding Areas and Volumes.

UNIT IV: Special functions:

Beta and Gamma functions- Properties - Relation between Beta and Gamma functions- Evaluation of improper integrals.

Applications: Evaluation of integrals.

UNIT V: Vector Differentiation:

Gradient- Divergence- Curl - Laplacian and second order operators -Vector identities.

Applications: Equation of continuity, potential surfaces

UNIT VI: Vector Integration:

Line integral – Work done – Potential function – Area- Surface and volume integrals Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems.

Applications: Work done, Force.

Text Books:

1. **B.S.Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **N.P.Bali**, Engineering Mathematics, Lakshmi Publications.

Reference Books:

1. **Greenberg,** Advanced Engineering Mathematics, 2nd edition, Pearson edn
2. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India
3. **Peter O'Neil,** Advanced Engineering Mathematics,7th edition, Cengage Learning.
4. **D.W. Jordan and T.Smith,** Mathematical Techniques, Oxford University Press.
5. **Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
6. **Dass H.K., Rajnish Verma. Er.,** Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

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I Year - II Semester

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ENGINEERING PHYSICS
(ME, CE, PE, PCE, MET.E, MINING, AUTOMOBILE, CHEMICAL, AERONAUTICAL, BIO.TECH)

OBJECTIVES: *Physics curriculum which is re-oriented to the needs of Circuital branches of graduate engineering courses offered by JNTUniv.KKD. that serves as a transit to understand the branch specific advanced topics. The courses are designed to:*

- *Impart concepts of Optical Interference, Diffraction and Polarization required to design instruments with higher resolution - Concepts of coherent sources, its realization and utility optical instrumentation.*
- *Study the Structure-property relationship exhibited by solid crystal materials for their utility.*
- *Tap the Simple harmonic motion and its adaptability for improved acoustic quality of concert halls.*
- *To explore the Nuclear Power as a reliable source required to run industries*
- *To impart the knowledge of materials with characteristic utility in appliances.*

UNIT-I

INTERFERENCE: Principle of Superposition – Coherent Sources – Interference in thin films (reflection geometry) – Newton's rings – construction and basic principle of Interferometers.

UNIT-II

DIFFRACTION: Fraunhofer diffraction at single slit cases of double slit, N-slits & Circular Aperture (Qualitative treatment only)-Grating equation - Resolving power of a grating, Telescope and Microscopes.

UNIT-III

POLARIZATION: Types of Polarization-production - Nicol Prism -Quarter wave plate and Half Wave plate – Working principle of Polarimeter (Sacharimeter)

LASERS: Characteristics– Stimulated emission – Einstein's Transition Probabilities- Pumping schemes - Ruby laser – Helium Neon laser.

UNIT-IV

ACOUSTICS: Reverberation time - Sabine's formula – Acoustics of concert-hall.

ULTRASONICS: Production - Ultrasonic transducers- Non-Destructive Testing – Applications.

UNIT-V

CRYSTALLOGRAPHY & X-RAY DIFFRACTION: Basis and lattice – Bravais systems- Symmetry elements- Unit cell- packing fraction – coordination number- Miller indices – Separation between successive (h k l) planes – Bragg's law.

NUCLEAR ENERGY – SOURCE OF POWER: Mass defect & Binding Energy – Fusion and Fission as sources – Fast breeder Reactors.

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UNIT-VI

MAGNETISM: Classification based on Field, Temperature and order/disorder –atomic origin – Ferromagnetism- Hysteresis- applications of magnetic materials (Para &Ferro)..

DIELECTRICS: Electric Polarization – Dielectrics in DC and AC fields – Internal field – Clausius Mossoti Equation - Loss, Breakdown and strength of dielectric materials – Ferroelectric Hysteresis and applications.

***Outcome**: Construction and working details of instruments, ie., Interferometer, Diffractometer and Polarimeter are learnt. Study Acoustics, crystallography magnetic and dielectric materials enhances the utility aspects of materials.*

Text Books:

1. A Textbook of Engineering Physics – by Dr. M.N.Avadhanulu and Dr.P.G.Kshirasagar, S.Chand & Company Ltd., (2014)
2. Physics for Engineers by M.R.Srinasan, New Age international publishers (2009)
3. Engineering Physics by D.K.Bhattacharya and Poonam Tandon , Oxford press (2015)

Refference Books:

1. Applied Physics by P.K.Palanisamy, Scitech publications (2014)
2. Lasers and Non-Linear optics by B.B.Laud, Newage international publishers (2008)

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I Year - II Semester

L	T	P	C
4	0	0	3

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Preamble:
This course covers the topics related to analysis of various electrical circuits, operation of various electrical machines, various electronic components to perform well in their respective fields.

Learning Objectives:

- To learn the basic principles of electrical circuital law's and analysis of networks.
- To understand the principle of operation and construction details of DC machines & Transformers.
- To understand the principle of operation and construction details of alternator and 3-Phase induction motor.
- To study the operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
- To learn the operation of PNP and NPN transistors and various amplifiers.

UNIT - I
Electrical Circuits:
Basic definitions - Types of network elements - Ohm's Law - Kirchhoff's Laws - Inductive networks - Capacitive networks – Series - Parallel circuits - Star-delta and delta-star transformations.

UNIT - II
Dc Machines:
Principle of operation of DC generator – EMF equation - Types of DC machine – Torque equation – Applications – Three point starter - Speed control methods of DC motor – Swinburne's Test.

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UNIT - III
Transformers:
Principle of operation and construction of single phase transformers – EMF equation – Losses – OC & SC tests - Efficiency and regulation.

UNIT - IV
AC Rotating Machines:
Principle of operation and construction of alternators– Types of alternators – Principle of operation of synchronous motor - Principle of operation of 3-Phase induction motor – Slip-torque characteristics - Efficiency – Applications.

UNIT V
Rectifiers & Linear ICs:
PN junction diodes - Diode applications(Half wave and bridge rectifiers).Characteristicsof operation amplifiers (OP-AMP) - application of OP-AMPs (inverting, non-inverting,integrator and differentiator).

UNIT VI

Transistors:

PNP and NPN junction transistor, transistor as an amplifier- Transistor amplifier - Frequency response of CE amplifier - Concepts of feedback amplifier.

Learning Outcomes:

- Able to analyse the various electrical networks.
- Able to understand the operation of DC generators,3-point starter and DC machine testing by Swinburne's Test.
- Able to analyse the performance of single-phase transformer.
- Able to explain the operation of 3-phase alternator and 3-phase induction motors.
- Able to analyse the operation of half wave, full wave bridge rectifiers and OP-AMPs.
- Able to explain the single stage CE amplifier and concept of feedback amplifier.

Text Books:

1. Electrical Technology by Surinder Pal Bali, Pearson Publications.
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

Reference Books:

1.Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group
2. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMH Publications
3.Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition
4.Basic Electrical Engineering by Nagsarkar,Sukhija, Oxford Publications,2nd edition
5.Industrial Electronics by G.K. Mittal, PHI

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I Year - II Semester

L	T	P	C
4	0	0	3

ENGINEERING DRAWING

Objective: Engineering drawing being the principle method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

UNIT I

Objective: To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.

Polygons: Constructing regular polygons by general methods, inscribing and describing polygons on circles.

Curves: Parabola, Ellipse and Hyperbola by general methods, cycloids, involutes, tangents & normals for the curves.

UNIT II

Objective: To introduce the students to use scales and orthographic projections, projections of points & simple lines.

Scales: Plain scales, diagonal scales and vernier scales

Orthographic Projections: Horizontal plane, vertical plane, profile plane, importance of reference lines, projections of points in various quadrants, projections of lines, lines parallel either to of the reference planes (HP,VP or PP)

UNIT III

Objective: The objective is to make the students draw the projections of the lines inclined to both the planes.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces- HT, VT

UNIT IV

Objective: The objective is to make the students draw the projections of the plane inclined to both the planes.

Projections of planes: regular planes perpendicular/parallel to one plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT V

Objective: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes.

Unit VI

Objective: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

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Text Books:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

Reference Books:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

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I Year - II Semester

L	T	P	C
0	0	3	2

ENGLISH-COMMUNICATIONS SKILLS LAB-II

PRESCRIBED LAB MANUAL FOR SEMESTER II:

'INTERACT: English Lab Manual for Undergraduate Students' Published by **Orient Blackswan Pvt Ltd.**

OBJECTIVES:

To enable the students to learn demonstratively the communication skills of listening, speaking, reading and writing.

OUTCOME:

A study of the communicative items in the laboratory will help the students become successful in the competitive world.

The course content along with the study material is divided into six units.

UNIT 1:

1. Debating
   Practice work

UNIT 2:

1. Group Discussions
   Practice work

UNIT 3:

1. Presentation Skills
   Practice work

UNIT 4:

1. Interview Skills
   Practice work

UNIT 5:

1. Email,
2. Curriculum Vitae
   Practice work

UNIT 6:

1. Idiomatic Expressions
2. Common Errors in English
   Practice work

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Reference Books:

1. Strengthen your communication skills by Dr M Hari Prasad, Dr Salivendra Raju and Dr G Suvarna Lakshmi, Maruti Publications.
2. English for Professionals by Prof Eliah, B.S Publications, Hyderabad.
3. Unlock, Listening and speaking skills 2, Cambridge University Press
4. Spring Board to Success, Orient BlackSwan
5. A Practical Course in effective english speaking skills, PHI
6. Word power made handy, Dr shalini verma, Schand Company
7. Let us hear them speak, Jayashree Mohanraj, Sage texts
8. Professional Communication, Aruna Koneru, Mc Grawhill Education
9. Cornerstone, Developing soft skills, Pearson Education

I Year - II Semester

L	T	P	C
0	0	3	2

ENGINEERING / APPLIED PHYSICS LAB
(Any 10 of the following listed experiments)

Objective: *Training field oriented Engineering graduates to handle instruments and their design methods to improve the accuracy of measurements.*

LIST OF EXPERIMENTS:

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2. Newton's rings – Radius of Curvature of Plano - Convex Lens.
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Determination of Rigidity modulus of a material- Torsional Pendulum.
5. Determination of Acceleration due to Gravity and Radius of Gyration- Compound Pendulum.
6. Melde's experiment – Transverse and Longitudinal modes.
7. Verification of laws of vibrations in stretched strings – Sonometer.
8. Determination of velocity of sound – Volume Resonator.
9. L- C- R Series Resonance Circuit.
10. Study of I/V Characteristics of Semiconductor diode.
11. I/V characteristics of Zener diode.
12. Characteristics of Thermistor – Temperature Coefficients.
13. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
14. Energy Band gap of a Semiconductor p - n junction.
15. Hall Effect in semiconductors.
16. Time constant of CR circuit.
17. Determination of wavelength of laser source using diffraction grating.
18. Determination of Young's modulus by method of single cantilever oscillations.
19. Determination of lattice constant – lattice dimensions kit.
20. Determination of Planck's constant using photocell.
21. Determination of surface tension of liquid by capillary rise method.

Outcome: *Physics lab curriculum gives fundamental understanding of design of an instrument with targeted accuracy for physical measurements.*

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I Year - II Semester

L	T	P	C
0	0	2	0

ENGINEERING / APPLIED PHYSICS - VIRTUAL LABS – ASSIGNMENTS

(Constitutes 5% marks of 30marks of Internal-component)

Objective: *Training Engineering students to prepare a technical document and improving their writing skills.*

LIST OF EXPERIMENTS

1. Hall Effect
2. Crystal Structure
3. Hysteresis
4. Brewster's angle
5. Magnetic Levitation / SQUID
6. Numerical Aperture of Optical fiber
7. Photoelectric Effect
8. Simple Harmonic Motion
9. Damped Harmonic Motion
10. LASER – Beam Divergence and Spot size
11. B-H curve
12. Michelson's interferometer
13. Black body radiation

URL: ***www.vlab.co.in***

Outcome: *Physics Virtual laboratory curriculum in the form of assignment ensures an engineering graduate to prepare a /technical/mini-project/ experimental report with scientific temper.*

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I Year - II Semester

L	T	P	C
0	0	3	2

ENGINEERING WORKSHOP & IT WORKSHOP

ENGINEERING WORKSHOP

Course Objective: To impart hands-on practice on basic engineering trades and skills.

Note: At least two exercises to be done from each trade.

Trade:

Carpentry	1. T-Lap Joint 2. Cross Lap Joint 3. Dovetail Joint 4. Mortise and Tenon Joint
Fitting	1. Vee Fit 2. Square Fit 3. Half Round Fit 4. Dovetail Fit
Black Smithy	1. Round rod to Square 2. S-Hook 3. Round Rod to Flat Ring 4. Round Rod to Square headed bolt
House Wiring	1. Parallel / Series Connection of three bulbs 2. Stair Case wiring 3. Florescent Lamp Fitting 4. Measurement of Earth Resistance
Tin Smithy	1. Taper Tray 2. Square Box without lid 3. Open Scoop 4. Funnel

IT WORKSHOP

OBJECTIVES:

- Understand the basic components and peripherals of a computer.
- To become familiar in configuring a system.
- Learn the usage of productivity tools.
- Acquire knowledge about the netiquette and cyber hygiene.
- Get hands on experience in trouble shooting a system?

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1. **System Assembling, Disassembling and identification of Parts / Peripherals**

2. **Operating System Installation**-Install Operating Systems like Windows, Linux along with necessary Device Drivers.
3. **MS-Office / Open Office**
    a. **Word** - Formatting, Page Borders, Reviewing, Equations, symbols.
    b. **Spread Sheet** - organize data, usage of formula, graphs, charts.
    c. **Power point** - features of power point, guidelines for preparing an effective presentation.
    d. **Access**- creation of database, validate data.

4. **Network Configuration & Software Installation**-Configuring TCP/IP, proxy and firewall settings. Installing application software, system software & tools.
5. **Internet and World Wide Web**-Search Engines, Types of search engines, netiquette, cyber hygiene.
6. Trouble Shooting-Hardware trouble shooting, Software trouble shooting.
7. **MATLAB**- basic commands, subroutines, graph plotting.
8. **LATEX**-basic formatting, handling equations and images.

OUTCOMES:

- Common understanding of concepts, patterns of decentralization implementation in Africa †
- Identified opportunities for coordinated policy responses, capacity building and implementation of best practices †
- Identified instruments for improved decentralization to the local level †
- Identified strategies for overcoming constraints to effective decentralization and sustainable management at different levels

Text Books:

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1. Computer Hardware, Installation, Interfacing, Troubleshooting and Maintenance, K.L. James, Eastern Economy Edition.
2. Microsoft Office 2007: Introductory Concepts and Techniques, Windows XP Edition ByGary B. Shelly, Misty E. Vermaat and Thomas J. Cashman (2007, Paperback).
3. LATEX- User's Guide and Reference manual, Leslie Lamport, Pearson, LPE, 2/e.
4. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, Rudraprathap, Oxford University Press, 2002.
5. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson, 2008
6. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech.
7. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech.
8. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.

II Year - I Semester

L	T	P	C
4	0	0	3

ELEMENTS OF AEROSPACE ENGINEERING

Course 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: After completion of the course students are able :

1. To know the properties of standard atmosphere relevant to the aspects of aerospace engineering.
2. To understand the basics issues of aerodynamics forces acting on an airfoil.
3. To analyze the working principles of various aircraft engines systems.
4. To identify and know functions of the various components of aircraft wing
5. To analyze 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

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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

Aircraft Instruments: Accelerometers, Air speed Indicators – Mach Meters – Altimeters, Tachometers – Temperature gauges – Pressure gauge, Gyroscopic Instruments

UNIT - VI

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. Pallet, E.H.J., "Aircraft Instruments & Principles", Pitman & Co., 1993.
2. Houghton E. L., Carpenter P.W., Aerodynamics for Engineering Students, 6th Edition, Elsevier
3. A.C. Kermode., Mechanics of Flight, 11th Edition, Pearson Education

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II Year - I Semester

L	T	P	C
4	0	0	3

THERMODYNAMICS

Course 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: After completion of the course students are able to:

1. To understand the concepts of heat, work and energy and temperature measurement.
2. To apply the first law of thermodynamics to various thermal systems for analysis.
3. To analyze the irreversibilities of various systems using second law of thermodynamics.
4. To analyze the properties of different gas mixtures and pure substances.
5. To apply ideal cycle analysis to simple heat engines to estimate various performance parameters.

UNIT – I

Introduction: Basic Concepts : System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – PMM I

UNIT II

Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation. Throttling and free expansion processes – deviations from perfect gas model – vander Waals equation of state – compressibility charts – variable specific heats – gas tables.

UNIT – III

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

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UNIT IV

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

UNIT – V

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

UNIT - VI

Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Refrigeration Cycles : Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell- Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS :

1. Engineering Thermodynamics , PK Nag 4th Edn , TMH.
2. Thermodynamics – An Engineering Approach with student resources DVD – Y.A.Cengel & M.A.Boles , 7th Edn – McGrawHill

REFERENCES :

1. Engineering Thermodynamics – Jones & Dugan PHI
2. Thermodynamics – J.P.Holman , McGrawHill
3. Basic Engineering Thermodynamics – A.Venkatesh – Universities press.
4. An Introduction to Thermodynamics - Y.V.C.Rao – Universities press.
5. Thermodynamics – W.Z.Black & J.G.Hartley, 3rd Edn Pearson Publ.
6. Engineering Thermodynamics – D.P.Misra, Cengage Publ.
7. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ.

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II Year - I Semester

L	T	P	C
4	0	0	3

MECHANICS OF FLUIDS

Corse Objective:

The students completing this course are expected to understand the basic terms like viscosity, shear stress, bulk modulus, vapour pressure, cavitation…etc and study the continuity, Euler, Bernoulli, momentum and energy equations. They should be able to determine the flow rate using various measuring devices. Further, the student shall be able to understand the boundary layer theory, its separation and control. Knowledge of fluid flow characteristics through various geometries and compressible fluid flow theory shall be imparted to the student.

UNIT – I

Objective: After studying this unit student will know the basic terms like Density, Specific weight, Specific gravity, viscosity, Vapour pressure. To evaluate the variation of pressure between the two pipes of a u tube mano meters, study the applications Buoyancy concepts submerged in air.

Fluid Properties And Fluid Statics: Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility, Pressure at a point, Pascal's law, pressure variation with temperature, density and attitude. Hydro static law, Piezometer, Simple and differential manometers, pressure gauges, total pressure and center of pressure – plane, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT – II

Objective: After studying this unit student will know the basic flows like stream line, path line, streak line, steam tube. Practical applications of a laminar flow and turbulent flow with their significance. Mathematical approach connecting with stream function and potential function.

Fluid Kinematics : Stream line, path line, streak line, stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, one, two and three dimensional flows – Continuity equation in 3D flow, stream function, velocity potential function.

UNIT – III

Objective: After studying this unit student will know the surface force gravity force viscos force pressure force surface tension force …etc. Using a cylindrical fluid element acting a gravity and pressure forces to generate the Eulers equation with its fluid kinematic analysis. Describe the flow measurements using a ventury meter and orifice meter.

Fluid Dynamics : Surface and Body forces – Euler's and Bernoulli's equation derivation, Navierstokes equation (explanation only) Momentum equation - applications, vortex – Free and Forced. Forced vortex with free surface. Similitude and Flow Measurement – Similarly laws, distorted models. Flow through Venturimeter and Orificemeter,

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UNIT – IV

Objective: After studying this unit student can be able to understand by approximate solution of N.S equations and Von-Karman's Prandtl equation. Describe the various velocity gradients, pressure gradients of a boundary layer separation concepts. Basic definitions about drag lift and magnus effect.

Flow through notches and weirs, Viscometers, Hot wire Anemometers, Pitot tube, Flow through nozzles. Approximate solutions of N.S. Equations - Boundary layer- concepts, Prandtl contribution, Characteristices of boundary layer along a thin flat plate Von-karman's momentum integral equation (No derivation), laminar and turbulent Boundary layers, BL in transition, separation of BL, control of BL separation, flow around submerged objects, Drag and lift – types of drag – magnus effect.

UNIT – V

Objective: After studying this unit student shall understand the flow characteristics of real fluids and should be able to calculate the various losses and friction factor for flow through tubes.

Closed Conduit Flow: Characteristics of real fluids – Reynolds experiment –Darcy's equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line. Exact Solutions of Navier Stokes Equations. Flow between parallel plates, flow through long tubes - Fow through inclined tubes, Turbulent flow, variation of friction factor with Reynold's Number.

Course outcomes:

Text Books:

References:

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II Year - I Semester

L	T	P	C
4	0	0	3

COMPUTER AIDED ENGINEERING DRAWING PRACTICE

Course Objective: To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.

UNIT-I:

Objective: The knowledge of projections of solids is essential in 3D modeling and animation. The student will be able to draw projections of solids. The objective is to enhance the skills they already acquired in their earlier course in drawing of projection.
PROJECTIONS OF SOLIDS: Projections of Regular Solids inclined to both planes – Auxiliary Views.

UNIT-II:

The knowledge of sections of solids and development of surfaces is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection.
SECTIONS OF SOLIDS: Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

DEVELOPMENT AND INTERPENETRATION OF SOLIDS: Development of Surfaces of Right
Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts.

UNIT-III:

The intersection of solids also plays an important role in designing and manufacturing. The objective is to impart this knowledge through this topic. A perspective view provides a realistic 3D View of an object. The objective is to make the students learn the methods of Iso and Perspective views.
INTERPENETRATION OF RIGHT REGULAR SOLIDS: Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.
PERSPECTIVE PROJECTIONS: Perspective View: Points, Lines, Plane Figures and Simple Solids,
Vanishing Point Methods (General Method only).

In part B computer aided drafting is introduced.

UNIT IV:

The objective is to introduce various commands in AutoCAD to draw the geometric entities and to create 2D and 3D wire frame models.
INTRODUCTION TO COMPUTER AIDED DRAFTING: Generation of points, lines, curves, polygons, dimensioning. Types of modeling : object selection commands – edit, zoom, cross hatching, pattern filling, utility commands, 2D wire frame modeling, 3D wire frame modeling,.

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UNIT V:
By going through this topic the student will be able to understand the paper-space environment thoroughly.
VIEW POINTS AND VIEW PORTS: view point coordinates and view(s) displayed, examples to exercise different options like save, restore, delete, joint, single option.

UNIT VI:
The objective is to make the students create geometrical model of simple solids and machine parts and display the same as an Isometric, Orthographic or Perspective projection.
COMPUTER AIDED SOLID MODELING: Isometric projections, orthographic projections of isometric projections, Modeling of simple solids, Modeling of Machines & Machine Parts.

TEXT BOOKS :

1. Engineering drawing by N.D Bhatt, Charotar publications.
2. Engineering Graphics, K.C. john, PHI Publications

REFERENCES:

1. Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura, Sybex
2. Auto CAD 2013 fundamentals- Elisemoss, SDC Publ.
3. Engineering Drawing and Graphics using Auto Cad – T Jeyapoovan, vikas
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age
5. Engineering Drawing – RK Dhawan, S Chand
6. Engineering Drawing – MB Shaw, BC Rana, Pearson
7. Engineering Drawing – KL Narayana, P Kannaiah, Scitech
8. Engineering Drawing – Agarwal and Agarwal, Mc Graw Hill
9. Engineering Graphics – PI Varghese, Mc Graw Hill
10. Text book of Engineering Drawing with auto-CAD , K.venkata reddy/B.S . publications.
11. Engineering Drawing with Auto CAD/ James D Bethune/Pearson Publications
12. Engineering Graphics with Auto CAD/Kulkarni D.M, Rastogi A.P, Sarkar A.K/PHI Publications

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End Semester examination shall be conducted for **Four** hours with the following pattern:

a) Two hours-Conventional drawing
b) Two hours – Computer Aided Drawing

II Year - I Semester

L	T	P	C
4	0	0	3

MECHANICS OF SOLIDS

Objective: The students completing this course are expected to understand the basic terms like stress, strain, poissons ratio…etc and different stresses induced in beams, thin cylinders, thick cylinders, columns. Further, the student shall be able to understand the shear stresses in circular shafts.

UNIT – I

Objective: After studying this unit student will know the basic terms like stress, strain poissons ratio…etc and stresses in bars of varying cross sections, composite bars, thermal stress in members, stresses on inclined planes with analytical approach and graphical approach, strain energy under different loadings and also problem solving techniques.

SIMPLE STRESSES & STRAINS : Elasticity and plasticity – Types of stresses & strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

Objective: After studying this unit student will know the construction of shear force diagrams and bending moment diagrams to the different loads for the different support arrangements and also problem solving techniques.

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

Objective**:** After studying this unit student will know the bending and shear stress induced in the beams which are made with different cross sections like rectangular, circular, triangular, I, T angle sections and also problem solving techniques.

FLEXURAL STRESSES : Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

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UNIT – IV

Obective: After studying this unit student will know how to finding slope and deflection for different support arrangements by Double integration method, Macaulay's method and Moment-Area and also problem solving techniques.

DEFLECTION OF BEAMS : Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams. Statically Indeterminate Beams and solution methods.

UNIT – V

Objective: After studying this unit student will know how a cylinder fails, what kind of stresses induced in cylinders subjected to internal, external pressures and also problem solving techniques.

THIN CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

THICK CYLINDERS: –lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

UNIT –VI

Objective: After studying this unit student will know shear stresses induced in circular shafts, discussing columns in stability point of view and columns with different end conditions.

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

COLUMNS:

Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula,

TEXT BOOKS:

1. Strength of materials /GH Ryder/ Mc Millan publishers India Ltd
2. Solid Mechanics, by Popov
3. Mechanics of Materials/Gere and Timoshenko, CBS Publishers

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REFERENCES :

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol-III, by S.B.Junnarkar.
4. Strength of Materials by S.Timshenko
5. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman.

II Year - I Semester

L	T	P	C
4	0	0	3

MANAGERIAL ECONOMICS & FINANCIAL ANALYASIS

Course Objectives:

- The Learning objectives of this paper is to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting, Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation. Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

UNIT-I

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand-Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

UNIT – II

Production and Cost Analyses:

Concept of Production function- Cobb-Douglas Production function- Leontief production function - Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs- Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(simple problems)-Managerial significance and limitations of Breakeven point.

UNIT – III

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing.

UNIT – IV

Types of Business Organization and Business Cycles:

Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms – Business Cycles : Meaning and Features – Phases of a Business Cycle.

UNIT – V

Introduction to Accounting & Financing Analysis:

Introduction to Double Entry Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow statements (Simple Problems)

UNIT – VI

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Course Outcome:

*****The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product and the knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.

*****One is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.

*****The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis and to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

TEXT BOOKS

1. Dr. N. AppaRao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
2. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3. Prof. J.V.Prabhakararao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

REFERENCES:

1.Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House, 2014.
2. V. Maheswari: Managerial Economics, Sultan Chand.2014
3. Suma Damodaran: Managerial Economics, Oxford 2011.
4. VanithaAgarwal: Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja: Financial Accounting for Managers, Pearson.
6. Maheswari: Financial Accounting, Vikas Publications.
7. S. A. Siddiqui& A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012
8. Ramesh Singh, Indian Economy, 7th Edn., TMH2015
9. Pankaj Tandon A Text Book of Microeconomic Theory, Sage Publishers, 2015
10.Shailaja Gajjala and Usha Munipalle, Univerties press, 2015

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II Year - I Semester

L	T	P	C
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FLUID MECHANICS AND STRENGTH OF MATERIALS LAB

Course 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 buckling.

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

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II Year - I Semester

L	T	P	C
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ELECTRICAL & ELECTRONICS ENGG LAB

Section A: Electrical Engineering:

Learning Objectives:

- To predetermine the efficiency of dc shunt machine using Swinburne's test.
- To predetermine the efficiency and regulation of 1-phase transformer with O.C and S.C tests.
- To obtain performance characteristics of DC shunt motor &3-phase induction motor.
- To find out regulation of an alternator with synchronous impedance method.
- To control speed of dc shunt motor using speed control methods.
- To find out the characteristics of PN junction diode & transistor
- To determine the ripple factor of half wave & full wave rectifiers.

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's test on D.C. Shunt machine (Predetermination of efficiency of a given D.C.Shunt machine working as motor and generator).
2. OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors).
3. Brake test on 3-phase Induction motor (Determination of performance characteristics)
4. Regulation of alternator by Synchronous impedance method.
5. Speed control of D.C. Shunt motor by
   a) Armature Voltage control b) Field flux control method
6. Brake test on D.C. Shunt Motor.

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Section B: Electronics Engineering.

The following experiments are required to be conducted as compulsory experiments:

1. PNjunction diode characteristics a) Forward bias b) Reverse bias (Cut in voltage and resistance calculations)
2. Transistor CE characteristics (Input and output)
3. Half wave rectifier with and with out filters.
4. Full wave rectifier with and with out filters.
5. CE amplifiers.
6. OP- Amp applications (inverting, non inverting, integrator and differentiator)

Learning Outcomes:

- Able to find out the efficiency of dc shunt machine without actual loading of the machine.
- Able to estimate the efficiency and regulation for different load conditions and power factors of single phase transformer with OC and SC test.
- Able to analyse the performance characteristics and to determine efficiencyof DC shunt motor &3-phase induction motor.
- Able to pre-determine the regulation of an alternator by synchronous impedance method.
- Able to control the speed of dc shunt motor using speed control methods.
- Able to find out the characteristics of PN junction diode & transistor
- Able to determine the ripple factor of half wave & full wave rectifiers.

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II Year - II Semester

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AERODYNAMICS-I

Course Objectives:

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: At the end of course the student will be able

1. To apply Laplace equation for obtaining 2D and axisymmetric solutions
2. To apply conformal transformation to from aerodynamic shapes
3. To apply potential flow theory to solve for aerofoil characteristics
4. To apply the Prandtl's lifting line theory to predict finite wing properties
5. To analyze the effect of boundary layer on flow over objects

UNIT-I

BASICS

Wing and Airfoil section geometry - Aerodynamic forces and moments-Force and moment components and coefficients, Pressure distribution on an airfoil, Types of drag, Estimation of lift, Drag and pitching moment coefficient from the pressure distribution. Experimental methods, wake survey.

UNIT-II

ELEMENTARY FLOWS

Incompressible flow condition, Governing equation for irrotational, incompressible flow: Laplace's equation, Boundary conditions. Elementary flows. Combination of uniform flow with a Source and Sink, Doublet. Flow over a circular cylinder, Vortex flow. Circulation, Kutta-Joukowski theorem. Lifting flow over a cylinder, the vortex sheet. Kelvin circulation theorem and starting vortex.

UNIT-III

INCOMPRESSIBLE FLOW OVER AIRFOILS

The complex potential function and conformal transformation, The Kutta-Zhukovsky transformation. Kutta condition. Lifton the Zhukovsky airfoil section.

THIN AIRFOIL THEORY

Classical thin airfoil theory for symmetric and cambered airfoil sections. Comparison of theoretical and experimental results. Limitations of thin airfoil theory.

UNIT-IV

INCOMPRESSIBLE FLOW OVER FINITE WINGS

Vortex filament, Biot-Savart law and Helmholtz's theorems, Prandtls classical lifting line theory: Downwash and induced drag. Elliptical and modified elliptical lift distribution. Lift distribution on wings. Limitations of Prandtl's lifting line theory.

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UNIT-V

EXTENDED LIFTING LINE THEORY

Extended lifting line theory- lifting surface theory, vortex lattice method for wings. Lift, drag and moment characteristics of complete airplane.

UNIT-VI

SOURCE PANEL METHOD

Source panel method-non-lifting flow over an arbitrary bodies-potential flow over a circular cylinder.

VORTEX PANEL METHOD

Vortex panel methods-Lifting flow over an arbitrary body- flow over a symmetrical airfoil

TEXT BOOKS:

1. Anderson, J .D., Fundamental of Aerodynamics, Mc Graw-Hill International Edition
2. Houghton, E.L., and Carruthers, N.B., Aerodynamics for Engineering Students, Edward Arnold Publishers Ltd., London, 1989

REFERENCE BOOKS:

1. Clancy, L.J., Aerodynamics, Pitman, 1986
2. Milne Thomson, Theoretical Aerodynamics, Macmillan, 1985

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II Year - II Semester

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MANUFACTURING TECHNOLOGY

Course Objectives:

1. 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.
2. The course also gives some idea about the basic machines, different operations to be performed and also about unconventional machining processes.

Course Outcomes: At the end of course the student will be able

1. To acquire knowledge of the basic aspects of casting process.
2. To know the various basic concepts of welding process
3. To apply metal forming process and sheet metal operations in the manufacturing of products
4. To apply various lathe operations to manufacture products.
5. 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.

UNIT - IV

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

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UNIT - V

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 - VI

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

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II Year - II Semester

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AIRCRAFT SYSTEMS AND INSTRUMENTS

Course 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: At the end of course the student will be able

1. To apply the various types of controls in the airplane design
2. To analyze the performance of hydraulic and pneumatic systems in the aircraft operation
3. To analyze the performance of various engine systems of an aircraft
4. To employ necessary auxiliary systems in the operation of an aircraft
5. 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 FUEL SYSTEMS: Fuel systems for Piston and jet engines, piston engine fuel systems-carburetor and its classification, Characteristics of aircraft fuel systems, fuel system components, fuel pumps, Fuel system operation-electronic control fuel system, fuel control unit-FADAC

UNIT IV

ENGINE INGNITION AND LUBRICATION SYSTEMS

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

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UNIT - V

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 - VI

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

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II Year - II Semester

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ELEMENTS OF HEAT TRANSFER

Course 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: At the end of course the student will be able

1. To formulate heat conduction phenomenon through plane, cylindrical, and spherical surfaces
2. To solve practical problems of steady and unsteady state heat transfer.
3. To analyze the convective heat transfer phenomenon in both external and internal flows
4. To understand the thermal radiation concepts.
5. 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.

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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

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

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

UNIT – V

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 - VI

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.

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II Year - II Semester

L	T	P	C
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APPLIED THERMODYNAMICS

Course 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: At the end of course the student will be able

1. To identify all the essential components of a thermal power plant and develop methods of reducing losses in a vapor power cycle.
2. To analyze performance the stream nozzles and condensers
3. To analyze and compare the performance of Impulse, Reaction turbines
4. To know the function of various components I.C engines
5. 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.

UNIT - II

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.

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UNIT - III

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 - IV

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 - V

I.C Engines: Classification-Components-S.I and C.I engines-Comparison –Four Stroke and Two stroke Engines-Comparision-Air-fuel mixture-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 – VI

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

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II Year - II Semester

L	T	P	C
4	0	0	3

INDUSTRIALS ENGINEERING AND MANAGEMENT

Course Objectives:

1. To impart fundamental knowledge and skill sets required in the Industrial Management and Engineering profession, which include the ability to apply basic knowledge of mathematics, probability and statistics, and the domain knowledge of Industrial Management and Engineering
2. To produce graduates with the ability to adopt a system approach to design, develop, implement and innovate integrated systems that include people, materials, information, equipment and energy.
3. To enable students to understand the interactions between engineering, business, technological and environmental spheres in the modern society.
4. To enable students to understand their role as engineers and their impact to society at the national and global context.

UNIT – I

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

UNIT – II

PLANT LAYOUT: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and breakdown maintenance.

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UNIT – III

OPERATIONS MANAGEMENT: Importance, types of production, applications, workstudy, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs,

UNIT – IV

STATISTICAL QUALITY CONTROL: Quality control, its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – $\overline{X}$ and R – charts $\overline{X}$ AND *S* charts and their applications, numerical examples.

TOTAL QUALITY MANAGEMENT: zero defect concept, quality circles, implementation, applications, ISO quality systems. six sigma – definition, basic concepts

UNIT – V

RESOURCE MANAGEMENT: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, types.

UNIT - VI

VALUE ANALYSIS: Value engineering, implementation procedure, enterprise resource planning and supply chain management.

PROJECT MANAGEMENT: PERT, CPM – differences & applications, critical path, determination of floats, importance, project crashing, smoothing and numerical examples.

TEXT BOOKS:

1. Industrial Engineering and management / O.P Khanna/Khanna Publishers.
2. Industrial Engineering and Production Management/Martand Telsang/S.Chand & Company Ltd. New Delhi

Reference Books:

1. Industrial Management / Bhattacharya DK/Vikas publishers
2. Operations Management / J.G Monks/McGrawHill Publishers.
3. Industrial Engineering and Management Science/ T. R. Banga, S. C. Sharma, N. K. Agarwal/Khanna Publishers
4. Principles of Management /Koontz O' Donnel/McGraw Hill Publishers.
5. Statistical Quality Control /Gupta/Khanna Publishers
6. Industrial Engineering and Management /NVS Raju/Cengage Publishers

Course outcome:

Upon successful completion of this course you should be able to:

1. Design and conduct experiments, analyse, interpret data and synthesize valid conclusions
2. Design a system, component, or process, and synthesize solutions to achieve desired needs
3. Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints
4. Function effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management

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II Year - II Semester

L	T	P	C
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APPLIED THERMODYNAMICS LAB

Course Objectives:

1. To learn the construction and working principle of I.C.Engines practically.
2. Understand the performance of air compressor practically.
3. To acquire the priorities given to the efficient use of energy and the minimization of environmental pollution.
4. 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.

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II Year - II Semester

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MANUFACTURING TECHNOLOGY LAB

Course 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

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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

III Year - I Semester

L	T	P	C
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AIRCRAFT PERFORMANCE

Course 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: At the end of course the student will be able

1. To analyze the performance of an airplane propellers
2. To analyze the various sources of drag force acting on an airplane
3. To apply the analytical approaches to identify the various parameters dictating the steady level flight performance at various altitudes and velocities
4. To analyze the nature of response of forces acting on manoeuvring flight to determine its performance
5. 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, Piston engine characteristics, Jet engine characteristics

UNIT-II

PROPELLER THEORY-Froude's Momentum Theory, Blade Element Theory, Propeller coefficients, Use of propeller charts, Performance of fixed and variable pitch propellers, Propulsion characteristics

UNIT - III

DRAG ESTIMATION: 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 - IV

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

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UNIT - V

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 - VI

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

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III Year - I Semester

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AERODYNAMICS - II

Course 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: At the end of course the student will be able

1. To apply the of compressible fluid flow equations to solve flow problems
2. To apply the steady one-dimensional flow principles in designing the nozzles and diffusers
3. To analyze the supersonic flow behavior over objects
4. To design ducts for fluid flows by considering friction and heat transfer affects
5. 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

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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 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,

UNIT - IV

Expansion Waves:

Expansion waves, Prandtl-Meyer expansion fan, Prandtl-Meyer function, Simple and Non-simple Regions, Similarity rule, Reflection and intersection of shock and expansion waves, wave reflection from free and wall boundary

UNIT - V

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 - VI

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

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III Year - I Semester

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AIRCRAFT STRUCTURES – I

Course 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: At the end of course the student will be able

1. To solve problems by apply the stress-strain relations
2. To analyze the trusses under loading conditions
3. To analyze the statically indeterminate structures under loading conditions
4. To evaluate the strain energy stored in the structural members
5. 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.

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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.

UNIT –VI

Failure Theories: Ductile and brittle materials, maximum principle stress theory, maximum principle strain theory, maximum shear stress theory, distortion energy theory, octahedral shear stress theory

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. Megson TMG, Aircraft structures for engineering students, Elseveir science and technology
2. B.C.Punmia, "Theory of Structures", Laxmi Publication.
3. S.Ramamrutham, R.Narayanan,"Theory of Structures"-Dhanpat Rai Publishing Co, 2003.

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III Year - I Semester

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PROPULSION - I

Course 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: At the end of course the student will be able

1. To analyse the performance characteristics of various Gas turbine engines
2. To design subsonic and supersonic inlets for jet engines
3. To analyse the performance characteristics aircraft compressors
4. To identify the parameters governing the design of combustion chambers
5. 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

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UNIT - III

Compressors: Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of Pre-whirl, Stall and Surge, Elementary theory of axial flow compressor – Velocity triangles – degree of reaction 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

UNIT –VI

Nozzles: Theory of flow in isentropic nozzles, Nozzle efficiency - Losses in nozzles – Over expanded and under expanded nozzles - Ejector and variable area, nozzles - Interaction of nozzle flow with adjacent surfaces - Types of nozzles- Thrust reversal

TEXT BOOK

1. Cohen, H. Rogers, G.F.C., Saravanamuttoo, H.I.H. "Gas Turbine Theory", Longman

REFERENCES

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

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III Year - I Semester

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THEORY OF MACHINES

Course 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: At the end of course the student will be able

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.

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UNIT - III

GEARS: Gear profile and geometry – Nomenclature of spur and helical gears only– Gear trains - Simple, compound gear trains and epicylic gear trains -

UNIT - IV

CAMS: 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 - V

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-VI

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.

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III Year - I Semester

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CAD/ CAM LABORATORY

Course Educational Objectives

1. To learn about basic principles of CAD/CAM.
2. To Gain the knowledge about part programming and CNC machines.

Course outcome: After completing the course learner will be in a position to make use of latest modeling , designing softwares and is expected to well verse with CNC programming and machining skills**.**

To apply CAQC techniques in manufacturing

1. **DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric representation of dimensioning and tolerances scanning and plotting. Study of script, DXE and IGES files.
2. **PART MODELING:** Generation of various 3D models through protrusion, revolve, shell sweep, creation of various features. Study of parent child relation, feature based and boolean based modeling surface and assembly modeling. Study of various standard translators, design simple components.

3. a). Determination of deflection and stresses in 2D and 3D trusses and beams.
   b). Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.
   c). Determination of stresses in 3D and shell structures (at least one example in each case)
   d). Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
   e). Steady state heat transfer Analysis of plane and Axisymmetric components.

4. a). Development of process sheets for various components based on tooling Machines.
   b). Development of manufacturing and tool management systems.
   c). Study of various post processors used in NC Machines.
   d). Development of NC code for free form and sculptured surfaces using CAM packages.
   e). Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package. Through RS 232.
   f) Quality Control and inspection.

Packages to be provided to cater to drafting, modeling & analysis from the following: Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM, Master CAM etc.

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III Year - I Semester

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AERODYNAMICS LAB

Course 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: At the end of the course the student will be able

1. To analyze the flow characteristics over aerodynamic bodies
2. 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 using three component strain gauge balance in wind tunnel
3. Determination of lift and drag for the cambered aerofoil using three component strain gauge balance in wind tunnel
4. Pressure Distribution over a smooth circular cylinder.
5. Pressure Distribution over a smooth rough cylinder.
6. Pressure Distribution over a symmetrical aerofoil.
7. Pressure Distribution over a cambered aerofoil.
8. Pressure Distribution over a forward facing step
9. Pressure Distribution over a backward facing step
10. Visualization of flow field around circular cylinder using smoke tunnel.
11. Generation of potential flow pattern over objects using Hele-Shaw Apparatus.
12. Visualization of flow field around cylinder using water flow channel
13. Visualization of flow field around aerofoil using water flow channel

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III Year - I Semester

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PROPULSION LAB

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

Course Outcomes: At the end of the course the student will be able

1. To analyze the performance of various jet engines components
2. To analyze the performance of piston engine components

Any of the 10 Experiments are required to be conducted

1. Free jet characteristics
2. Wall jet characteristics
3. Free convective heat transfer over a flat plate
4. Forced convective heat transfer over a flat plate
5. Free convective heat transfer over aerofoil
6. Forced convective heat transfer over aerofoil
7. Cascade testing of compressor blade row
8. Cascade testing of turbine blade row
9. Properties of aviation fuel
10. Burn rate measurements of Solid propellant
11. Performance of propeller
12. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
13. Study of an aircraft jet engine - various components, their functions and operating principles
14. Flow thorough Convergent Nozzle
15. Flow thorough Convergent- Divergent Nozzle
16. Supersonic Flow Visualization using Shadowgraph Technique.

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III Year - I Semester

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INTELLECTUAL PROPERTY RIGHTS AND PATENTS

Objectives:

***To know the importance of Intellectual property rights, which plays a vital role in advanced Technical and Scientific disciplines.**

***Imparting IPR protections and regulations for further advancement, so that the students can familiarize with the latest developments.**

Unit I: Introduction to Intellectual Property Rights (IPR)

Concept of Property - Introduction to IPR – International Instruments and IPR - WIPO - TRIPS – WTO -Laws Relating to IPR - IPR Tool Kit - Protection and Regulation - Copyrights and Neighboring Rights – Industrial Property – Patents - Agencies for IPR Registration – Traditional Knowledge –Emerging Areas of IPR - Layout Designs and Integrated Circuits – Use and Misuse of Intellectual Property Rights.

Unit II: Copyrights and Neighboring Rights

Introduction to Copyrights – Principles of Copyright Protection – Law Relating to Copyrights - Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of Performers – Copyright Registration – Limitations – Infringement of Copyright – Relief and Remedy – Case Law - Semiconductor Chip Protection Act.

Unit III: Patents

Introduction to Patents - Laws Relating to Patents in India – Patent Requirements – Product Patent and Process Patent - Patent Search - Patent Registration and Granting of Patent - Exclusive Rights – Limitations - Ownership and Transfer — Revocation of Patent – Patent Appellate Board - Infringement of Patent – Compulsory Licensing — Patent Cooperation Treaty – New developments in Patents – Software Protection and Computer related Innovations.

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Unit IV: Trademarks

Introduction to Trademarks – Laws Relating to Trademarks – Functions of Trademark – Distinction between Trademark and Property Mark – Marks Covered under Trademark Law - Trade Mark Registration – Trade Mark Maintenance – Transfer of rights - Deceptive Similarities - Likelihood of Confusion - Dilution of Ownership – Trademarks Claims and Infringement – Remedies – Passing Off Action.

Unit V: Trade Secrets

Introduction to Trade Secrets – General Principles - Laws Relating to Trade Secrets - Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreements – Breach of Contract –Law of Unfair Competition – Trade Secret Litigation – Applying State Law.

Unit VI: Cyber Law and Cyber Crime

Introduction to Cyber Law – Information Technology Act 2000 - Protection of Online and Computer Transactions - E-commerce - Data Security – Authentication and Confidentiality - Privacy - Digital Signatures – Certifying Authorities - Cyber Crimes - Prevention and Punishment – Liability of Network Providers.

- Relevant Cases Shall be dealt where ever necessary.

Outcome:

*** IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents.**

***Student get an insight on Copyrights, Patents and Software patents which are instrumental for further advancements.**

References:

1. Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, New Delhi.
2. Deborah E.Bouchoux: Intellectual Property, Cengage Learning, New Delhi.
3. PrabhuddhaGanguli: Intellectual Property Rights, Tata Mc-Graw –Hill, New Delhi
4. Richard Stim: Intellectual Property, Cengage Learning, New Delhi.
5. Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
6. Cyber Law - Texts & Cases, South-Western's Special Topics Collections.
7. R.Radha Krishnan, S.Balasubramanian: Intellectual Property Rights, Excel Books. New Delhi.
8. M.Ashok Kumar and MohdIqbal Ali: Intellectual Property Rights, Serials Pub.

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III Year - II Semester

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AIRCRAFT STABILITY AND CONTROL

Course 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: At the end of the course the student will be able

1. To apply the conditions in static longitudinal stability in the aircraft design
2. To apply the static lateral stability condition s in the design of an aircraft
3. To apply the static directional stability conditions in the design of an aircraft
4. To analyze the dynamics longitudinal motion of an aircraft
5. To analyze the dynamic lateral and directional mode of motion of an aircraft

UNIT – I

Degree of freedom of a system - Static and dynamic stability - Need for stability in an airplanes - Purpose of controls -Inherently and marginally stable airplanes.

EQUATIONS OF MOTION

Equations of motion of a rigid body, Inertial forces and moments, Equations of motion of flight vehicles, Aerodynamic forces and moments, Decoupling of longitudinal and lateral-directional equations. Linearization of equations

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UNIT - II

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 - III

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 - IV

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 - V

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-VI

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

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III Year - II Semester

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AIRCRAFT STRUCTURES – II

Course 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: At the end of the course the student will be able

1. To analyze the behavior of beam structures subjected to different loading conditions
2. To analyze the shear flow distribution and location of shear centre for open sections
3. To analyze the shear flow distribution in closed sections
4. To design elementary beam structures to withstand specified loads.
5. 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.

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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

UNIT –V

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 - VI

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.

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III Year - II Semester

L	T	P	C
4	0	0	3

PROPULSION-II

Course 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: At the end of the course the student will be able

1. To analyze the performance of ramjet engine components
2. To understand the basic aspects of rocket propulsion
3. To analyze the performance of liquid propellant rocket systems
4. To analyze the performance of solid propellant rocket systems
5. 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,

UNIT-II

SCRAMJET PROPULSION

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 - III

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

UNIT - IV

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

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UNIT - V

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

UNIT - V I

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.

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III Year - II Semester

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FINITE ELEMENT METHODS

Course Objectives:

1. To learn basic principles of finite element analysis procedure
2. To learn the theory and characteristics of finite elements that represent engineering structures
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others
4. Learn to model complex geometry problems and solution techniques.

Course outcomes: Upon successful completion of this course you should be able to:

1. Understand the concepts behind variational methods and weighted residual methods in FEM
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso parametric elements, and 3-D element .
3. Develop element characteristic equation procedure and generation of global stiffness equation will be applied.
4. Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.
5. Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer, and fluid flow.

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UNIT-I

Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, one dimensional problems.

UNIT – II

Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – III

Analysis of Trusses: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, and strain and support reaction calculations. Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – IV

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

UNIT-V

Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

UNIT – VI

Steady state heat transfer analysis: one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu / Prentice – Hall.
2. The Finite Element Methods in Engineering / SS Rao / Pergamon.

REFERENCES:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers
2. An introduction to Finite Element Method / JN Reddy / McGrawHill
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
4. Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson Education

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III Year - II Semester

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DATA BASE MANAGEMENT SYSTEM
(OPEN ELECTIVE)

OBJECTIVES

- To learn the principles of systematically designing and using large scale Database Management Systems for various applications.

UNIT-I: An Overview of Database Management, Introduction- What is Database System- What is Database-Why Database- Data Independence- Relation Systems and Others- Summary,

Database system architecture, Introduction- The Three Levels of Architecture-The External Level- the Conceptual Level- the Internal Level- Mapping- the Database Administrator-The Database Management Systems- Client/Server Architecture.

UNIT-II:

The E/R Models, The Relational Model, Relational Calculus, Introduction to Database Design, Database Design and Er Diagrams-Entities Attributes, and Entity Sets-Relationship and Relationship Sets-Conceptual Design With the Er Models, The Relational Model Integrity Constraints Over Relations- Key Constraints –Foreign Key Constraints-General Constraints, Relational Algebra and Calculus, Relational Algebra- Selection and Projection- Set Operation, Renaming – Joins- Division- More Examples of Queries, Relational Calculus, Tuple Relational Calculus- Domain Relational Calculus.

UNIT-III:

Queries, Constraints, Triggers, Overview, The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.

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UNIT-IV:

SCHEMA REFINEMENT (NORMALIZATION) : Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF).

UNIT-V:

Transaction Management and Concurrency Control:

Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and savepoint.

Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods : lock granularity, lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes, Database Recovery management : Transaction recovery.

UNIT-VI:

Overview of Storages and Indexing, Data on External Storage- File Organization and Indexing –Clustered Indexing – Primary and Secondary Indexes, Index Data Structures, Hash-Based Indexing – Tree-Based Indexing, Comparison of File Organization

OUTCOMES

- Describe a relational database and object-oriented database.
- Create, maintain and manipulate a relational database using SQL
- Describe ER model and normalization for database design.
- Examine issues in data storage and query processing and can formulate appropriate solutions.
- Understand the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage.
- Design and build database system for a given real world problem

TEXT BOOKS:

1. Introduction to Database Systems, CJ Date, Pearson

2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition
3. Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom Pearson

REFERENCES BOOKS:

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Introduction to Database Systems, C.J.Date Pearson Education

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WASTE WATER MANAGEMENT
OPEN ELECTIVE

Learning Objectives:

- Outline planning and the design of waste water collection ,conveyance and treatment systems for a community/town/city
- Provide knowledge of characterization of waste water generated in a community
- Impart understanding of treatment of sewage and the need for its treatment
- Summarize the appurtenance in sewage systems and their necessity
- Teach planning and design of septic tank and imhoff tank and the disposal of the effluent from these low cost treatment systems
- Effluent disposal method and realize the importance of regulations in the disposal of effluents in rivers

UNIT-I:

Introduction to Sanitation-Systems of sanitation- relative merits and demerits - collection and conveyance of waste water - classification of sewerage systems-Estimation of sewage flow and storm water drainage- fluctuations-types of sewers- Hydraulics of sewers and storm drains-design of sewers- appurtenances in sewerage- cleaning and ventilation of sewers

UNIT-II:

Pumping of wastewater: Pumping stations-location- components- types of pumps and their suitability with regard to wastewaters.

House Plumbing: Systems of plumbing-sanitary fittings and other accessories-one pipe and two pipe systems-Design of building drainage

UNIT-III:

Sewage characteristics-Sampling and analysis of waste water-Physical, chemical and Biological examination-measurement of BOD & COD- BOD equations

Treatment of sewage: Primary treatment- Screens-grit chambers- grease traps- floatation-sedimentation-design of preliminary and primary treatment units.

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UNIT-IV:

Secondary treatment: Aerobic and anaerobic treatment process -comparison.

Suspended growth process: Activated sludge process, principles, design and operational problems, modifications of Activated sludge processes, Oxidation ponds, Aerated Lagoons.

Attached Growth process: Trickling Filters-mechanism of impurities removal-classification-design -operation and maintenance problems. RBCs. Fluidized bed reactors

UNIT-V:

Miscellaneous Treatment Methods: Nitrification and Denitrification- Removal of phosphates-UASB- Membrane reactors- Integrated fixed film reactors. Anaerobic Processes: Septic Tanks, Imhoff tanks- working principles and Design-disposal of septic tank effluent-FAB Reactors

UNIT-VI:

Bio-solids (sludge) management: Characteristics- handling and treatment of sludge-thickening-anaerobic digestion of sludge

Disposal of sewage: Methods of disposal- disposal into water bodies- Oxygen sag Curve-Disposal into sea-disposal on land- sewage sickness

Outcomes:

By the end of successful completion of this course, the students will be able to:

- Plan and design the sewerage systems
- Characterization of sewage
- Select the appropriate appurtenances in the sewerage systems
- Select the suitable treatment flow for sewage treatment
- Identify the critical point of pollution in a river for a specific amount of pollutant disposal into the river

Text Book:

1. Waste water Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw-Hill edition.
2. Elements of Environmental Engineering by K.N. Duggal, S.Chand & Company Ltd. New Delhi, 2012.
3. Environmental Engineering by Howard S.Peavy , Donald R. Rowe, Teorge George Tchobanoglus- Mc-Graw-Hill Book Company, New Delhi, 1985
4. Wastewater Treatment for pollution control and Reuuse, by soli.J Areivala, sham R Asolekar, Mc-GrawHill, New Delhi; 3rd Edition
5. Industrial water & wastewater management by KVSG MuraliKrishna

Reference Book:

1. Environmental Engineering-II: Sewage disposal and Air pollution Engineering , by Garg, S.K.,: Khanna publishers
2. Sewage treatment and disposal by Dr.P.N.Modi & Sethi.
3. Environmental Engineering, by Ruth F. Weiner and Robin Matthews- 4th Edition Elsevier, 2003
4. Environmental Engineering by D. Srinivasan, PHI Learning private Limited , New Delhi,2011.

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ENTEREPRENEURSHIP
(OPEN ELECTIVE)

COURSE OBJECTIVE:

To develop and strengthen entrepreneurial quality and motivation in students. To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.

UNIT I ENTREPRENEURAL COMPETENCE

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur.

UNIT II ENTREPRENEURAL ENVIRONMENT

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services –

UNIT III INDUSTRIAL POLACIES

Central and State Government Industrial Policies and Regulations - International Business.

UNIT IV BUSINESS PLAN PREPARATION

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.

UNIT V LAUNCHING OF SMALL BUSINESS

Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Venture capital, IT startups.

UNIT VI MANAGEMENT OF SMALL BUSINESS

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.

COURSE OUTCOME:

Students will gain knowledge and skills needed to run a business.

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TEXTBOOKS

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001.
2. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001.

REFERENCES

1. Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition ,2005
2. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
3. P.Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai - 1997.
4. Arya Kumar. Entrepreneurship. Pearson. 2012
5. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning. 2012

SATELLITE TECHNOLOGY
(OPEN ELECTIVE)

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

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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: 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-

UNIT - IV

THERMAL CONTROL:

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 - V

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 - VI

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.

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INDUSTRIAL AERODYNAMICS
(OPEN ELECTIVE)

Course Objectives:

1. To study different types of winds and wind energy collectors
2. To understand vehicle aerodynamics
3. To understand wind loading
4. Pressure distribution on low rise buildings

Course Outcomes: At the end of course the student will be able to

1. Understand different types of wind collectors.
2. Understand the effect of cut back angle
3. Analyze and synthesize different loading coefficients.

UNIT I

ATMOSPHERE
Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height, Structure of turbulent flows.

UNIT II

WIND ENERGY COLLECTORS
Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.

UNIT III

VEHICLE AERODYNAMICS
Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and Hovercraft.

UNIT –IV

WIND LOADING: Introduction, Analysis and synthesis loading coefficients, local & global coefficients pressure shear stress coefficients, force and moment coefficients – Assessment methods – Quasi steady method – Peak factor method – Extreme value method

UNIT V

BUILDING AERODYNAMICS
Pressure distribution on low rise buildings, wind forces on buildings. Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics.

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UNIT VI

FLOW INDUCED VIBRATIONS

Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Galloping and stall flutter.

TEXT BOOKS

1. M.Sovran (Ed), "Aerodynamics and drag mechanisms of bluff bodies and road vehicles", Plenum press, New York, 1978.
2. P. Sachs, "Winds forces in engineering", Pergamon Press, 1978.

REFERENCES

1. R.D. Blevins, "Flow induced vibrations", Van Nostrand, 1990.
2. N.G. Calvent, "Wind Power Principles", Charles Griffin & Co., London, 1979.

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THEORY OF ELASTICITY
(OPEN ELECTIVE)

Course 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.

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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

TORSION OF PRISMATIC BARS: Torsion of rectangular bars, torsion of hollow shafts, torsion of circular shafts of variable diameter

UNIT - VI

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

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III Year - II Semester

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AIRCRAFT STRUCTURES LAB

Course Objectives:

1. 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.
2. 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:

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

Any of the 10 Experiments are required to be conducted

1. Tensile testing using universal testing Machine - Mechanical and optical Extensometers - Stress - strain curves and strength tests for various engineering materials.
2. Bending tests - Stress and deflection of beams for various end conditions - Verification of Maxwell's and Castiglianos theorems - Influence coefficients.
3. Compression tests on long and short columns - Critical buckling loads – South well plot.
4. Test on riveted and bolted joints.
5. Test using NDT inspection method.
6. Strain gauge techniques - Measurement of strain in beams, thin and thick walled cylinders subjected to internal pressure - Shaft subjected to combined loading.
7. Shear centre in open and closed sections beams - Test on semi-tension field beams.
8. Elastic constants for composite materials - Flexural test on composites.
9. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude.
11. Critical Fracture toughness of Aerospace material

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Equipment Needed

1. UTM – 20 / 40 Tons with. Jigs and Fixtures and precision Extensometers
2. Deflection test rig (Fabricated hardware + precession dial gauge)
3. Shear center Test rig
4. NDT Equipment. a) Ultrasonic apparatus, b) Magnetic Particle test rig ,c) Dye penetration test.
5. Strain measuring equipment a) wheat stone Bridge b) Multi channel strain measuring equipment c) Various gauges / rosettes
6. Various Hardware rigs desired in the lab for specific test.

III Year - II Semester

L	T	P	C
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AIRCRAFT DESIGN LAB

OBJECTIVE 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

Preliminary Structural design study – Theory approach

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III Year - II Semester

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AERO MODELLING LAB

The objective of this laboratory is to learn and understand the low cost. UAV Systems which is suitable for generating variety of data's to verify and validate the different types of algorithms developed by the researchers and Scientists working on MINI UAV's and MAV's.

1. Model Building and working with Materials
   - Balsa : Techniques of working
   - Coro Plast : Techniques of working
   - Foam : Hot wire cutting of aero foils and Techniques of working
   - Hinging control surfaces : techniques
   - Covering techniques using film, Mylar, Textile coat, painting etc.
   - Integrations and Trimming of control surfaces.

2. Power system integration including setting of thrust line
   - Various types of Power system options with Test benches
   - Understanding the propeller types and its performance
   - Understanding the procedure for choosing power systems including selection of motor / ESC and battery for a given airframe
   - Engine fitting and adjusting thrust line
   - Tuning of engines
   - Studying engine efficiency with change of propellers

3. Real Flight RC simulator training required to understand flying and the use of control systems from a practical point of view.
4. Simple flight stabilization system integration
5. Quad rotor stabilization (rotary)
6. Build your own UAV airframe of your own design and integrate with Autopilot system.

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III Year - II Semester

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PROFESSIONAL ETHICS AND HUMAN VALUES

Course Objectives:

*To give basic insights and inputs to the student to inculcate Human values to grow as a responsible human beings with proper personality.
*Professional Ethics instills the student to maintain ethical conduct and discharge their professional duties.

UNIT I: Human Values:
Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality-Character.

UNIT: II: Principles for Harmony:
Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT III: Engineering Ethics and Social Experimentation:
History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism —Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg's Theory - Gilligan's Argument – Heinz's Dilemma - Comparison with Standard Experiments — Learning from the Past – Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

UNIT IV: Engineers' Responsibilities towards Safety and Risk:

Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/sInvoluntary Risk – Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/sImmediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT V: Engineers' Duties and Rights:

Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality – Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights – Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving-Occupational Crimes-Industrial Espionage- Price Fixing-Whistle Blowing.

UNIT VI: Global Issues:
Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights.

- Related Cases Shall be dealt where ever necessary.

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Outcome:

*****It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.

*It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.

References:

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill – 2003.
3. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana - Maruthi Publications.
4. Engineering Ethics by Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
5. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
8. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill - 2013
9. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publications

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IV Year - I Semester

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THEORY OF VIBRATIONS

Course 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: At the end of course the student will be able

1. To formulate mathematical models for mechanical systems using mass, spring and dampers
2. To analyze the systems with damped free vibrations single degree of freedom
3. To develop a single degree of freedom forced vibrating mechanical system under various types of excitation conditions
4. To analyze and modify two degree of freedom mechanical systems
5. 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

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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.

UNIT VI

Steady state response, using fourier analysis for decomposing complex periodic load functions of modal equations using S-plane representation. Transient response analysis of modal equations using Duhamel's integrals

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

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IV Year - I Semester

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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:

1. To formulate the basic fluid dynamics problem mathematically
2. To analyze the mathematical behaviour of partial differential equations
3. To apply the grid generation principles for different problems.
4. To solve elementary incompressible fluid problems using the CFD techniques
5. To solve the elementary heat transfer problems using the CFD techniques

UNIT-I

ELEMENTARY DETAILS IN NUMERICAL TECHNIQUES: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.

UNIT – II

APPLIED NUMERICAL METHODS: Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for banded matrices.

REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER: Introduction, conservation of mass, Newton's second law of motion, expanded forms of navier-stokes equations, conservation of energy principle, special forms of the navier-stokes equations.

UNIT – III

Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function - vorticity formulation.

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, closure.

UNIT – IV

Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modeling: introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

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UNIT – V

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

UNIT –VI

FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth Publishers
2. Computational fluid dynamics - Basics with applications - John. D. Anderson / Mc Graw Hill.

REFERENCES:

1. Computational Fluid Flow and Heat Transfer/ Niyogi, Pearson Publications
2. Fundamentals of Computational Fluid Dynamics – Tapan K. Sengupta / Universities Press.
3. Computational fluid dynamics, 3rd edition/Wendt/Springer publishers

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IV Year - I Semester

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INSTRUMENTATION, MEASUREMENTS AND EXPERIMENTS IN FLUIDS

Course 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 acqusion and uncertainty estimation of measured data

Course Outcomes:

1. To employ the wind tunnels for aerodynamic testing of bodies
2. To employ the flow visualization techniques to analyze high-speed flow field
3. To employ different instruments to measure velocity of fluid flow
4. To employ pressure and temperature measurement instruments in fluid flow studies
5. 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

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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

UNIT-VI
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.

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IV Year - I Semester

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HELICOPTER ENGINEERING

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:

1. To analyze the performance various components of helicopter
2. To analyze the performance of V/STOL aircrafts
3. 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 ROTAR THEORY
Hovering performance - Momentum and simple blade element theories - Figure of merit - Profile and induced power estimation - Constant chord and ideal twist rotors.

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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
STABILITY AND CONTROL: Trim, Static stability-incidence disturbance, forward speed disturbance, angular velocity disturbance, Sideslip disturbance, yawing disturbance Dynamics stability, hinge less rotor, control

UNIT – V

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 – VI

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

TEXT BOOKS

1. Johnson, W., Helicopter Theory, Princeton University Pres, 1980.
2. McCormick, B.W., Aerodynamics, Aeronautics & Flight Mechanics John Wiley, 1995

REFERENCES

1. Gessow, A., and Myers, G.C., Aerodynamics of Helicopter, Macmillan & Co., N.Y.1987.
2. McCormick, B.W., Aerodynamics of V/STOL Flight, Academics Press, 1987
3. Gupta, L Helicopter Engineering, Himalayan books, 1996.

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IV Year - I Semester

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AIRFRAME REPAIR AND MAINTENANCE

(ELECTIVE I)

Course 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:

1. To employ the welding and sheet metal repair techniques for an aircraft
2. To employ the techniques to repair the plastics and composite components in an aircraft
3. To employ trouble shooting and maintenance practices of hydraulic and pneumatic systems in aircraft
4. 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.

UNIT – II

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 - III

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 repair schemes – Scopes. Inspection and Repair of composite components – Special precautions – Autoclaves.

UNIT - IV

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.

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UNIT - V

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 pressurization 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 - VI

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

TEXT BOOKS

1. KROES, WATKINS, DELP, "Aircraft Maintenance and Repair", McGraw-Hill, New York, 1992.
2. LARRY REITHMEIR, "Aircraft Repair Manual", Palamar Books, Marquette, 1992.

REFERENCES

1. BRIMM D.J. BOGGES H.E., "Aircraft Maintenance", Pitman Publishing corp. New York, 1940

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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:

1. To apply the viscous flow equations to solve fluid flow problems
2. To analyze laminar and turbulent boundary layer flow fields

UNIT – I

BASIC LAWS

Basic laws of fluid flow – Continuity, momentum and energy equations as applied to system and control volume – Concept of flow fields.

FUNDAMENTALS OF BOUNDARY LAYER THEORY

Viscous fluid flow – Boundary conditions – Development of boundary layer – Estimation of boundary layer thickness – Displacement thickness, momentum and energy thickness for two-dimensional flows. General stress system in a deformable body – General strain system.

UNIT – II

NAVIER STOKES EQUATION

Relation between stress and strain system in a solid body (Hooke's Law) – Relation between stress and strain rate system in liquids and gases (Stroke's Law) – The Navier – Strokes Equation (N-S) – General properties of Navier - Stokes Equation.

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UNIT- III

EXACT SOLUTION OF N-S EQUATION

Two dimensional flow through a straight channel, Hagen –Poiseulle flow – Suddenly accelerated plane wall – Flow near a rotating disk – Very slow motion: Parallel flow past a sphere.

UNIT – IV

LAMINAR BOUNDARY LAYER

Analysis of flow past a flat plate and a cylinder – Integral relation of Karman – Integral analysis of energy equation – Laminar boundary layer equations – Flow separation – Blasius solution for flat–plate flow – Boundary layer temperature profiles for constant plate temperature.

BOUNDARY LAYER METHODS

Falkner Skan Wedge flows – Integral equation of Boundary layer – Pohlhausen method – Thermal boundary calculations – One parameter and two parameter integral methods.

UNIT – V

INCOMPRESSIBLE TURBULENT MEAN FLOW

Two-dimensional turbulent boundary layer equations – Integral relations – Eddy viscosity theories – Velocity profiles.

UNIT – VI

COMPRESSIBLE – BOUNDARY LAYER FLOW

The law of the wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent boundary on a flat plate – Boundary layers with pressure gradient.

TEXT BOOKS

1. "Turbulent Flows in Engineering", Reynolds AJ, John Wiley & Sons, 1980
2. "Incompressible Flow", Panton RL, John Wiley & Sons, 1984.

REFERENCES

1. "Boundary Layer Theory", Schlichting H, McGraw Hill, New York, 1979
2. "Viscous fluid Flow", White FM, McGraw Hill Co. Inc., NY, 1991, 2nd Edition
3. "Fundamentals of Aerodynamics", Anderson JD, McGraw Hill Book Co., Inc., NY, 2001, 3rd Edition.

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FATIGUE AND FRACTURE MECHANICS

Course Objectives:

1. To provide an understanding of fundamental principles and assumptions, and to give a basis for analysis and evaluation of structures from a fracture mechanics point of view.
2. Also students will be explored to fatigue, creep deformation, creep-fatigue interactions.

Course outcomes:

1. After completion of this course students will acquire the knowledge for applying fracture mechanics theory
2. To calculate stress areas and the "energy release rate" around crack tips and crack growth due to fatigue.
3. To develop the theory of fracture by different postulator- Griffith's theory and fracture toughness etc.
4. Understand the concepts of elastic-plastic functional machines (EPFM) theorems

UNIT - I

FATIGUE OF STRUCTURES

S-N Curves - Endurance limit - Effect of mean stress - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factor - Notched S-N curves.

DESIGN OF COMPONENTS

Goodman, Gerber and Soderberg relations and diagrams – Modified Goodman Diagram – Design of components subjected to axial, bending, torsion loads and combination of them.

UNIT - II

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STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR

Low cycle and high cycle fatigue - Coffin - Manson's relation – Transition life – Cyclic strain hardening and softening.

LOAD ASPECTS

Analysis of load histories - Cycle counting techniques - Cumulative damage - Miner's theory - Other theories.

UNIT - III

PHYSICAL ASPECTS OF FATIGUE

Phase in fatigue life - Crack initiation - Crack growth - Final fracture - Dislocations - Fatigue fracture surfaces.

UNIT - IV

FRACTURE MECHANICS

Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin-Orwin extension of Griffith's theory to ductile materials.

UNIT – V

STRESS ANALYSIS

Stress analysis of cracked bodies - Effect of thickness on fracture toughness – Stress intensity factors for typical geometries. Introduction of finite element approach for crack propagation studies.

UNIT – VI

FATIGUE DESIGN AND TESTING

Safe life and fail-safe design philosophies – Importance of fracture mechanics in aerospace structure - Application to composite materials structures.

TEXT BOOK

1. Knott, J.F., Fundamentals of Fracture Mechanics, Butter Worth & Co., (Publishers) Ltd., London, 1983.

REFERENCES

1. Barrois, W., and Ripley, E.L., Fatigue of Aircraft Structures, Pergamon Pres., Oxford, 1983.
2. Sih, C.G., Mechanics of Fracture, Vol. I, Sijthoff and Noordhoff International Publishing Co., Netherlands, 1989.
3. "Mechanical Engineering Design" by J E Shigley.

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IV Year - I Semester

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ELEMENTS OF COMBUSTION

(ELECTIVE – II)

Course 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:

1. To analyze the various factors effecting the combustion process in aircraft engines-piston and jet engines
2. To analyze the various combustion models of rocket engines
3. 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.

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UNIT - V

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

UNIT VI

COMBUSTION AND ENVIRONMENT:
Introduction, Chemicals from combustion-emissions of CO, CO_2, O_2, water vapour, NOx, N_2O, Hydrocarbons, SO_2, soot particles

TEXT BOOKS

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.

REFERENCES

1. Chowdhury,R., Applied Engineering Thermodynamics, Khanna Publishers, New Delhi, 1986
2. Sutton, G.P., Rocket Propulsion Elements, John Wiley and Sons, Inc., New York, 1993.
3. D.P Mishra, Fundamentals of Combustion**,** PHI Learning Pvt. Ltd., 2008

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QUALITY AND RELIABILITY ENGINEERING

Course objectives:

1. The aim of this course is to provide students with a basic understanding of the approaches and techniques to assess and improve process and/or product quality and reliability.
2. The objectives are to introduce the principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring
3. To understand techniques of modern reliability engineering tools.

Course outcome: Upon successful completion of this course, students should be able to:

1. Understand quality and reliability concept, beware of some basic techniques for quality improvement, and acquire fundamental knowledge of statistics and probability.
2. Apply control charts to analyze and improve the process quality
3. Design a simple sampling plan, construct its OC curve and evaluate its effectiveness on a given sampling process
4. Acquire the concepts of the reliability, *and calculate* the system reliability based on the given component connection; *calculate* the reliability based on the given failure model

UNIT-I

Quality value and engineering – quality systems – quality engineering in product design and production process – system design – parameter design – tolerance design, quality costs – quality improvement.

UNIT-II

Statistical process control $\overline{X}$, R, p, c charts, other types of control charts, process capability, process capability analysis, process capability index. (SQC tables can be used in the examination)

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UNIT-III

Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plans.

UNIT-IV

Loss function, tolerance design – N type, L type, S type; determination of tolerance for these types. online quality control – variable characteristics, attribute characteristics, parameter design. Quality function deployment – house of quality, QFD matrix, total quality management concepts. quality information systems, quality circles, introduction to ISO 9000 standards.

UNIT-V

Reliability – Evaluation of design by tests - Hazard Models, Linear, Releigh, Weibull. Failure Data Analysis, reliability prediction based on weibull distribution, Reliability improvement.

UNIT-VI

Complex system, reliability, reliability of series, parallel & standby systems & complex systems & reliability prediction and system effectiveness. Maintainability, availability, economics of reliability engineering, replacement of items, maintenance costing and budgeting, reliability testing.

TEXT BOOKS:

1. G Taguchi, 'Quality Engineering in Production Systems - McGraw Hill
2. E.Bala Guruswamy, 'Reliability Engineering', Tata McGraw Hill,
3. Montgomery "Statistical Quality Control : A Modern Introduction" Wiley

REFERENCE BOOKS:

1. Frank.M.Gryna Jr. "Jurans Quality planning & Analysis", McGraw Hill.
2. Philipposs, 'Taguchi Techniques for Quality Engineering', McGraw Hill,
3. LS Srinath, 'Reliability Engineering', Affiliated East West Pvt. Ltd.,
4. Eugene Grant, Richard Leavenworth "Statistical Process Control",McGraw Hill.
5. W.A. Taylor, 'Optimization & Variation Reduction in Quality', Tata McGraw Hill
6. Quality and Performance Excellence: James R Evans, Cengage learning

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HYPERSONIC AERODYNAMICS

Course 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

1. To apply the hypersonic flow theories to analyze flow over bodies
2. 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.

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UNIT-VI - HYPERSONIC VEHICLE DESIGN: Design considerations, Cooling techniques, Drag reduction techniques, Hypersonic flight parameters and stability, Hypersonic propulsion and vehicle design

TEXT BOOKS

1. "Hypersonic and High Temperature Gas Dynamics", Anderson, J.D,McGraw-Hill, 1989.
2. "Hypersonic Aerothermodynamics", Bertin, J.J., AIAA, 1994.

REFERENCES

1. "Introduction to Hypersonic flow", Cherni C G, Academic Press,1961
2. "Hypersonic Flow Theory", Hayes W D and Problein R F, Academic Press 1959
3. "Elements of Hypersonic Aerodynamics", Cox R N and Crabtree L P, London 1965

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IV Year - I Semester

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COMPUTATIONAL FLUID DYNAMICS LAB

Course Objectives:

1. To learn the solutions simple fluid flow and hear transfer problems

Course Outcomes:

1. To solve elementary incompressible fluid problems using the CFD techniques
2. To solve the elementary heat transfer problems using the CFD techniques

Experiments:

1. Overview of Ansys CFD work bench fluid flow and create a fluid flow analysis system
2. Overview of Ansys CFD work bench heat transfer
3. Create geometry for a two dimensional pipe junction-an Elbow
4. Generate a computational mesh for two dimensional pipe junction-an Elbow
5. Generate a computational mesh for two dimensional car body
6. Generate a computational mesh for three dimensional wing body
7. Generate a computational mesh for missile body
8. Generate a computational mesh for an airplane
9. Analysis of flow filed in the Pipe junction-an Elbow
10. Analysis of flow filed over circular cylinder
11. Analysis of flow over backward facing step
12. Analysis of flow over symmetric aerofoil

13 Analysis of flow over unsymmetric aerofoil

14. Analysis flow thorough convergent-divergent nozzle
15. Analysis of temperature distribution in a slab
16. Analysis of temperature distribution in an insulated wall

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Equipment Needed

1 Computers P-IV with 512 MB RAM and parallel processing computational facility 60 Nos / 60 students a batch.

2. 60 educational version licenses of b) Ansys c) NASTRAN d) Pro – e e) FLUENT OR STAR CD or CFX

IV Year - I Semester

L	T	P	C
0	0	3	2

FINITE ELEMENT METHOD LAB

OBJECTIVES:

Students will get exposure to the use of structural analysis software for solving varieties of problems. Students will be grouped into several batches, each batch containing two students, and each batch has to select a problem solve it and verify the results with that obtained from the software.

OUTCOMES: Students will

1. Have overall understanding of various approximate methods used for solving structural mechanics problems.
2. Understanding the formulation of governing equation for the finite element method, convergence criteria and advantage over other approximate methods.
3. Capability to solve 1-D problems related to static analysis of structural members.
4. Understand the formulation of element matrices for 2-D problems.

1. Axial loading, statically determinate and indeterminate cases
2. Static analysis of beam using beam element, plane stress and solid elements.
3. Buckling column using beam and plane stress element.
4. Stress concentration, plane with hole
5. Analysis torque arm
6. Free vibration of beam with various end conditions
7. Combined loading
8. Thin cylinder under internal pressure
9. Heat transfer in composite wall
10. Analysis heat transfer in extended surface
11. 2-D heat transfer problem
12. Thermo – structural analysis of axially loaded bar
13. Solving problems by command mode.

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Equipment Needed

1 Computers P-IV with 512 MB RAM and parallel processing computational facility 60 Nos / 60 students a batch.
2. 60 educational version licenses of a) Ansys b) NASTRAN d) Pro – e

IV Year - II Semester

L	T	P	C
4	0	0	3

ROCKETRY AND 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:

1. To understand the basic aspects of space
2. To apply N-body aspects in space exploration issues
3. To know the general aspects satellite injection and orbit perturbations
4. To evaluate interplanetary trajectories of spacecrafts
5. To evaluate trajectory details of ballistic missiles

UNIT I

ORBITAL MECHANICS

Description of solar system – Kepler's Laws of planetary motion – Newton's Law of Universal gravitation – Two body and Three-body problems – Jacobi's Integral, Librations points - Estimation of orbital and escape velocities

UNIT II

SATELLITE DYNAMICS

Geosynchronous and geostationary satellites life time – satellite perturbations – Hohmann orbits – calculation of orbit parameters – Determination of satellite rectangular coordinates from orbital elements

UNIT III

ROCKET MOTION

Principle of operation of rocket motor - thrust equation – one dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields – Description of vertical, inclined and gravity turn trajectories determinations of range and altitude – simple approximations to burnout velocity – staging of rockets.

UNIT IV

ROCKET AERODYNAMICS

Description of various loads experienced by a rocket passing through atmosphere – drag estimation – wave drag, skin friction drag, form drag and base pressure drag – Boat-tailing in missiles – performance at various altitudes – conical and bell shaped nozzles – adapted nozzles – rocket dispersion – launching problems.

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UNIT V

STAGING AND CONTROL OF ROCKET VEHICLES

Need for multistaging of rocket vehicles – multistage vehicle optimization – stage separation dynamics and separation techniques- aerodynamic and jet control methods of rocket vehicles - SITVC.

UNIT- VI

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. G.P. Sutton, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edition, 1986.
2. J.W. Cornelisse, "Rocket Propulsion and Space Dynamics", J.W. Freeman & Co., Ltd., London, 1982.

REFERENCES

1. Van de Kamp, "Elements of astromechanics", Pitman Publishing Co., Ltd., London, 1980.
2. E.R. Parker, "Materials for Missiles and Spacecraft", McGraw-Hill Book Co., Inc., 1982.

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IV Year - II Semester

L	T	P	C
4	0	0	3

MECHANICS OF COMPOSITES

Course Objective:

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

Course Outcomes:

1. To understand the stress-strain relations applicable for composite materials
2. To analyze behaviour of composite materials at micro level and macro level
3. To design the multi directional composites
4. To design different types of sandwich panels used in aerospace industries
5. To apply techniques of fabrication processes to manufacture composites

UNIT-I

Introduction to laminated composite plates, Mechanical Properties of constituent materials such as Matrix and Filaments of different types. Netting analysis of composite materials, determination of properties of laminates with fibers and matrices.

UNIT-II

Stress-Strain relations of Isotropic, Orthotropic and Anisotropic materials, transformation of material properties for arbitrary orientation of fibers.

UNIT-III

Methods of Analysis: Mechanics of materials approach to determine Young's modulus, Shear Modulus and Poisson's ratio, brief mention of elasticity approach and Macro mechanics of laminates.

UNIT-IV

Anisotropic elasticity, stress –strain relations in material coordinates - Transformation of geometric axes, strength concepts, Biaxial strength theories, Maximum stress and Maximum strain.

UNIT-V

Analysis of laminated plates: Classical plate theory, Classical lamination theory – Special cases of single layer, symmetric, anti-symmetric & unsymmetrical composites with cross ply, angle ply lay up. Deflection analysis of laminated plates. Analysis laminated beam and plates.

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UNIT-VI

Shear deformation theories for composite laminated beams, plates. Buckling analysis of laminated composite plates with different orientation of fibers. Tsai-wu criteria and Tsai – Hill Criteria.

TEXT BOOKS

1. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press,1994
2. "Analysis and performance of fibre composites ", Agarwal B. D., Broutman. L. J., John Wiley and sons – New york, 1980.

REFERENCES

1. " Mechanics of Composite Materials" Jones R.M. McGrawHill Kogakusha, ltd. Tokyo.
2. "Advanced Composite Materials" Lalith Gupta, Himalayan book, New Delhi, 1998.
3. Hand Book on "Advanced Plastics and fibre glass " , Lubin. G, Von. Nostrand, Reinhold Co. New york, 1989

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IV Year - II Semester

L	T	P	C
4	0	0	3

AEROSPACE MATERIALS

Course Objectives:

1. To understand the mechanical behavior of engineering materials.
2. To understand the classification and characterization of composite materials.
3. To understand Stress strain relations of composites

Course Outcomes:

1. Study the behavior of engineering materials.
2. Study the characterization of composite materials.

UNIT-I

Mechanical behavior of engineering materials, linear and non-linear elastic properties, yielding, strain hardening, fracture Barochinger's effect, notch effect, testing and flow detection of materials including super alloys and P-H. steels.Thermo-Structural behavior of materials for application at elevated temperatures. Wrought, cast and forged aluminum alloys, production of semi-fabricated forms for aerospace applications.

UNIT-II

Introduction to composites:
Classification characterization, advantages and applications of composite materials – Reinforcements and matrices, composite structures, Single layer symmetric, Anti-symmetric and un-symmetric layup configurations with cross ply and angle ply layups. Introduction to 3D composites, filament wound and Woven composites

UNIT-III

Characterization of Composites
Stress strain relations of composites, Orthotropic behavior of composites, Mechanics of Materials approach to determine Young's modulus, Shear modulus and Poisson's ratio, Stress strain relations in material co-ordinates, strength concepts, Biaxial strength theories, maximum stress, maximum strain, fracture toughness of composites.

UNIT-IV

Lamination of CCA models and introduction to micro mechanics. Elasticity based micro-mechanical models, introduction to FEM in composites characterization. Open and closed mould process, filament winding, pulltrusion and online production methods of manufacture of fibers and composites. Manufacture of high performance composite materials applicable in elevated temperature field.

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UNIT-V

Introduction to impact damage of composite life production and damage tolerance studies, fracture toughness of composites. NDT techniques for quality assurance.

UNIT-VI

Environmental and Manufacturing considerations in selection of materials for Aircrafts, Rockets. Materials used for Aircraft applications – application of composite materials, super alloys for supersonic vehicles.

TEXT BOOKS:

1. "Analysis and performance of fibre composites ", Agarwal B. D., Broutman. L. J., John Wiley and sons – New york,1980.
2. Hand Book on "Advanced Plastics and fibre glass " , Lubin. G, Von. Nostrand, Reinhold Co. New york, 1989.

REFERENCE BOOKS:

1. "Advanced Composite Materials" Lalith Gupta, Himalayan book, New Delhi, 1998.
2. "Mechanics of Composite Materials" Jones R.M. McGrawHill Kogaku

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IV Year - II Semester

L	T	P	C
4	0	0	3

AVIONICS

(ELECTIVE III)

Course Objective:

1. The main objective of the subject is to study the concepts related to aviation industry which involves airline management, airport management etc.
2. It also involves study of airline, airport economic, aviation security &safety and marketing aspects. After completion of this course the student can be able to manage airline, airport industries

Course outcomes:

After undergoing the course the student shall be able to:

1. Describe the concepts related to aviation industry which involves airline management, airport management etc.
2. Understands study of airline, airport economic, aviation security &safety and marketing aspects.
3. Manage airline, airport industries

UNIT –I

BASICS

Basic principles of Avionics – Typical avionics sub system in civil/ military aircraft and space vehicles.

FLIGHT DECK AND DISPLAY SYSTEMS

Flight deck display technologies – CRT, LED, LCD, Touch screen – Head up display – Electronic instrumentation systems.

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UNIT-II

AUDIO AND COMMUNICATION SYSTEMS

Aircraft audio systems basic – audio transmitter and receiver principles – VHF communication system – UHF communication systems.

UNIT-III

RANGING AND LANDING SYSTEMS

VHF Omnirange – VOR receiver principles – distance maturity equipment – principles of operation – Instrument landing system – localizer and glide slope.

UNIT-IV

POSITIONG SYSTEM

Global positioning system principles – triangulation – position accuracy – applications in aviation

INERTIAL NAVIGATION SYSTEM

Principle of Operation of INS – navigation over earth – components of inertial Navigation systems – accelerometers – gyros and stabilized platform

UNIT-V

SURVELLIENCE SYSTEM

ATC surveillance systems principles and operation interrogation and replay standards – Collision avoidance system – ground proximity warning system.

UNIT-VI

AUTO FLIGHT SYSTEM

Automatic flight control systems – fly by wire and fly by light technologies – flight director systems – flight management systems. Integrated DATATRANSFER methodology by use of MILS – STD – 1553/ ARINC – 42

TEXT BOOKS

1. Elements of electronic navigation, N.S.Nagaraja, Tata Mc Graw Hill, 1995.
2. Avionic systems Operation and maintenance, Janes W.Wasson, Jeppesen Sandersen Training products (Sterling Book House, Mumbai),1994.

REFERENCES

1. Principle of Avionics, Albert Hel frick, Avionics Communications Inc., 2000.
2. Aircraft Instrumentation and Integrated systems EHJ Pallet, Longan Scientific Technical (Sterling Book House, Mumbai) 1996.
3. Aircraft Radio Systems, J.Powell, Pitman publishers, 1998.

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PROPELLANT TECHNOLOGY

Course Objective:

1.The main objective of the course is to know about the family of aviation fuels.
2.The subject encompasses several varieties of liquid and solid propellants and their burning capabilities.
3. To study the properties of cryogenic fuels will also be considered as a first pace.
4. To understand Propellant testing and performance evaluation methods such as Micro-merograph - Strand burner tests impulse bomb are clearly described.

Course Outcomes:

Upon successful completion of this course, students should be able to:

1. Understand the family of aviation fuels.
2. Categorize several varieties of liquid and solid propellants and their burning capabilities.
3. Identify the role of cryogenic fuels in the aviation industry.
4. Propellant testing and performance evaluation methods such as Micro-merograph - Strand burner tests impulse bomb are clearly described.

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.

UNIT – III

LIQUID PROPELLANTS
Various liquid propellants and their properties - Monopropellants and bipropellant system - concept of ullage – Ignition studies of liquid propellants. Propellant loading tolerances - inventory - Volume versus mass loading – Loading measurement and control - Outage control.

UNIT –IV

CRYOGENIC PROPELLANTS – I
Introduction to cryogenic propellants - Liquid hydrogen, liquid oxygen, liquid nitrogen and liquid nitrogen and liquid helium and their properties.

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UNIT –V

CRYOGENIC PROPELLANTS – II

Theory behind the production of low temperature - Expansion engine – Cascade process - Joule Thompson effect - Magnetic effect - Ortho and Para H2 - Helium 4 and Helium 3 - Ideal cycles and efficiency of cryo systems - Storing of cryogenic propellants - Cryogenic loading problems.

UNIT – VI

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.

REFERENCES

1. Shutton, G.P., Rocket Propulsion Elements, John Wiley, 1993.
2. Sharma, S.P. and Mohan .C., Fuels and Combustion, Tata McGraw Hill Publishing Co, Ltd., 1984
3. Mathur, M., and Sharma, R.P., Gas Turbine and Jet and Rocket Propulsion, Standard Publishers, New Delhi 1988.

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AERO ELASTICITY

Course Objective:

1. To elucidate the aero elastic Phenomena, formulations and solutions techniques for aerospace vehicles in flight and to incorporate the spin off benefits.
2. Formulations of Structural Dynamics Equation and Coupling effects for panels and plates considered for structural integrity.
3. The process of model the aeroelasticity into an experiment is thoroughly reviewed.

Course Outcomes:

Upon successful completion of this course, students should be able to:

1. Elucidate the aero elastic Phenomena, formulations and solutions techniques for aerospace vehicles in flight
2. Incorporate the spin off benefits.
3. Formulations of Structural Dynamics Equation and Coupling effects for panels and plates considered for structural integrity.
4. Process and model the aeroelasticity into an experiment is thoroughly reviewed.

UNIT I

Introduction to Aero elasticity COLLARS Triangle, Aerodynamics and interactions of Structural and Inertial forces Static and Dynamic Aero Elasticity Phenomena.

UNIT II

Simple Two dimensional idealization of flow, String Theory, Fredholm Integral equations of Second Kind Exact Solutions for simple rectangular wings.

UNIT III

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Formulations of Structural Dynamics Equation and Coupling effects for panels and plates, Generalized coordinates, Lagrange's Equations of motion Hamilton's Principle Orthogonality conditions. Static Aero elastic Studies Divergences, control reversal, Aileron reversal speed, Aileron efficiency, lift distribution, Rigid and elastic wings.

UNIT IV

Non dimensional Parameters, stiffness criteria, dynamic mass balancing - model experiments and dimensional similarity– flutter analysis.

UNIT V

Formulation of Aero elastic Equations for a Typical Section, Quasi Steady Aerodynamic derivatives, modal equations Galerkins method of analysis. Stability of motion of Continua Torsion flexure flutter – Solution of flutter determinant, method of determining the classical flutter speed – Flutter Prevention and control.

UNIT VI

Application of Aero Elasticity in Engineering Problems – Galloping of transmission lines, flow induces vibrations of tall slender structures and suspension Budges.

TEXT BOOKS

1. Fung Y.C. an introduction to the Theory of Aeroelasticity John Wiley and Sons, New York, 1985.
2. Bisphlinghoft R. C. Ashlay. H and Halfmam. R Aero-elasticity – Addition Werley Publishing Company.
3. Scnlan R.H. and Rosenbaum. R Introduction to the study of Aircraft Vibrations and Flutter McGraw Company, New York 1981.

REFERENCE

Bisphlinghoft R. C. and Ashely, Principles of Aeroelasticity Johnwiley Company. 1998.

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IV Year - II Semester

L	T	P	C
0	3	0	2

SEMINAR

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IV Year - II Semester

L	T	P	C
0	0	0	10

PROJECT

Course Objectives:

The aim of the course is to make the student perform a comprehensive project work that involves either or all of the following: optimum design of a mechanical component or an assembly, thermal analysis, computer aided design & analysis, cost effective manufacturing process, material selection, testing procedures or fabrication of components and prepare a detailed technical thesis report. The completed task should also take into account the significance of real time applications, energy management and the environmental affects.

Course Outcomes:

After completing the project work the student should learn the technical procedure of planning, scheduling and realizing an engineering product and further acquire the skills of technical report writing and data collection.

Course content:

The student should work in groups to achieve the aforementioned objectives and the outcomes.

LEARNING ASSESSMENT

Distribution and weightage of Marks for all Design / Drawing subjects:

The Assessment of a student's performance shall be evaluated as suggested below:

For the subject having design and / or drawing, (such as Engineering Drawing, Machine Drawing), the distribution shall be 30 marks for internal evaluation and 70 marks for end semester examination. There shall be two internal tests in a Semester and the best of the two shall be considered for the award of marks for internal tests.

1. Out of 30 internal marks, the marks shall be awarded as follows:
- Day to day work 20
- 10 marks to be awarded by conducting an internal mid examination.

2. The external examination shall be conducted for 70 marks.

a) For subject like engineering drawing the pattern of external examination shall be similar to theory examination.

b) For subjects like Machine Drawing, external examination pattern shall be as mentioned below:

- Part-I: Should contain 3 questions out of which 2 must be answered for 20 marks.
- Part-II: Assembly drawing should contain 50 marks which is compulsory.

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