ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

AERONAUTICAL ENGINEERING

For

AERONAUTICAL ENGINEERING FOUR DEGREE COURSE

(Applicable for batches admitted from 2013-2014)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA - 533 003, Andhra Pradesh, India

COURSE STRUCTURE

I Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	English – I	3+1	--	3
2	Mathematics - I	3+1	--	3
3	Engineering Chemistry	3+1	--	3
4	Engineering Mechanics	3+1	--	3
5	Computer Programming	3+1	--	3
6	Environmental Studies	3+1	--	3
7	Engineering Chemistry Laboratory	--	3	2
8	English - Communication Skills Lab - I	--	3	2
9	C Programming Lab	--	3	2
Total Credits				**24**

I Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	English – II	3+1	--	3
2	Mathematics – II (Mathematical Methods)	3+1	--	3
3	Mathematics – III	3+1	--	3
4	Engineering Physics	3+1	--	3
5	Professional Ethics and Human Values	3+1	--	3
6	Engineering Drawing	3+1	--	3
7	English - Communication Skills Lab - II	--	3	2
8	Engineering Physics Lab	--	3	2
9	Engineering Physics – Virtual Labs - Assignments	--	2	--
10	Engg.Workshop & IT Workshop	--	3	2
Total Credits				**24**

II Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	Mechanisms and Mechanical Design	3+1*	--	3
2	Thermodynamics	3+1*	--	3
3	Mechanics of Fluids	3+1*	--	3
4	Aerospace Materials and Composites	3+1*	--	3
5	Mechanics of Solids	3+1*	--	3
6	Computer aided Engineering Drawing Practice	3+1*	--	3
7	Mechanics of Solids and Aircraft Materials Lab	--	3	2
8	Mechanics of Fluids Lab	--	3	2
Total Credits				**22**

II Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Aerodynamics - I	3+1*	--	3
2	Aircraft Production Technology	3+1*	--	3
3	Control Systems	3+1*	--	3
4	Electrical and Electronics Engineering	3+1*	--	3
5	IC Engines & Gas Turbines	3+1*	--	3
6	Aircraft Engineering Drawing	3+1*	--	2
7	Electrical and Electronics Engineering Lab	--	3	2
8	Aircraft Production Lab	--	3	2
Total Credits				**21**

III Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	Flight Mechanics-I	3+1*	--	3
2	Aerodynamics – II	3+1*	--	3
3	Aerospace Vehicle Structures – I	3+1*	--	3
4	Aerospace Propulsion – I	3+1*	--	3
5	CAD/CAM	3+1*	--	3
6	Introduction to Space Technology	3+1*	--	3
7	CAD/CAM Lab	--	3	2
8	Aerodynamics and Propulsion Lab	--	3	2
9	IPR & Patents	--	3	2
Total Credits				**24**

III Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Flight Mechanics-II	3+1*	--	3
2	Aerospace Vehicle Structures –II	3+1*	--	3
3	Aerospace Propulsion – II	3+1*	--	3
4	Flight Vehicle Design	3+1*	--	3
5	System Modeling And Simulation	3+1*	--	3
6	**Departmental Elective-I**	3+1*	--	3
7	Aerospace Structures Lab	--	3	2
8	Flight Vehicle Design Lab	--	3	2
Total Credits				**22**

IV Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	Vibrations and Structural Dynamics	3+1*	--	3
2	Computational Fluid Dynamics	3+1*	--	3
3	Avionics	3+1*	--	3
4	Finite Element Methods	3+1*	--	3
5	**Open Elective**	3+1*	--	3
6	**Departmental Elective-II**	3+1*	--	3
7	Computational Structural and Aerodynamics Lab	--	3	2
8	Structural Analysis and Detailed Design Lab	--	3	2
Total Credits				**22**

IV Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Aircraft Systems and Instrumentation	3+1*	--	3
2	Structural Analysis and Detailed Design	3+1*	--	3
3	**Departmental Elective-III**	3+1*	--	3
4	**Departmental Elective-IV**	3+1*	--	3
5	Project	--	--	9
Total Credits				**21**

OPEN ELECTIVE:

1. Airport Management
2. Nano Technology

Elective-I:

1. Experimental Stress Analysis
2. Space Mechanics
3. Rockets and Missiles
4. Aircraft Maintenance Management

Elective-II:

1. Analysis of Composite Structure
2. Air Line Management
3. Helicopter Engineering
4. Quality and Reliability Engineering

Elective-III:

1. Engineering Optimization
2. Propellant Technology
3. Boundary Layer Theory
4. Hypersonic Aerodynamics

Elective-IV:

1. Aero elasticity
2. Industrial Aerodynamics
3. Advanced Computational Aerodynamics
4. Fatigue and Fracture Mechanics

SYLLABUS

I Year – I SEMESTER

T	P	C
3+1	0	3

ENGLISH –I
(Common to All Branches)

DETAILED TEXT-I English Essentials : Recommended Topics :

1. **IN LONDON: M.K.GANDHI**
   OBJECTIVE: To apprise the learner how Gandhi spent a period of three years in London as a student.
   OUTCOME: The learner will understand how Gandhi grew in introspection and maturity.
2. **THE KNOWLEDGE SOCIETY- APJ KALAM**
   OBJECTIVE: To make the learners rediscover India as a land of Knowledge.
   OUTCOME: The learners will achieve a higher quality of life, strength and sovereignty of a developed nation.
3. **THE SCIENTIFIC POINT OF VIEW- J.B.S. HALDANE**
   OBJECTIVE: This essay discusses how scientific point of view seeks to arrive at the truth without being biased by emotion.
   OUTCOME: This develops in the student the scientific attitude to solve many problems which we find difficult to tackle.
4. **PRINCIPLES OF GOOD WRITING:**
   OBJECTIVE: To inform the learners how to write clearly and logically.
   OUTCOME: The learner will be able to think clearly and logically and write clearly and logically.
5. **MAN'S PERIL**
   OBJECTIVE: To inform the learner that all men are in peril.
   OUTCOME: The learner will understand that all men can come together and avert the peril.
6. **THE DYING SUN—SIR JAMES JEANS**
   OBJECTIVE: This excerpt from the book "The Mysterious Universe" presents the mysterious nature of the Universe and the stars which present numerous problems to the scientific mind. Sir James Jeans uses a poetic approach to discuss the scientific phenomena.
   OUTCOME: This provides the students to think about the scientific phenomena from a different angle and also exposes the readers to poetic expressions.
7. **LUCK—MARK TWAIN**
   OBJECTIVE: This is a short story about a man's public image and his true nature. The theme of the story is that luck can be a factor of life, so that even if one is incompetent but lucky, one can still succeed.
   OUTCOME: The story is humourous in that it contains a lot of irony. Thus this develops in the learner understand humourous texts and use of words for irony.

Text Book : 'English Essentials' by Ravindra Publications

NON-DETAILED TEXT:

(From Modern Trailblazers of Orient Blackswan)
(Common single Text book for two semesters)
(Semester I (1 to 4 lessons)/ Semester II (5 to 8 lessons)

1. **G.D.Naidu**
   OBJECTIVE: To inspire the learners by G.D.Naidu's example of inventions and contributions.
   OUTCOME: The learner will be in a position to emulate G.D.Naidu and take to practical applications.
2. **G.R.Gopinath**
   OBJECTIVE: To inspire the learners by his example of inventions.
   OUTCOME: Like G.R.Gopinath, the learners will be able to achieve much at a low cost and help the common man.
3. **Sudhamurthy**
   OBJECTIVE: To inspire the learners by the unique interests and contributions of Sudha Murthy.
   OUTCOME: The learner will take interest in multiple fields of knowledge and make life worthwhile through social service.
4. **Vijay Bhatkar**
   OBJECTIVE: To inspire the learner by his work and studies in different fields of engineering and science.
   OUTCOME: The learner will emulate him and produce memorable things.

Text Book : 'Trail Blazers' by Orient Black Swan Pvt. Ltd. Publishers

I Year – I SEMESTER

T	P	C
3+1	0	3

MATHEMATICS – I (DIFFERENTIAL EQUATIONS)
(Common to All Branches)

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.
Subject Category
ABET Learning Objectives a d e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

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).
Applications: LCR circuit, Simple Harmonic motion
Subject Category
ABET Learning Objectives a d e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT III Laplace transforms:
Laplace transforms of standard functions-ShiftingTheorems, Transforms of derivatives and integrals – Unit step function –Dirac's delta function- Inverse Laplace transforms– Convolution theorem (with out proof).
Application: Solutions of ordinary differential equations using Laplace transforms.
Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT IV Partial differentiation:
Introduction- Total derivative-Chain rule-Generalized Mean Value theorem for single variable (without proof)-Taylors and Mc Laurent's series for two variables– Functional dependence- Jacobian.
Applications: Maxima and Minima of functions of two variables with constraints and without constraints.
Subject Category
ABET Learning Objectives a c e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

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 type) equations
Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT VI Higher order Partial differential equations:
Solutions of Linear Partial differential equations with constant coefficients- Method of separation of Variables
Applications: One- dimensional Wave, Heat equations - two-dimensional Laplace Equation.
Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 6
JNTUK External Evaluation B E

Books:

1. **B.S.GREWAL,** Higher Engineering Mathematics, 42nd Edition, Khanna Publishers
2. **ERWIN KREYSZIG,** Advanced Engineering Mathematics, 9th Edition, Wiley-India
3. **GREENBERG,** Advanced Engineering Mathematics, 2nd edition, Pearson edn
4. **DEAN G. DUFFY,** Advanced engineering mathematics with MATLAB, CRC Press
5. **PETER O'NEIL,** advanced Engineering Mathematics, Cengage Learning.

Subject Category	ABET Learning Objectives	ABET Internal Assessments	JNTUK External Evaluation	Remarks
Theory Design Analysis Algorithms Drawing Others	a) Apply knowledge of math, science, & engineering b) Design & conduct experiments, analyze & interpret data c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, & sustainability constraints d) Function on multidisciplinary teams e) Identify, formulate, & solve engineering problems f) Understand professional & ethical responsibilities g) Communicate effectively h) Understand impact of engineering solutions in global, economic, environmental, & societal context i) Recognize need for & be able to engage in lifelong learning j) Know contemporary issues k) Use techniques, skills, modern tools for engineering practices	1. Objective tests 2. Essay questions tests 3. Peer tutoring based 4. Simulation based 5. Design oriented 6. Problem based 7. Experiential (project based) based 8. Lab work or field work based 9. Presentation based 10. Case Studies based 11. Role-play based 12. Portfolio based	A. Questions should have: B. Definitions, Principle of operation or philosophy of concept. C. Mathematical treatment, derivations, analysis, synthesis, numerical problems with inference. D. Design oriented problems E. Trouble shooting type of questions F. Applications related questions G. Brain storming questions	

I Year – I SEMESTER

T	P	C
3+1	0	3

ENGINEERING CHEMISTRY

UNIT-I: WATER TECHNOLOGY

Hard Water – Estimation of hardness by EDTA method – Potable water- Sterilization and Disinfection – Boiler feed water – Boiler troubles – Priming and foaming , scale formation, corrosion, caustic embrittlement, turbine deposits – Softening of water – Lime soda, Zeolite processes – Reverse osmosis – Electro Dialysis, Ion exchange process

Objectives : For prospective engineers knowledge about water used in industries (boilers etc.) and for drinking purposes is useful; hence chemistry of hard water, boiler troubles and modern methods of softening hard water is introduced.

UNIT-II : ELECTROCHEMISTRY

Concept of Ionic conductance – Ionic Mobilities – Applications of Kohlrausch law – Conductometric titrations – Galvanic cells – Electrode potentials – Nernst equation – Electrochemical series – Potentiometric titrations – Concentration cells – Ion selective electrode –Glass electrodes – Fluoride electrode; Batteries and Fuel cells

Objectives : Knowledge of galvanic cells, electrode potentials, concentration cells is necessary for engineers to understand corrosion problem and its control ; also this knowledge helps in understanding modern bio-sensors, fuel cells and improve them.

UNIT-III : CORROSION

Causes and effects of corrosion – theories of corrosion (dry, chemical and electrochemical corrosion) – Factors affecting corrosion – Corrosion control methods – Cathodic protection –Sacrificial Anodic, Impressed current methods – Surface coatings – Methods of application on metals (Hot dipping, Galvanizing, tinning , Cladding, Electroplating, Electroless plating) – Organic surface coatings – Paints – Their constituents and their functions.

Objectives : the problems associated with corrosion are well known and the engineers must be aware of these problems and also how to counter them

UNIT-IV : HIGH POLYMERS

Types of Polymerization – Stereo regular Polymers – Physical and Mechanical properties of polymers – Plastics – Thermoplastics and thermo setting plastics – Compounding and Fabrication of plastics – Preparation and properties of Polyethylene, PVC and Bakelite – Elastomers – Rubber and Vulcanization – Synthetic rubbers – Styrene butadiene rubber – Thiokol – applications.

Objectives : Plastics are materials used very widely as engineering materials. An understanding of properties particularly physical and mechanical properties of polymers / plastics / elastomers helps in selecting suitable materials for different purposes.

UNIT-V : FUELS

Coal – Proximate and ultimate analysis – Numerical problems based on analysis – Calorific vaule – HCV and LCV – Problems based on calorific values; petroleum – Refining – Cracking – Petrol – Diesel knocking; Gaseous fuels – Natural gas – LPG, CNG – Combustion – Problems on air requirements.

Objectives : A board understanding of the more important fuels employed on a large scale is necessary for all engineer to understand energy – related problems and solve them.

UNIT-VI : CHEMISTRY OF ADVANCED MATERIALS

Nanometerials (Preparation of carbon nanotubes and fullerenes – Properties of nanomaterials – Engineering applications) – Liquid crystals (Types – Application in LCD and Engineering Applications) – Fiber reinforced plastics – Biodegradable polymers – Conducting polymers – Solar cells (Solar heaters – Photo voltaic cells – Solar reflectors – Green house concepts – Green chemistry (Methods for green synthesis and Applications) – Cement – Hardening and setting – Deterioration of cement concrete

Objectives : With the knowledge available now, future engineers should know at least some of the advanced materials that are becoming available. Hence some of them are introduced here.

TEXT BOOKSS

1. Jain and Jain (Latest Edition), Engineering Chemistry, Dhanpat Rai Publishing company Ltd,
2. N.Y.S.Murthy, V.Anuradha, KRamaRao "A Text Book of Engineering Chemistry", Maruthi Publications
3. C.Parameswara Murthy, C.V.Agarwal, Adhra Naidu (2006) Text Book of Engineering Chemistry, B.S.Publications
4. B.Sivasankar (2010), Engineering Chemistry, McGraw-Hill companies.
5. Ch.Venkata Ramana Reddy and Ramadevi (2013) , Engineering Chemistry, Cengage Learning

REFERENCES

1. S.S. Dara (2013) Text Book of Engineering Chemistry, S.Chand Technical Series
2. K.Sesha Maheswaramma and Mridula Chugh (2013), Engineering Chemistry, Pearson Publications.
3. R.Gopalan, D.Venkatappayya, Sulochana Nagarajan (2011), Text Book of Engineering Chemistry, Vikas Publications.
4. B.Viswanathan and M.Aulice Scibioh (2009), Fuel Cells, Principals and applications, University Press.

I Year – I SEMESTER

T	P	C
3+1	0	3

ENGINEERING MECHANICS

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. 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.

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 basis principles), centre of gravity of composite bodies, pappus theorem.

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.

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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.
2. Engineering Mechanics: Statics and Dynamics 3rd edition, Andrew Pytel and Jaan Kiusalaas; Cengage Learning publishers.

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 , dynamics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
4. Engineering Mechanics , statics and dynamics – I.H.Shames, – Pearson Publ.
5. Mechanics For Engineers , statics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
6. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
7. 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.
8. Engineering Mechanics , Fedinand . L. Singer , Harper – Collins.
9. Engineering Mechanics statics and dynamics , A Nelson, Mc Graw Hill publications
10. Engineering Mechanics, Tayal. Umesh Publ.

I Year – I SEMESTER | **T** | **P** | **C**
3+1 | **0** | **3**

COMPUTER PROGRAMMING

Objectives: Formulating algorithmic solutions to problems and implementing algorithms in C

UNIT I:
Unit objective: Notion of Operation of a CPU, Notion of an algorithm and computational procedure, editing and executing programs in Linux
Introduction: Computer systems, Hardware and Software Concepts**,**
Problem Solving: Algorithm / Pseudo code, flowchart, program development steps, computer languages: machine, symbolic and highlevel languages, Creating and Running Programs: Writing, Editing(vi/emacs editor), Compiling(gcc), Linking and Executing in under Linux.
BASICS OF C: Structure of a C program, identifiers, basic data types and sizes. Constants, Variables, Arthmetic , relational and logical operators, increment and decrement operators, conditional operator, assignment operator, expressions, type conversions, Conditional Expressions, precedence and order of evaluation, Sample Programs.

UNIT II:
Unit objective: understanding branching, iteration and data representation using arrays
SELECTION – MAKING DECISION: TWO WAY SELECTION: if-else, null else, nested if, examples, Multi-way selection: switch, else-if, examples**.**
ITERATIVE: loops- while, do-while and for statements , break, continue, initialization and updating, event and counter controlled loops, Looping applications: Summation, powers, smallest and largest.
ARRAYS: Arrays- concepts, declaration, definition, accessing elements, storing elements, Strings and String Manipulations, 1-D arrays, 2-D arrays and character arrays, string manipulations, Multidimensional arrays, array applications: Matrix operations, checking the symmetricity of a Matrix**.**
STRINGS: concepts, c strings.

UNIT III:
Objective: Modular programming and recursive solution formulation
FUNCTIONS- MODULAR PROGRAMMING: functions, basics, parameter passing, storage classes extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, Recursive solutions for fibonacci series, towers of Hanoi, header files, C Preprocessor, example c programs, Passing 1-D arrays, 2-D arrays to functions.

UNIT IV:
Objective: Understanding pointers and dynamic memory allocation
POINTERS: pointers- concepts, initialization of pointer variables, pointers and function arguments, passing by address- dangling memory, address arithmetic, character pointers and functions, pointers to pointers, pointers and multi-dimensional arrays, dynamic memory management functions, command line arguments

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UNIT V:
Objective: Understanding miscellaneous aspects of C
ENUMERATED, STRUCTURE AND UNION TYPES: Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit-fields, program applications
BIT-WISE OPERATORS: logical, shift, rotation, masks.

UNIT VI:
Objective: Comprehension of file operations
FILE HANDLING: Input and output- concept of a file, text files and binary files, Formatted I/O, File I/O operations, example programs

Text Books:

1. Problem Solving and Program Design in C, Hanly, Koffman, 7th ed, PERSON
2. Programming in C, Second Edition Pradip Dey and Manas Ghosh, OXFORD Higher Education
3. Programming in C, A practical approach Ajay Mittal PEARSON
4. The C programming Language by Dennis Richie and Brian Kernighan
5. Programming in C, B. L. Juneja, Anith Seth, Cengage Learning.

Reference Books and web links:

1. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE
2. Programming with C, Bichkar, Universities Press
3. Programming in C, Reema Thareja, OXFORD
4. C by Example, Noel Kalicharan, Cambridge

I Year – I SEMESTER

T	P	C
3+1	0	3

ENVIRONMENTAL STUDIES

Course Learning Objectives:

The objectives of the course is to impart

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

Course Outcomes:

The student should have knowledge on

1. The natural resources and their importance for the sustenance of the life and recognise the need to conserve the natural resources
2. 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
3. The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
4. Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
5. Social issues both rural and urban environment and the possible means to combat the challenges
6. The environmental legislations of India and the first global initiatives towards sustainable development.
7. About environmental assessment and the stages involved in EIA and the environmental audit

Syllabus:

UNIT - I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance –Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, 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

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.

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-sports 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.

Solid Waste Management: Sources, classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products.

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

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

Text Books:

1. Environmental Studies by R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
2. A Textbook of Environmental Studies by Shaashi Chawla, TMH, New Delhi
3. Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

Reference:

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada
3. Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Environmental Studies by Piyush Malaviya, Pratibha Singh, Anoop singh: Acme Learning, New Delhi

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I Year – I SEMESTER

T	P	C
0	3	2

ENGINEERING CHEMISTRY LABORATORY

List of Experiments

1. Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis, Quantitative analysis etc.,
2. Trial experiment – Estimation of HCI using standard Na_2co_3 solutions
3. Estimation of $KMnO_4$ using standard Oxalic acid solution.
4. Estimation of Ferric iron using standard $K_2Cr_2O_7$ solution.
5. Estimation of Copper using standard $K_2Cr_2O_7$ solution.
6. Estimation of Total Hardness water using standard EDTA solution.
7. Estimation of Copper using standard EDTA solution.
8. Estimation of Copper using Colorimeter
9. Estimation of pH of the given sample solution using pH meter.
10. Conductometric Titrations between strong acid and strong base
11. Conductometric Titrations between strong acid and Weak base
12. Potentiometric Titrations between strong acid and strong base
13. Potentiometric Titrations between strong acid and Weak base
14. Estimatinog of Zinc using standard potassium ferrocyanide solution
15. Estimation of Vitamin – C

TEXT BOOKSS

1. Dr.Jyotsna Cherukuis(2012)Laboratory Manual of Engineering Chemistry-II, VGS Techno Series
2. Chemistry Practical Manual, Lorven Publications
3. K. Mukkanti (2009) Practical Engineering Chemistry, B.S.Publication

I Year – I SEMESTER

T	P	C
0	3	2

ENGLISH – COMMUNICATION SKILLS LAB – I

Suggested Lab Manuals:

OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading, and writing including soft, that is life skills.

BASIC COMMUNICATION SKILLS

UNIT 1	A. Greeting and Introductions
	B. Pure Vowels
UNIT 2	A. Asking for information and Requests
	B. Diphthongs
UNIT 3	A. Invitations
	B. Consonants
UNIT 4	A. Commands and Instructions
	B. Accent and Rhythm
UNIT 5	A. Suggestions and Opinions
	B. Intonation

Text Book:

'Strengthen your Communication Skills' Part-A by Maruthi Publications

Reference Books:

1. INFOTECH English (Maruthi Publications)
2. Personality Development and Soft Skills (Oxford University Press, New Delhi)

I Year – I SEMESTER **T P C**
0 3 2

C PROGRAMMING LAB

Exercise l

a) Write a C Program to calculate the area of triangle using the formula
area = (s (s-a) (s-b)(s-c))$^{1/2}$ where s= (a+b+c)/2

b) Write a C program to find the largest of three numbers using ternary operator.

c) Write a C Program to swap two numbers without using a temporary variable.

Exercise 2

a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.

b) Write a C program to find the roots of a quadratic equation.

c) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Exercise 3

a) Write a C program to find the sum of individual digits of a positive integer and find the reverse of the given number.

b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the

c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Exercise 4

a) Write a C Program to print the multiplication table of a given number n up to a given value, where n is entered by the user.

b) Write a C Program to enter a decimal number, and calculate and display the binary equivalent of that number.

c) Write a C Program to check whether the given number is Armstrong number or not.

Exercise 5

a) Write a C program to interchange the largest and smallest numbers in the array.

b) Write a C program to implement a liner search.

c) Write a C program to implement binary search

Exercise 6

a) Write a C program to implement sorting of an array of elements .

b) Write a C program to input two m x n matrices, check the compatibility and perform addition and multiplication of them

Exercise 7

Write a C program that uses functions to perform the following operations:

i. To insert a sub-string in to given main string from a given position.
ii. To delete n Characters from a given position in a given string.
iii. To replace a character of string either from beginning or ending or at a specified location

Exercise 8

Write a C program that uses functions to perform the following operations using Structure:

i) Reading a complex number ii) Writing a complex number
iii) Addition of two complex numbers iv) Multiplication of two complex numbers

Exercise 9

Write C Programs for the following string operations without using the built in functions

- to concatenate two strings
- to append a string to another string
- to compare two strings

Exercise 10

Write C Programs for the following string operations without using the built in functions

- to find t he length of a string

- to find whether a given string is palindrome or not

Exercise 11

a) Write a C functions to find both the largest and smallest number of an array of integers.

b) Write C programs illustrating call by value and call by reference cncepts.

Exercise 12

Write C programs that use both recursive and non-recursive functions for the following

i) To find the factorial of a given integer.

ii) To find the GCD (greatest common divisor) of two given integers.

iii) To find Fibonacci sequence

Exercise 13

a) Write C Program to reverse a string using pointers

b) Write a C Program to compare two arrays using pointers

Exercise 14

a) Write a C program consisting of Pointer based function to exchange value of two integers using passing by address.

b) Write a C program to swap two numbers using pointers

Exercise 15

Examples which explores the use of structures, union and other user defined variables

Exercise 16

a) Write a C program which copies one file to another.

b) Write a C program to count the number of characters and number of lines in a file.

c) Write a C Program to merge two files into a third file. The names of the files must be entered using command line arguments.

I Year – II SEMESTER

T	P	C
3+1	0	3

ENGLISH –II
(Common to All Branches)

DETAILED TEXT-II : Sure Outcomes: English for Engineers and Technologists

Recommended Topics :

1. **TECHNOLOGY WITH A HUMAN FACE**
   OBJECTIVE: To make the learner understand how modern life has been shaped by technology.
   OUTCOME: The proposed technology is people's technology. It serves the human person instead of making him the servant of machines.
2. **CLIMATE CHANGE AND HUMAN STRATEGY**
   OBJECTIVE: To make the learner understand how the unequal heating of earth's surface by the Sun, an atmospheric circulation pattern is developed and maintained.
   OUTCOME: The learner's understand that climate must be preserved.
3. **EMERGING TECHNOLOGIES**
   OBJECTIVE: To introduce the technologies of the 20th century and 21st centuries to the learners.
   OUTCOME: The learner will adopt the applications of modern technologies such as nanotechnology.
4. **WATER- THE ELIXIR OF LIFE**
   OBJECTIVE: To inform the learner of the various advantages and characteristics of water.
   OUTCOME: The learners will understand that water is the elixir of life.
5. **THE SECRET OF WORK**
   OBJECTIVE:**:** In this lesson, Swami Vivekananda highlights the importance of work for any development.
   OUTCOME: The students will learn to work hard with devotion and dedication.
6. **WORK BRINGS SOLACE**
   OBJECTIVE: In this lesson Abdul Kalam highlights the advantage of work.
   OUTCOME: The students will understand the advantages of work. They will overcome their personal problems and address themselves to national and other problems.

Text Book : 'Sure Outcomes' by Orient Black Swan Pvt. Ltd. Publishers

NON-DETAILED TEXT:

(From Modern Trailblazers of Orient Blackswan)
(Common single Text book for two semesters)
(Semester I (1 to 4 lessons)/ Semester II (5 to 8 lessons)

5. **J.C. Bose**
   OBJECTIVE: To apprise of J.C.Bose's original contributions.
   OUTCOME: The learner will be inspired by Bose's achievements so that he may start his own original work.
6. **Homi Jehangir Bhaba**
   OBJECTIVE: To show Bhabha as the originator of nuclear experiments in India.
   OUTCOME: The learner will be inspired by Bhabha's achievements so as to make his own experiments.
7. **Vikram Sarabhai**
   OBJECTIVE: To inform the learner of the pioneering experiments conducted by Sarabhai in nuclear energy and relevance of space programmes.
   OUTCOME: The learner will realize that development is impossible without scientific research.
8. **A Shadow- R.K.Narayan**
   OBJECTIVE: To expose the reader to the pleasure of the humorous story
   OUTCOME: The learner will be in a position to appreciate the art of writing a short story and try his hand at it.

Text Book : 'Trail Blazers' by Orient Black Swan Pvt. Ltd. Publishers

1.

I Year – II SEMESTER

T	P	C
3+1	0	3

MATHEMATICS – II
(MATHEMATICAL METHODS)

(Common to All Branches)

UNIT I Solution of Algebraic and Transcendental Equations:

Introduction- Bisection Method – Method of False Position – Iteration Method – Newton-Raphson Method (One variable and Simultaneous Equestions)

Subject Category
ABET Learning Objectives a e k
ABET internal assessments 1 2 4 6
JNTUK External Evaluation A B E

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 unevenly spaced points - Lagrange's Interpolation formula

Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 4 6
JNTUK External Evaluation A B E

UNIT III Numerical solution of Ordinary Differential equations:

Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods

Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 4 6
JNTUK External Evaluation A B E

UNIT IV Fourier Series:

Introduction- Determination of Fourier coefficients – even and odd functions –change of interval– Half-range sine and cosine series

application: Amplitude, spectrum of a periodic function

Subject Category
ABET Learning Objectives a e d
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT V Fourier Transforms:

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

Subject Category
ABET Learning Objectives a d e k
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT VI Z-transform:

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

Subject Category
ABET Learning Objectives a b e k
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

BOOKS:

1. **B.S. GREWAL,** Higher Engineering Mathematics, 42nd Edition, Khanna Publishers
2. **DEAN G. DUFFY,** Advanced Engineering Mathematics with MATLAB, CRC Press
3. **V.RAVINDRANATH and P. VIJAYALAXMI,** Mathematical Methods, Himalaya Publishing House
4. **ERWYN KREYSZIG,** Advanced Engineering Mathematics, 9th Edition, Wiley-India

Subject Category	ABET Learning Objectives	ABET Internal Assessments	JNTUK External Evaluation	Remarks
Theory Design Analysis Algorithms Drawing Others	a) Apply knowledge of math, science, & engineering b) Design & conduct experiments, analyze & interpret data c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, & sustainability constraints d) Function on multidisciplinary teams e) Identify, formulate, & solve engineering problems f) Understand professional & ethical responsibilities g) Communicate effectively h) Understand impact of engineering solutions in global, economic, environmental, & societal context i) Recognize need for & be able to engage in lifelong learning j) Know contemporary issues k) Use techniques, skills, modern tools for engineering practices	1. Objective tests 2. Essay questions tests 3. Peer tutoring based 4. Simulation based 5. Design oriented 6. Problem based 7. Experiential (project based) based 8. Lab work or field work based 9. Presentation based 10. Case Studies based 11. Role-play based 12. Portfolio based	A. Questions should have: B. Definitions, Principle of operation or philosophy of concept. C. Mathematical treatment, derivations, analysis, synthesis, numerical problems with inference. D. Design oriented problems E. Trouble shooting type of questions F. Applications related questions G. Brain storming questions	

I Year – II SEMESTER

T	P	C
3+1	0	3

MATHEMATICS – III
(LINEAR ALGEBRA & VECTOR CALCULUS)
(Common to All Branches)

UNIT I Linear systems of equations:

Rank-Echelon form, Normal form – Solution of Linear Systems – Direct Methods- Gauss Elimination - Gauss Jordon and Gauss Seidal Methods.

Application: Finding the current in a electrical circuit.

Subject Category
ABET Learning Objectives a e k
ABET internal assessments 1 2 6 4
JNTUK External Evaluation A B E

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- Quadratic forms- Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - index – signature.

Application: Free vibration of a two-mass system.

Subject Category
ABET Learning Objectives a d e k
ABET internal assessments 1 2 4 6
JNTUK External Evaluation A B E

UNIT III Multiple integrals:

Review concepts of Curve tracing (Cartesian - Polar and Parametric curves)-

Applications of Integration to Lengths, Volumes and Surface areas of revolution in Cartesian and Polar Coordinates.

Multiple integrals - double and triple integrals – change of variables – Change of order of Integration

Application: Moments of inertia

Subject Category
ABET Learning Objectives a e d
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT IV Special functions:

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

Application: Evaluation of integrals

Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT V Vector Differentiation:

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

Application: Equation of continuity, potential surfaces

Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT VI Vector Integration:

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

application: work done, Force

Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

BOOKS:

1. **GREENBERG,** Advanced Engineering Mathematics, 9th Edition, Wiley-India
2. **B.V. RAMANA,** Higher Engineering Mathematics, Tata McGrawhill
3. **ERWIN KREYSZIG,** Advanced Engineering Mathematics, 9th Edition, Wiley-India
4. **PETER O'NEIL,** Advanced Engineering Mathematics, Cengage Learning
5. **D.W. JORDAN AND T. SMITH,** Mathematical Techniques, Oxford University Press

Subject Category	ABET Learning Objectives	ABET Internal Assessments	JNTUK External Evaluation	Remarks
Theory Design Analysis Algorithms Drawing Others	a) Apply knowledge of math, science, & engineering b) Design & conduct experiments, analyze & interpret data c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, & sustainability constraints d) Function on multidisciplinary teams e) Identify, formulate, & solve engineering problems f) Understand professional & ethical responsibilities g) Communicate effectively h) Understand impact of engineering solutions in global, economic, environmental, & societal context i) Recognize need for & be able to engage in lifelong learning j) Know contemporary issues k) Use techniques, skills, modern tools for engineering practices	1. Objective tests 2. Essay questions tests 3. Peer tutoring based 4. Simulation based 5. Design oriented 6. Problem based 7. Experiential (project based) based 8. Lab work or field work based 9. Presentation based 10. Case Studies based 11. Role-play based 12. Portfolio based	A. Questions should have: B. Definitions, Principle of operation or philosophy of concept. C. Mathematical treatment, derivations, analysis, synthesis, numerical problems with inference. D. Design oriented problems E. Trouble shooting type of questions F. Applications related questions G. Brain storming questions	

I Year – II SEMESTER

T	P	C
3+1	0	3

ENGINEERING PHYSICS

UNIT-I
PHYSICAL OPTICS FOR INSTRUMENTS

"Objective Designing an instrument and enhancing the resolution for its operation would be effective as achieved through study of applicational aspects of physical Optics"

INTERFACE : Introduction – Interference in thin films by reflection – Newton's rings.

DIFFRACTION : Introduction – Fraunhofer diffraction - Fraunhofer diffraction at double slit (qualitative) – Diffraction grating – Grating spectrum – Resolving power of a grating – Rayleigh's criterion for resolving power.

POLARIZATION : Introduction – Types of Polarization – Double refraction – Quarter wave plate ad Half Wave plate.

UNIT-II
COHERENT OPTICS – COMMUNICATIONS AND STRUCTURE OF MATERIALS

Objectives while lasers are trusted Non-linear coherent sources established for the fitness of instrumentation, establishing a structure property relationship for materials requires allotment of an equivalent footing in convening the physics knowledge base.

LASERS: Introduction – coherent sources – Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Three and Four level pumping schemes – Ruby laser – Helium Neon laser.

FIBER OPTICS : Introduction – Principle of Optical Fiber – Acceptance angle and acceptance cone – Numerical aperture.

CRYSTALLOGRAPHY : Introduction – Space lattice – Basis – Unit Cell – Lattice parameters – Bravais lattices – Crystal systems – Structures and packing fractions of SC,BCC and FCC

X-RAY DIFFRACTION TECHNIQUES : Directions and planes in crystals – Miller indices – Separation between successive [h k l] planes – Bragg's law.

UNIT-III
MAGNETIC, ELECTRIC FIELD RESPONSE OF MATERIALS & SUPERCONDUCTIVITY

"Objective many of the Electrical or Electronic gadgets are designed basing on the response of naturally abundant and artificially made materials, while their response to E- or H- fields controls their performance.

MAGNETIC PROPERTIES : Magnetic permeability – Magnetization – Organ or magnetic moment – Classification of Magnetic materials – Dir, para, Ferro, anti ferro and ferri-magnetism – Hysteresis curve

DIELECTRIC PROPERTIES : Introduction – Dielectric constant – Electronic, ionic and orientational polarization – internal fields – Clausius – Mossotti equation – Dielectric loss, Breakdown and Strength.

SUPERCONDUCTIVITY : General properties – Meissner effect – Type I and Type II superconductors – BCS Theory Flux quantization London's equations – Penetration depth – DC and AC Josephson effects – SQUIDS.

UNIT – IV
ACOUSTICS AND EM – FIELDS:

Objective: The utility and nuances of ever pervading SHM and its consequences would be the first hand-on to as it clearly conveyed through the detailed studies of Acoustics of Buildings, while vectorial concepts of EM fields paves the student to gear – up for a deeper understanding.

ACOUSTICS:_ Sound absorption, absorption coefficient and its measurements, Reverberations time – Sabine's formula, Eyring's formula.

ELECTRO-MAGNETIC FIELDS: Gauss and stokes theorems (qualitative) – Fundamental laws of electromagnetism – Maxwell's Electromagnetic Equations (Calculus approach).

UNIT – V
QUANTUM MECHANICS FOR ELECTRONIC TRANSPORT

Objective: The discrepancy between classical estimates and laboratory observations of physical properties exhibited by materials would be lifted out through the understanding quantum picture of sub-atomic world dominated by electron and its presence.

QUANTUM MECHANICS: Introduction to matter waves – Schrodinger Time Independent and Time Dependent wave equations – Particle in a box.

FREE ELECTRON THEORY: Classical free electron theory – electrical conductivity – Mean free path – Relaxation time and drifty velocity – Quantum free electron theory – Fermi – Dirac (analytical) and its dependence on temperature – Fermi energy – density of states – derivations for current density.

BAND THEORY OF SOLIDS: Bloch theorem (qualitative) – Kronig – Penney model – Origin of energy band formation in solids – Classification of materials into conductors, semi – conductors & insulators – Concepts of effective mass of electron - concept of hole.

UNIT – VI

SEMICONDUCTOR PHYSICS:

Objective: In the wake of ever increasing demand for the space and power the watch word "small is beautiful", understanding the physics of electronic transport as underlying mechanism for appliances would provide a knowledge base.

Introduction – Intrinsic semiconductor and carrier concentration – Equation for conductivity – Extrinsic semiconductor and carrier concentration – Drift and diffusion – Einstein's equation – Hall Effect – direct & indirect band gap semiconductors – Electronic transport Mechanism for LEDs, Photo conductors and solar cells.

TEXT BOOKS

1. Solid state Physics by A.J. Dekker (Mc Millan India Ltd)
2. A text book of Engineering Physics by M.N. Avadhanulu & P.G. Kshirasagar (S. Chand publications)
3. Engineering Physics b;y M.R. Srinivasan (New Age international publishers)

REFERENCE BOOKS

1. 'Introduction to solid state physics' by Charles Kittle (Willey India Pvt.Ltd)
2. 'Applied Physics' by T. Bhimasenkaram (BSP BH Publications)
3. 'Applied Physics' by M.Arumugam (Anuradha Agencies)
4. 'Engineering Physics' by Palanisamy (Scitech Publishers)
5. 'Engineering Physics' by D.K.Bhattacharya (Oxford University press)
6. 'Engineering Physics' by Mani Naidu S (Pearson Publications)
7. 'Engineering Physics' by Sanjay D Jain and Girish G Sahasrabudhe (University Press)
8. 'Engineering Physics' by B.K.Pandey & S. Chaturvedi (Cengage Learning)

I Year – II SEMESTER

T	P	C
3+1	0	3

Professional Ethics and Human Values

UNIT I : Human Values:
Morals, Values and Ethics – Integrity – 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 : Engineering Ethics:
The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics-Consensus and Controversy –Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories-Professional Ethics-Types of Inquiry – Engineering and Ethics-Kohlberg's Theory – Gilligan's Argument –Heinz's Dilemma.

UNIT III : Engineering as Social Experimentation:
Comparison with Standard Experiments – Knowledge gained – Conscientiousness – Relevant Information – Learning from the Past – Engineers as Managers, Consultants, and Leaders – Accountability – Role of Codes – Codes and Experimental Nature of Engineering.

UNIT IV : Engineers' Responsibility for Safety and Risk:
Safety and Risk, Concept of Safety – Types of Risks – Voluntary v/s Involuntary Risk- Short term v/s Long term Consequences- Expected Probability- Reversible Effects- Threshold Levels for Risk- Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT V : Engineers' Responsibilities and Rights:
Collegiality-Techniques for Achieving Collegiality –Two Senses of Loyalty-obligations of Loyalty-misguided Loyalty – professionalism and Loyalty- Professional Rights –Professional Responsibilities – confidential and proprietary information-Conflict of Interest-solving conflict problems – Self-interest, Customs and Religion- Ethical egoism-Collective bargaining-Confidentiality-Acceptance of Bribes/Gifts-when is a Gift and a Bribe-examples of Gifts v/s Bribes-problem solving-interests in other companies-Occupational Crimes-industrial espionage-price fixing-endangering lives- Whistle Blowing-types of whistle blowing-when should it be attempted-preventing whistle blowing.

UNIT VI : Global Issues:
Globalization- Cross-culture Issues-Environmental Ethics-Computer Ethics-computers as the instrument of Unethical behaviour-computers as the object of Unethical Acts-autonomous computers-computer codes of Ethics-Weapons Development-Ethics and Research-Analysing Ethical Problems in Research-Intellectual Property Rights.

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Text Books:

1. "Engineering Ethics and Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009
2. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications
3. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran-Laxmi Publications
4. "Professional Ethics and Human Values" by Prof.D.R.Kiran-
5. "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication
6. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill – 2003.
7. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

I Year – II SEMESTER

T	P	C
3+1	0	3

ENGINEERING DRAWING

Objective: Engineering drawing being the principle method of communication for engineers, the objective 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: The objective is to introduce the use and the application of drawing instruments and to make the students construct the polygons, curves and various types of scales. The student will be able to understand the need to enlarge or reduce the size of objects in representing them.

Polygons, Construction of regular polygons using given length of a side; Ellipse, arcs of circles and Oblong methods; Scales – Vernier and Diagonal scales.

UNIT II

Objective: The objective is to introduce orthographic projections and to project the points and lines parallel to one plane and inclined to other.

Introduction to orthographic projections; projections of points; projections of straight lines parallel to both the planes; projections of straight lines – parallel to one plane and inclined to the other plane.

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 inclinations and traces.

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.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers.
3. Engineering Graphics by PI Varghese, McGrawHill Publishers

REFERENCE BOOKS:

1. Engineering Graphics for Degree by K.C. John, PHI Publishers
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers
3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

I Year – II SEMESTER

T	P	C
0	3	2

ENGLISH – COMMUNICATION SKILLS LAB – II

Suggested Lab Manuals:

OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading, and writing including soft, that is life skills.

ADVANCED COMMUNICATION SKILLS

UNIT 6	Body language
UNIT 7	Dialogues
UNIT 8	Interviews and Telephonic Interviews
UNIT 9	Group Discussions
UNIT 10	Presentation Skills
UNIT 11	Debates

Text Book:

'Strengthen your Communication Skills' Part-B by Maruthi Publications

Reference Books:

1. INFOTECH English (Maruthi Publications)
2. Personality Development and Soft Skills (Oxford University Press, New Delhi)

I Year – II SEMESTER

T	P	C
0	3	2

ENGINEERING PHYSICS LAB

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 thin object using 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 stretched string – Sonometer.
8. Determination of velocity of sound – Volume resonator.
9. L C R Senes Resonance Circuit
10. Study of I/V Characteristics of Semiconductor diode
11. I/V characteristics of Zener diode
12. Thermistor characteristics – Temperature Coefficient
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 for semiconductor.

REFERENCE:

1. Engineering Physics Lab Manual by Dr.Y. Aparna & Dr.K.Venkateswarao (V.G.S.Book links)
2. Physics practical manual, Lorven Publications.

I Year – II SEMESTER

T	P	C
0	3	2

Engineering Physics
Virtual Labs - Assignments

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

URL : WWW.vlab.co.in

3.

I Year – II SEMESTER

T	P	C
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 Tennon 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: Enabling the student to understand basic hardware and software tools through practical exposure

PC Hardware:
Identification of basic peripherals, assembling a PC, installation of system software like MS Windows, device drivers. Troubleshooting Hardware and software _ some tips and tricks.

Internet & World Wide Web:
Different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet, web browsers, email, newsgroups and discussion forums .Awareness of cyber hygiene(protecting the personal computer from getting infected with the viruses), worms and other cyber attacks .

Productivity tools Crafting professional word documents; excel spread sheets, power point presentations and personal web sites using the Microsoft suite of office tools

(Note: Student should be thoroughly exposed to minimum of 12 Tasks)

PC Hardware

Task 1: Identification of the peripherals of a computer.
To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O Devices

Task 2(Optional) : A practice on disassembling the components of a PC and assembling them to back to working condition.

Task 3: Examples of Operating systems- DOS, MS Windows, Installation of MS windows on a PC.

Task 4: Introduction to Memory and Storage Devices , I/O Port, Device Drivers, Assemblers, Compilers, Interpreters , Linkers, Loaders.

Task 5:
Hardware Troubleshooting (Demonstration):

Identification of a problem and fixing a defective PC(improper assembly or defective peripherals).
Software Troubleshooting (Demonstration):. Identification of a problem and fixing the PC for any software issues

Internet & Networking Infrastructure

Task 6: Demonstrating Importance of Networking, Transmission Media, Networking Devices- Gateway, Routers, Hub, Bridge, NIC ,Bluetooth Technology, Wireless Technology, Modem, DSL, Dialup Connection.
Orientation & Connectivity Boot Camp and web browsing: Students are trained to configure the network settings to connect to the Internet. They are trained to demonstrate the same through web browsing (including all tool bar options) and email access.
Task 7: **Search Engines & Netiquette:**
Students are enabled to use search engines for simple search, academic search and any other context based search (Bing, Google etc). Students are acquainted to the principles of micro-blogging, wiki, collaboration using social networks, participating in online technology forums
Task 8: Cyber Hygiene (Demonstration): Awareness of various threats on the internet. Importance of security patch updates and anti-virus solutions. Ethical Hacking, Firewalls, Multi-factor authentication techniques including Smartcard, Biometrics are also practiced

Word

Task 9 : MS Word Orientation:
Accessing, overview of toolbars, saving files, Using help and resources, rulers, formatting ,Drop Cap , Applying Text effects, Using Character Spacing, OLE in Word, using templates, Borders and Colors, Inserting Header and Footer, Using Date and Time option, security features in word, converting documents while saving
Task 10: Creating project : Abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check , Track Changes, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs.

Excel

Task 11: Using spread sheet features of EXCEL including the macros, formulae, pivot tables, graphical representations
Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

LOOKUP/VLOOKUP

Task 12: Performance Analysis - Features to be covered:- Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

Power Point

Task 13: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting –Images, Clip Art, Tables and Charts in Powerpoint.

Task 14: Focusing on the power and potential of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides, OLE in PPT.

TEXT BOOK:

Faculty to consolidate the workshop manuals using the following references

1. Computer Fundamentals, Anita Goel, Pearson
2. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson,2008
3. Information Technology Workshop,3e, G Praveen Babu, M V Narayana BS Publications.
4. Comdex Information Technology , Vikas Gupta, dreamtech.

REFERENCE BOOK:

1. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu

II Year – I SEMESTER

T	P	C
3+1	0	3

MECHANISMS AND MECHANICAL DESIGN

UNIT - I

MECHANISMS: Elements of links – Classification – Rigid link, flexible and fluid link – Types of kinematic pairs – Sliding, turning, rolling,screw and spherical pairs – Lower ad higher pairs – Closed and open pairs – Constrained motion – Completely, partiallyor successfully constrained and incompletely constrained.

MACHINES: Mechanism and machines – Classification of machines – Kinematic chain – Inversion of mechanism – Inversion of quadratic cycle, Chain – single and double slider crank chains. Exact and approximate Straight line Mechanisms - Peaucellier, Hart T. Chebibheff , Pantograph.

UNIT – II

KINEMATICS: Velocity and acceleration – Motion of link in machine – Determination of velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain.

ANALYSIS OF MECHANISMS: Analysis of slider crank chain for displacement, Velocity and acceleration of sliding – Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, Determination of Coriolis component of acceleration.

UNIT – III

PLANE MOTION OF BODY: Instantaneous center of rotation, centroids and axodes – Relative motion between two bodies – Three centers in line theorem – Graphical determination of instantaneous center, diagrams for simple mechanisms and determination of angular velocity of points and links.

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

UNIT – V

CAMS: Definition of cam and followers – Their uses – Types of followers and cams – Terminology – Types of follower motion – Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and Maximum acceleration during out ward and return strokes in all the above three cases.

ANALYSIS OF MOTION OF FOLLOWERS: Roller follower – Circular cam with straight, concave and convex flanks.

UNIT – VI

DESIGN OF MACHINE ELEMENTS: Principles of mechanical design- dimensional tolerances, fits. Design of common machine elements Springs, shafts, couplings, Universal coupling.

GEARS AND GEAR TRAINS: Introduction to gears-types, Law of gearing, Tooth profiles, specifications, classification-Helical, Bevel and worm gears:

Simple and reverted gear train, epicyclical gear trains-velocity ratio or train value

TEXT BOOKS

1. Theory of Machines, Dr Jagdish Lal, JM Shaw, 2003
2. Theory of Machines, PL Ballaney, Khanna Publishers, 2003.

REFERENCES

1. Theory of Mechanisms and machines, Amithab Ghosh and Asok Kumar Malik, East West Press Private Limited –2001.
2. Theory of Machines, Abdulla Sharif, Dhanpat Rai, 1987.
3. Mechanism and Machine Theory, JS Rao and RV Dukkipati / New Age – 1996.
4. Theory of Machines Through Solved Problems, JS Rao / New Age – 1996.
5. Machine Design Pandya & Sha - Charotar Publication House – 1997.
6. Mechanical Engineering and Design, J.E.Shigley and Charles.R.Mischke, TMH, 2003.

II Year – I SEMESTER

T	P	C
3+1	0	3

THERMODYNAMICS

Course Objectives:
To impart the knowledge of the thermodynamic laws and principles so as to enable the student to prepare an energy audit of any mechanical system that exchange heat and work with the surroundings.

UNIT – I
Objectives: The student should be able to understand the basic concepts like thermodynamic system, its boundary and related fundamental definitions. Distingvision between point function and path function shall be made with respect to energy, work and Heat.
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
Objectives: To learn the first law of thermodynamics, which is also the energy conservation principle, and should be able to apply to different thermodynamic systems. To understand the concept of equality of temperature and the principle of operation of various temperature measuring devices. To learn the applications of steady flow energy equation to the various mechanical components.
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
Objectives: To understand the second law statements and the associated terms and should be able to apply the principles to heat engines. Should be able to analyse the concepts of Carnot cycle, entropy, availability and irreversibility. Should be able to understand the use of Maxwells relations and thermodynamic functions.
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.

UNIT – IV
Objectives: should understand the process of steam formation and its representation on property diagrams with various phase changes and should be able to calculate the quality of steam after its expansion in a steam turbine, with the help of standard steam tables and charts.
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
Objectives: Should be able to use Psychrometric chart and calculate various psychrometric properties of air.
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

Objectives: To understand the concept of air standard cycles and should be able to calculate the efficiency and performance parameters of the systems that use these cycles.

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.

II Year – I SEMESTER

T	P	C
3+1	0	3

MECHANICS OF FLUIDS

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,

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 definations 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.

UNIT VI

Objective: After studying this unit student shall understand the characteristics of compressible fluids and should be able to calculate the values of Mach number and related parameters.

Flow of Compressible Fluid: Introduction, Thermodynamic relations, basic equations of compressible flow, velocity of sound wave in a fluid for isothermal and adiabatic process, mach number and its applications, mach angle, Propagation of Pressure waves and stagnation properties

TEXT BOOKS:

1. Fluid Mechanics Hydraulics and Hydraulics Machines Modi & Seth, Standard publications, New Delhi.
2. Engineering Fluid Mechanics by K.L.Kumar, S.Chand & Co.

REFERENCES :

1. Fluid Mechanics – Frank in white Mc-Grawhill.
2. Fluid Mechanics - John – F.Dauglas, Pearson Educations publishers.
3. Fluid Mechanics & Hydraulic Machines - D. Ramadurgaiah, Newage Publishers.

II Year – I SEMESTER

T	P	C
3+1	0	3

AEROSPACE MATERIALS AND COMPOSITES

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 lay up configurations with cross – plyand angle – ply lay – ups. Introduction to 3D composites, filament wound and Woven composites.

UNIT-III

Characterization of Composites

Stress strain relations of composites, Otrhotropic behavior of composites, Mechanics of Materials approach todetermine Young's modulus, Shear modulus and Poisson's ratio, Stress strain relations in material coordinates,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, pull-trusion and online production methods of manufacture of fibers and composites. Manufacture of high performance composite materials applicable in elevated temperature field.

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 Kogakusha, ltd. Tokyo.

II Year – I SEMESTER

T	P	C
3+1	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.

UNIT – IV

Objective: 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.

Brief explanation of 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 by Bhavikatti, Lakshmi publications.
2. Solid Mechanics, by Popov
3. Mechanics of Materials by - Ferdinand P Beer, E Russell Johnston, and John T Dewolf.

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

T	P	C
3+1	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 and sections of solids.

PROJECTIONS OF PLANES & SOLIDS : Projections of Regular Solids inclined to both planes – Auxiliary Views. Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

UNIT-II:

The knowledge of development of surfaces of solids is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection. The intersection of solids also plays an important role in designing and manufacturing. The objective is to impart this knowledge through this topic.

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

Interpenetration of Right Regular Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT-III:

Isometric projections provide a pictorial view with a real appearance. Perspective views provides a realistic 3D View of an object. The objective is to make the students learn the methods of Iso and Perspective views.

ISOMETRIC PROJECTIONS : Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Transformation of Projections: Conversion of Isometric Views to Orthographic Views – Conventions.

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,.

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 Graphics, K.C. john, PHI Publications

2. Engineering drawing by N.D Bhatt , Charotar 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.

II Year – I SEMESTER **T P C**
0 3 2

MECHANICS OF SOLIDS & AIRCRAFT MATERIALS LAB

MECHANICS OF SOLIDS LAB

1. Direct tension test
2. Bending test on
    a) Simply supported beam
    b) Cantilever beam
3. Torsion test
4. Hardness test
    a) Brinells hardness test
    b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

AIRCRAFT MATERIALS LAB

1. Aircraft wood gluing practice
2. Study of properties of sandwich structures
3. Study of Micro Structures of Non ferrous alloys
4. Experiment on Autoclave for different geometrical structures

Reference:

1. "Air craft production techniques" Keshu S.C, Ganapathy K.K., Interline Publishing House, Banglore-1993

II Year – I SEMESTER

T	P	C
0	3	2

MECHANICS OF FLUIDS LAB

Course Objective: To impart practical exposure on the performance evaluation methods of various flow measuring equipment and to establish the theories of fluid mechanics through experimental methods.

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method
4. Determination of Coefficient of discharge for an external mouthpiece by variable head method
5. Calibration of contracted Rectangular Notch
6. Calibration of contracted Triangular Notch
7. Calibration of rectangular weir
8. Determination of Coefficient of loss of head in a sudden contraction and friction factor
9. Verification of Bernoulli's equation
10. Determination of friction factor for a given pipe line
11. Reynolds experiment to determine the type of flow
12. Calibration of pitot tube

II Year – II SEMESTER

T	P	C
3+1	0	3

AERODYNAMICS-I

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 thepressure distribution. Experimental methods, wake survey.

UNIT-II - ELEMENTARY FLOWS

Incompressible flow condition, Governing equation for irrotational, incompressible flow: Laplace's equation, Boundaryconditions. Elementary flows. Combination of uniform flow with a Source and Sink, Doublet. Flow over a circularcylinder, Vortex flow. Circulation, Kutta-Joukowski theorem. Lifting flow over a cylinder The vortex sheet. Kelvincirculation 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 induceddrag. Elliptical and modified elliptical lift distribution. Lift distribution on wings. Limitations of Prandtl's lifting line theory.

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

II Year – II SEMESTER

T	P	C
3+1	0	3

AIRCRAFT PRODUCTION TECHNOLOGY

UNIT – I
INTRODUCTION
Classification and comparison (merits and limitations) of manufacturing process, criterion for selection of a process General principles of various Casting Processes - Sand casting, die-casting, centrifugal casting, investment casting, shell moulding types.

UNIT -II
WELDING AND BONDING TECHNIQUES
Principles and equipment used in arc welding, gas welding, resistance welding, thermit welding, recent advances in welding technology, Soldering and brazing techniques.

UNIT - III
SHEET METAL FORMING
Sheet metal operations-shearing, punching, dropstamp forming, Advanced metal forming (super plastic forming and diffusion bonding). Bend correction for bending in single plane, Automation in bend forming and different operations in bending like stretch forming spinning drawing etc.

UNIT- IV
MACHINING
General principles (with schematic diagram only) of working and types-lathe, shaper, milling machines, grinding, drilling m/c, CNC machining and general principles.

UNCONVENTIONAL MACHINING
Principles (with schematic diagram only) of working and applications of abrasive jet machining, ultrasonic machining, electric discharge machining, electro chemical machining, laser beam/electron beam/plasma arc machining.

UNIT-V
HEAT TREATMENT AND SURFACE FINISHING
Heat treatment of Aluminum alloys, titanium alloys, steels, case hardening, Initial stresses and the stress alleviation procedures. Corrosion prevention, protective treatment for aluminum alloys, steels, anodizing of titanium alloys, organic coating, and thermal spray coatings. Grinding and Polishing, Technology of surface finish.

UNIT - VI
AIRCRAFT ASSEMBLY
Aircraft Tooling Concepts, Jigs, fixtures, stages of assembly, types and equipment for riveted joints, bolted joints (only).

QUALITY CONTROL AND ASSURANCE
Concepts and definitions of quality, reliability, quality circles, zero defect program: international standards, six-sigma quality.

NDT AND OTHER INSPECTION TECHNIQUES
Dye Penetrant Test, X - ray, magnetic particle and ultrasonic testing. Accoustic holography.

TEXTBOOKS:

1. “Air craft production techniques” Keshu S.C, Ganapathy K.K., Interline Publishing House, Banglore-1993
2. “Manufacturing Engineering and Technology” by Kalpakajam – Addison Wesley.

REFERENCES:

1. “Production technology”- R.K. Jain – Khanna Publishers – 2002.
2. “Production technology”-O.P.Khanna and lal. M.Dhanpat rai publications-New Delhi-1997

II Year – II SEMESTER

T	P	C
3+1	0	3

CONTROL SYSTEMS

UNIT – I INTRODUCTION

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems

UNIT II TRANSFER FUNCTION REPRESENTATION

Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.

UNIT-III TIME RESPONSE ANALYSIS

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

UNIT – IV STABILITY ANALYSIS IN S-DOMAIN

The concept of stability - Routh stability criterion – qualitative stability and conditional stability

Root Locus Technique:

The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT – V FREQUENCY RESPONSE ANALYSIS

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

STABILITY ANALYSIS IN FREQUENCY DOMAIN

Polar Plots, Nyquist Plots and applications of Nyquist criterion to find the stability – Effects of adding poles and zeros to G(s)H(s) on the shape of the Nyquist diagrams-stability analysis.

UNIT – VI CLASSICAL CONTROL DESIGN TECHNIQUES

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers.

STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

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

TEXT BOOKS:

1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, edition.
2. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

REFERENCES:

1. Control Systems by N.K.Sinha, New Age International (P) Limited Publishers, 3rd Edition, 1998.
2. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John wiley and son's.
3. Control Systems Engg. by NISE 3rd Edition – John Wiley
4. " Modelling & Control Of Dynamic Systems" by Narciso F. Macia George J. Thaler, Thomson Publishers.

II Year – II SEMESTER

T	P	C
3+1	0	3

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:

i. To learn the basic principles of electrical law's and analysis of networks.
ii. To understand the principle of operation and construction details of DC machines.
iii. To understand the principle of operation and construction details of transformer.
iv. To understand the principle of operation and construction details of alternator and 3-Phase inductio motor.
v. To study the operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
vi. 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 and star-delta and delta-star transformations.

UNIT - II

DC MACHINES : Principle of operation of DC generator – emf equation - types – DC motor types –torque equation – applications – three point starter, swinburn's Test, speed control methods.

UNIT - III

TRANSFORMERS: Principle of operation of single phase transformers – e.m.f equation – losses –efficiency and regulation.

UNIT - IV

AC MACHINES: Principle of operation of alternators – regulation by synchronous impedance method –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). Characteristics of 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, single stage CE Amplifier, frequency response of CE amplifier, concepts of feedback amplifier.

Outcomes:

i. Able to analyse the various electrical networks.
ii. Able to understand the operation of DC generators,3-point starter and conduct the Swinburne's Tes
iii. Able to analyse the performance of transformer.
iv. Able to explain the operation of 3-phase alternator and 3-phase induction motors.
v. Able to analyse the operation of half wave, full wave rectifiers and OP-AMPs.
vi. Able to explain the single stage CE amplifier and concept of feedback amplifier.

TEXT BOOKS:

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

3. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group

REFERENCE BOOKS:

1.Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMH Publications
2.Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition
3. Basic Electrical Engineering by Nagsarkar,Sukhija, Oxford Publications,2nd edition
4. Industrial Electronics by G.K. Mittal, PHI

II Year – II SEMESTER

T	P	C
3+1	0	3

IC ENGINES AND GAS TURBINES

Course Objective: The aim is to introduce the concepts of I.C.Engines, compressors, Gas turbines and the steam turbines, which are used in the field of aeronautical engineering. The geometrical and operational details of the aforementioned systems along with the necessary auxiliary components shall be dealt in detail.

UNIT – I

Objectives: To familiarize the student with the operational principles of various types of engines and their systems along with applications. Further, the student shall distinguish between the phenomenon of normal and abnormal combustion of spark ignited engines along with the factors affecting the combustion.

I. C. ENGINES : Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of wankle engine, principles of supercharging and turbocharging.

Combustion in S.I. Engines: Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking. Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

UNIT – II

Objectives: To make the student learn to perform testing on S.I and C.I Engines for the calculations of performance and emission parameters.

Measurement, Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT – III

Objectives: To impart the knowledge of gas turbine fundamentals, the governing cycles and the efficiency improvement techniques.

GAS TURBINES: Simple gas turbine plant – open and closed cycle arrangements - ideal cycle and their analysis - essential components – parameters of performance – actual cycles and their analysis – regeneration, inter cooling and reheating – merits and demerits.

UNIT – IV

Objectives: To make the student learn about the geometrical and operational details of the compressors that are used in aeronautical field.

COMPRESSORS:

Centrifugal compressors: Essential parts-principle of operation, flow analysis-performance parameters-losses and characteristics.

Axial compressors: Essential parts-principle of operation, flow analysis-performance parameters- losses and characteristics – comparison between axial and centrifugal compressors.

UNIT – V

Objectives: The make the student understand the fundamentals of combustion theory and types of combustion chambers of gas turbines.

COMBUSTION SYTEMS: Combustion theory – combustion chamber requirements - factors affecting combustion chamber design & performance — combustion chamber geometry & types.

UNIT – VI

Objectives: The student shall understand the operation and construction of types of steam turbines. He shall be able to calculate the performance of the turbines with the help of velocity triangles.

IMPULSE AND REACTION TURBINES: Velocity triangles – expression for work output and efficiencies – compounding of multistage impulse turbines – performance – losses.

TEXT BOOKS:

1. IC Engines by V.Ganessan, TMH Publishers, 4th Edition.
2. Gas Turbines – V.Ganesan /TMH Publishers, 3rd Edition.
3. Heat Engineering – V.P Vasandani and D.S Kumar- Metropolitan Book Company,New Delhi

REFERENCES:

1. Gas Turbines and Propulsive Systems – P.Khajuria & S.P.Dubey - /Dhanpatrai
2. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman
3. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
4. Thermal Engineering-M.L.Marthur & Mehta/Jain bros.

II Year – II SEMESTER

T	P	C
3+1	0	2

AIRCRAFT ENGINEERING DRAWING

UNIT :I

Machine Drawing conventions. Need for Drawings conventions – Introduction to ISI- Conventions

a) Conventional representation of materials , common machine elements and parts such as screws,nuts,bolts,keys,gears,webs,ribs
b) Types of sections – Selection of sectional planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned
c) Methods of dimensioning , general rules for sizes and placement of dimensions for holes ,centers, curved and Tapered features
d) Title boxes, their size, location and details –common abbreviations and their liberal usage.
e) Types of drawing – working drawing for machine parts

UNIT : II

Drawing of Machine Elements and simple parts .Section of views , additional views for the following machine elements and parts with every drawing proportions

a) Popular forms of screw threads, bolts, set screws and bolted joints.
b) Keys,cottered joint and knuckle joint
c) Riveted joints for plates.
d) Shaft couplings, spigot and socket pipe joint.
e) Journal, pivot, collar and foot step bearing
f) Welded joints and welding symbols.

UNIT : III

Following simple Air Craft assembly drawings only.

a) Different types of trusses used in wings fuselage including ribs, striengers,skin,brakets
b) Different elements of fuselage structures ,bulk head , rings (frame) long irons
c) Different types of fuselage.
d) landing gear basic elements ,structural brackets ,wheel, shock absorber and Hydraulic cylinder
e) connecting rod for aero piston engine

Text Books:

1. Machine drawing by N.D. Baht / V.M. Panchal / Charotar Publication House – 2000 Ed .
2. Air Craft structures BY TMH Megson

REFERENCES:

1. Machine Drawing by K.L.Narayana, P.Kannaiah and K.Venkata Reddy / New Age Publishers.
2. Air Craft structures by Bruhn.E.H
3. Machine Drawing by P.S.Gill
4. Machine Drawing by Luzzader
5. Machine Drawing by Rajput.

II Year – II SEMESTER

T	P	C
0	3	2

ELECTRICAL & ELECTRONICS ENGINEERING LAB

Section A: Electrical Engineering:

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.

Section B: Electronics Engineering:

1. PN junction Diode characteristics A. Forward bias, B. Reverse bias.(Cut in voltage & Resistance calculations)
2. Transistor CE Characteristics (Input and Output).
3. Full wave Rectifier with and without filters.
4. CE Amplifiers.
5. RC Phase Shift Oscillator.
6. Class A Power Amplifier.

II Year – II SEMESTER

T	P	C
0	3	2

AIRCRAFT PRODUCTION LAB

Basic Exercises in Lathe, Shaper, Milling, Slotting, EDM, CNC and Grinding machines welding equipment and metallurgy equipment comprising Microscopes polishing disc grinders as under.

1. Plain Turning, Taper turning, Facing, Knurling, Thread Cutting.
2. Drilling, boring, counter boring, counter sinking
3. Shaping and planning of square blocks, V-ways and Dovetail ways
4. Plain Milling
5. Gear Milling
6. Cylindrical Grinding / Surface Grinding
7. Simple exercises in EDM
8. Sheet metal joining by rivets, Soldering and brazing.
9. Simple exercises on CNC machines and Programme generation.
10. Simple exercises in Solid State Welding, Gas Welding and Arc Welding.
11. Metal joining Techniques (Brazing and Soldering).

Reference:

1. "Air craft production techniques" Keshu S.C, Ganapathy K.K., Interline Publishing House, Banglore-1993
2. "Manufacturing Engineering and Technology" by Kalpakajam – Addison Wesley.

III Year – I SEMESTER

T	P	C
3+1*	0	3

FLIGHT MECHANICS-I

Course Objective:

The main objective of the subject is to study basic party nomenclature of airplane and aerodynamic characteristics of aerofoil, wing bodies using performance augmentation methods. The subject also helps to estimate drag, thrust, and lift of flighing vehicle at different angle of attack and free stream velocities. It also considers the performance of space vehicles like rockets, missiles.

UNIT-I

Aerodynamic Characteristics

Airfoils, wings and bodies: geometry, nomenclature. Aerodynamic characteristics. Effect of geometry, Reynolds number, Mach number. Measures of aerodynamic performance, Performance augmentation methods.

UNIT –II

Drag and Thrust Evaluations

Drag of aerospace vehicle components. Total drag estimation, Methods of drag reduction, Propellers, Performance analysis. Aerospace engines reciprocating, turbine and rockets. Design features, Performance characteristics.

UNIT –III

Aircraft Performance In Steady And Accelerated Flight

Level flight, Stall, Cruise, Maximum speed, Ceiling, Cruise climb, Range and endurance. Climb performance, Performance optimization, Take-off and landing. Level turns and maneuvers.

UNIT-IV

Performance Of Rockets And Missiles

Principal design features of rockets and missiles. Types, Applications, Staging, Launch and Climb. Performance in boost glide, boost sustain, long range cruise and long - range ballistic trajectories.

UNIT-V

Flight Path Performance And Hazards

Introduction to Flight path and performance optimizations. Introduction to Sonic boom and hazards of Transonic and Supersonic Flight. Flight path control based on Ground noise considerations.

UNIT-VI

Fundamentals Of Rigid Body Mechanics

Rigid Body Mechanics relevant to Aircrafts, space crafts and Missiles.

TEXT BOOKS

1. Anderson, J .D, Aircraft Performance and Design, Mc Graw-Hill International Edition 1999

2. Clancy, L.J., Aerodynamics, Pitman, 1986

REFERENCE BOOKS:

1. PerPerkins, C.D., and Hage, R.E., Airplane Performance and Stability and Control, Wiley Toppan, 1974

2. Milne Thomson, Theoretical Aerodynamics, Macmillan, 1985

3. Houghton, E.L., and Carruthers, N.B., Aerodynamics for Engineering Students, Edward Arnold Publishers Ltd. London, 1989

4. Chin SS, Missile Configuration Design, Mc Graw Hill, New York, 1961.

Course Outcomes:

At the end of the course the students shall be able to:

1. Describe the nomenclature of airplane
2. Know the aerodynamic characteristics of aerofoil, wing bodies using performance augmentation methods.
3. Estimate the drag, thrust, and lift of flighing vehicle at different angle of attack and free stream velocities.
4. It also considers the performance of space vehicles like rockets, missiles.

III Year – I SEMESTER

T	P	C
3+1*	0	3

AERODYNAMICS – II

Course Objective:

The main objective of the subject is to study the concept of fluid flow and its behavior in the engine parts like Nozzle. The subject estimates the performance of aircraft in presence of flow obstacles, there by one can able to minimize the number of obstacles in the flow. It also makes the student to analyze the flow over different critical bodies and He/She able to calculate the forces generate in the experimental analysis fluid on different bodies in the wind tunnel.

Tables/Codes: Isentropic Expansion, Normal Shock, Oblique Shock.

UNIT-I

One Dimensional Flows

Isentropic process for closed system/flow processes. Velocity of sound. Mach number, flow regimes. Governing equations of inviscid compressible flow. Continuity, Momentum and Energy equations in Integral and Differential form. Stagnation conditions.

Flow Through Nozzles

Isentropic flow through Convergent – Divergent nozzles. Chocked flow conditions. Normal shock. Under and over expansion conditions. Flow through diffusers – wave reflections from a free boundary. Description of supersonic wind tunnels and rocket engine.

UNIT-II

Oblique Shocks And Expansion Waves

Oblique shock relations. Supersonic flow over a wedge, M relations strong and weak shock solutions / Shock polar. Regular reflection from a solid boundary. Intersections of shock wave. Expansion waves. Prandtl – Meyer Expansion.

UNIT-III

Subsonic Compressible Flow Over Airfoil

Introduction - Velocity potential equation – Transonic small perturbation equation - Prandtl-Glauert compressibility corrections - Critical Mach number - Drag divergence Mach number - Area rule - Supercritical airfoil.

UNIT-IV

Supersonic Flow

Linearized supersonic flow- Linearized supersonic flow over airfoil and wings. Shock Expansion theory. Detached shock. Axi-symmetrical flows-flow past slender bodies of revolution, conical flows-Numerical integration procedure.

UNIT-V

Hypersonic Flows

Qualitative aspects of hypersonic flow. Newtonian theory. Flat plate at an angle of attack. Hypersonic shock wave relations. Lift and drag of wings at hypersonic speeds. Recent advances in hypersonic flows and testing techniques.

UNIT-VI

Flow Measurements And Model Testing

Non dimensional parameters and II numbers Similarity of flows. Model testing in wind tunnels. Pressure, Velocity measurements – Hotwire and Laser – Doppler anemometer, Turbulence measurements. Measurement errors. Testsection speed, horizontal buoyancy, flow angularities.

Force Measurements Wind Tunnel Balances

Force measurements – Wind tunnel balances. Scale effects and corrections, wall interferences, induced drag and other computations/corrections.

TEXT BOOKS

1. Anderson, J .D, Fundamental of Aerodynamics, Mc Graw-Hill International third edition Singapore-2001.

2. Radhakrishnan, E, E., Gas Dynamics, Prentice Hall of India, 1995

RFFERENCE BOOKS

1. Anderson, J .D, Modern Compressible Fluid Flow, Mc Graw-Hill International Edition

2. Hodge B.K & Koenig K Compressible Fluid Dynamics with Computer Application, Prentice Hall, 1995

3. Clancy, L.J., Aerodynamics, Pitman, 1986, Macmillan, 1985

Course Outcomes:

Upon completion of the course the students shall be able to:

1. Identify the concept of fluid flow and its behavior in the engine parts like Nozzle.
2. Estimates the performance of aircraft in presence of flow obstacles,
3. Minimize the number of obstacles in the flow.
4. Analyze the flow over different critical bodies
5. Calculate the forces generate in the experimental analysis fluid on different bodies in the wind tunnel.

III Year – I SEMESTER

T	P	C
3+1*	0	3

AEROSPACE VEHICLE STRUCTURES – I

Course Objective:

The main objective of the subject is to study the response of common engineering structures like beams, Un-Symmetric beams column, indeterminate beams and frames. The subject also dealt the concepts like tension field, Semi-tension field beams. The student also able to calculate Shear flow in the thin sections like T,L ,I and Z – sections and their effects on the structural stability

UNIT I

Redundant Structures

Indeterminate structures and order of redundancy. Introduction to redundant analysis. Statically determinate models. Use of free body diagrams to explain compatibility and redundant analysis principles. Matrix methods of redundant analysis utilizing (a) equilibrium equations / compatibility conditions and (b) Singularity method for uniform beams with various boundary and support conditions (props, hinges and fixities) subjected to distributed / discrete loads (including moments).

UNIT II

Beams With Elastic Supports And Initial Curvature:

Direct solution of beams on elastic foundation Deflection of beams with discrete elastic supports using singularity methods and modeling concepts. Equation of equilibrium for curved beam stress and deflections of a typical curved beam (Bulk Head segments on fuselages).

UNIT III

STABILITY

Stability of Structural systems, Modes of instability of columns. Euler's formula for critical loads of column. Slenderness ratio, Effect of boundary conditions on mode shapes and critical loads. Column with initial curvature, effect of eccentricity. Long, medium and short column ranges. Rankine and Jhonson's formulae. Eigen values and Eigen modes. Effect of intermediate supports. Concept of beam column.

UNIT IV

Introduction To Theory Of Elasticity

Equilibrium and Compatibility conditions for elastic solids. 2D elasticity equations for plane stress, plane strain and generalized plane strain cases Airy's stress function. Simple problems in plane stress / plane strain using Cartesian and polar coordinates. Super position techniques. Examples include (a) panels subjected to a generalized plane strain Biaxial loading (b) Uniform/Linearly varying edge loads on elastic half plane (c) Thick cylindrical shells. Stresses and Strains on arbitrary planes and transformations. Concept of principal planes, stress and Strains. Construction of Mohr's circle. Failure mechanism and fracture modes.

UNIT – V

Energy Principles And Methods

Introduction to energy principles and methods. Principles of Virtual Displacement and Principle of Virtual Force Castigliano's theorems, Maxwell's reciprocal theorem and Unit load method. Direct application of energy principles to beams and trusses.

The displacement method (Rayleigh Ritz method). Admissible functions energy and work expressions for redundant analysis of 1-D structures (rods, shafts and beams). Various 1D Structures subjected to Complex loading. Stresses, of errors and convergence.

UNIT – VI

Shear Flow In Closed Sections

Bredt-Batho formula. Single and multi-cell closed box structures. Semi monocoque and moncoque structures. Approximate method for box beams. Shear flow in single and multicell monocoque and semi monocoque box beams subject to torsion.

TEXT BOOKS:

1. Timoshenko S. P. and J.N. Goodier, "Theory of Elasticity McGraw Hill Book Co.

2. Donaldson, B. K. Analysis of Aircraft Structues-An introduction "McGraw Hill.

REFRENCE BOOKS:

1. Shames I. H. and Dym C. L. Energy and finite element methods structural analysis McGraw Hill

2. Megson THG, "Aircraft Structures for Engineering students", Edward Arnold Publication.

3. B.C.Punmia, "Theory of Structures", Laxmi Publication.

4. S.Ramamrutham, R.Narayanan, "Theory of Structures" – Dhanpat Rai Publishing Co, 2003.

5. Argyris J. H. and Kelsey S. energy theorems and structural analysis, Butterworths Scientific

Publications.1960

Course Outcomes:

At the end of the course the students shall be able to:

1. Study the response of common engineering structures like beams and columns
2. Recognize Un-Symmetric beams, beam columns, indeterminate beams and frames.
3. Understand the concepts like tension field, Semi-tension field beams.
4. Calculate Shear flow in the thin sections like T,L ,I and Z – sections and their effects on the structural stability.

III Year – I SEMESTER

T	P	C
3+1*	0	3

AEROSPACE PROPULSION – I

Course Objective:

The main objective of the subject is to study the fundamentals of gas turbine engines working principles and thrust equation. Subsonic and Supersonic inlets and modes of their evaluation are also considered. It also includes combustion chambers different types of combustion chambers and performance analysis. The compressors and nozzles of gas turbine are studied.

UNIT -I

Fundamentals Of Gas Turbine Engines:

Illustration of working of gas turbine engine - The thrust equation - Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressors – Method of thrust augmentation – Characteristics of turboprop, turbojet – Performance characteristics.

UNIT - II

Subsonic Inlets

Internal flow and Stall in Subsonic inlets - Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and eternal deceleration ratio - Diffuser performance.

Supersonic Inlets

Supersonic inlets - Starting problem in supersonic inlets - Shock swallowing by area variation- External deceleration –Modes of inlet operation.

UNIT - III

Combustion Chambers And Performance:

Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process– Combustion chamber performance.

UNIT - IV

Performance Sensitivity:

Effect of operating variables on performance - Flame tube cooling - Flame stabilization – Use of flame holders –Numerical problems.

UNIT - V

Nozzles:

Theory of flow in isentropic nozzles - Convergent nozzles and nozzle choking – Nozzle throat conditions – Nozzle efficiency – Losses in nozzles – Over-expanded and under-expanded nozzles - Ejector and variable area nozzles - Interaction of nozzle flow with adjacent surfaces – Thrust reversal.

UNIT - VI

Centrifugal Compressors:

Principle of operation of centrifugal compressors - Work done and pressure rise -Velocity diagrams - Diffuser vane design considerations – Concept of Prewhirl –Rotating stall.

Axial Flow Compressors:

Elementary theory of axial flow compressor – Velocity triangles – Degree of reaction - Three dimensional flow - Air angle distribution for free vortex and constant reaction designs - Compressor blade design - Centrifugal and Axial compressor performance characteristics.

TEXT BOOKS:

1. Mathur M L & Sharma R P; Gas Turbines and Jet & Rocket Propulsion, Standard Publisher, Delhi, 2000.

2. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. Gas Turbine Theory, Longman, ELBSEd, 1989.

REFERENCE BOOKS:

1. Oates G C, AeroThermodyanamics of Aircraft Engine Components, AIAA Edn. Services, NY, 1986.

2. Rolls- Royce, Jet Engine, 3rd edition, 1983.

3. Ganesan V, Gas Turbines, TMGH Pub Co & Ed, Delhi, 1999.

4. Philipa Hill and Carl Peterson, Mechanics and Thermodynamics of Propulsion, Addison Wesley Longman Inc, 1999.

Course Outcomes:

At the end of the course the students shall be able to:

1. Understand the fundamentals of gas turbine engines working principles and thrust equation.
2. Evaluate Subsonic and Supersonic inlets and modes.
3. Describe the different types of combustion chambers and performance analysis.
4. Emphasize the compressors and nozzles of gas turbine.

III Year – I SEMESTER

T	P	C
3+1*	0	3

CAD/CAM

Course Objectives:

-

The general objectives of the course are to enable the students to

1. Understand the basic fundamentals of computer aided design and manufacturing.
2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc
3. To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication
4. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control
5. To learn the overall configuration and elements of computer integrated manufacturing systems.

UNIT – I

Introduction:

Computers in industrial manufacturing, product cycle, CAD / CAM Hardware, basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II

Geometric Modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

Drafting And Modeling Systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

UNIT – III

Part Programming For Nc Machines: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

UNIT – IV

Group Technology: Part family, coding and classification, production flow analysis, types and advantages. Computer aided processes planning – importance, types.

UNIT – V

Computer Aided Quality Control: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

UNIT – VI

Computer Integrated Manufacturing Systems: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requrirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.

TEXT BOOKS:

1. CAD / CAM / E Zimmers & M.Groover/Pearson Education
2. Automation, Production systems & Computer integrated Manufacturing/ Groover/P.E

REFERENCE BOOKS:

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH
2. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
3. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.
4. Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang, Elsevier Publishers

Course Outcomes:

At the end of the course the students shall be able to:

1. Describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid, and the technique of transformation of geometric entities using transformation matrix
2. Describe the use of GT and CAPP for the product development
3. Identify the various elements and their activities in the Computer Integrated Manufacturing Systems.

III Year – I SEMESTER

T	P	C
3+1*	0	3

INTRODUCTION TO SPACE TECHNOLOGY

Course Objective:

The main objective of the subject is to make the students to understand about space mission, types of mission, and different types of space environments. It includes the study of different type's space vehicles and their launching procedures. The student able to learn atmospheric reentry problems, Orbital mechanics and different types of orbital maneuvers while the space vehicle being launching in the space.

UNIT-I

Introduction:

Space Mission-Types-Space Environment-Launch Vehicle Selection

Fundamentals Of Rocket Propulsion

Introduction to rocket propulsion-fundamentals of solid propellant rockets- Fundamentals of liquid propellant rockets-Rocket equation

UNIT-II

Ascent Flight Mechanics Of Rockets And Missiles

Two-dimensional trajectories of rockets and missiles-Multi-stage rockets-Vehicle sizing-Two stage Multi-stage Rockets- Trade-off Ratios-Single Stage to Orbit- Sounding Rocket-Aerospace Plane-Gravity Turn Trajectories-Impact point calculation-Injection conditions-Flight dispersions

UNIT-III

Atmospheric Reentry

Introduction-Steep Ballistic Reentry-Ballistic Orbital Reentry-Skip Reentry-"Double-

Dip" Reentry - Aero-braking - Lifting Body Reentry

UNIT-IV

Fundamentals Of Orbital Mechanics

Two-body motion-Circular, elliptic, hyperbolic, and parabolic orbits-Basic Orbital

Elements-Ground Trace

UNIT-V

Orbital Maneuvers

In-Plane Orbit changes-Hohmann Transfer-Bielliptical Transfer-Plane Changes- Combined Maneuvers-Propulsion for Maneuvers

UNIT -VI

Satellite Attitude Dynamics

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

Spacecraft Power And Communication Systems

Spacecraft Power-Telecommunications

TEXT BOOKS

1. “Spaceflight Dynamics”, W.E. Wiesel, McGraw-Hill, 1997

2. “Rocket Propulsion and Space flight dynamics”, Cornelisse, Schoyer HFR, and Wakker KF, Pitman, 1984

REFERENCE BOOKS

1."Understanding Space: An Introduction to Astronautics”, J.Sellers, McGraw- Hill, 2000

2.”Introduction to Space Flight”, Francis J Hale, Prentice-Hall, 1994

3. ”Spacecraft Mission Design”, Charles D.Brown, AIAA Education Series, 1998

4. ”Spacecraft Mission Design”, Charles D.Brown, AIAA Education Series, 1998

5. ”Elements of Space Technology for Aerospace Engineers”, Meyer Rudolph X, Academic Press, 1999

Course outcomes:

Upon completion of the course the students shall be able to:

1. Understand the space mission, types of mission, and different types of space environments.
2. Get complete idea on different type’s space vehicles and their launching procedures.
3. Learn atmospheric reentry problems, Orbital mechanics
4. Know different types of orbital maneuvers while the space vehicle being launching in the space.

III Year – I SEMESTER

T	P	C
0	3	2

CAD/ CAM LABORATORY

Course objective: To impart the skill to use various softwares available for design and drafting of mechanical components that are been used in automobiles. The students are exposed to latest trends in manufacturing technologies.

1. **Drafting:** Development of part drawings for various components in the form of orthographic andisometric. 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.

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

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.

AERODYNAMICS AND PROPULSION LAB

AERODYNAMICS LAB

1. Fluid flow studies using blower
2. Calibration of low speed wind tunnel
3. Drag of different bodies
4. Pressure distribution studies on two-dimensional models
5. Pressure distribution over an airfoil at different angles of attack
6. Aero dynamic Characterization on NACA - 0012 Air Foil
7. Axial Flow Compressor
8. Centrifugal Flow Compressor
9. Flow Visualization Techniques.

PROPULSION LAB

1. Study of piston engine (Valve Timing and Port Timing Diagram)
2. Stripping of a piston engine, visual inspection and reasoning for common troubles and trouble shooting
3. Performance of piston engine
4. Heat Balance Test on piston engine
5. Engine Balancing
6. Characterization of Aviation fuels

Equipment Needed

1. Low Speed Wind-tunnel Test Rig with a test section of 1 meter X 1 meter with necessary accessories.
2. Test Rig for Axial flow Compressor
3. Test rig for centrifugal flow compressor.
4. Heat Engine Test Rig.
5. Balancing test Rig
6. Calorimeter apparatus

INTELLECTUAL PROPERTY RIGHTS AND PATENTS

Unit I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics - Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement - Regulatory – Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues.

Unit II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law- Semiconductor Chip Protection Act.

Unit III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

Unit IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law

Unit V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

Unit VI

Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy - International aspects of Computer and Online Crime.

REFERENCE BOOKS:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning , New Delhi
2. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections
4. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw – Hill, New Delhi
5. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
7. M.Ashok Kumar and Mohd.Iqbal Ali: “Intellectual Property Right” Serials Pub.

III Year – II SEMESTER

T	P	C
3+1*	0	3

FLIGHT MECHANICS-II

Course Objective:

The main objective of the subject is to change its orientation relative to the passing air. A power-driven heavier than air aircraft, deriving its lift chiefly from aerodynamic reactions on surface which remain fixed under given conditions of flight. The actual linkages within the aircraft are discussed in aircraft flight control systems.

UNIT – I

Introduction:

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.

UNIT - II

Aerodynamic Stability Derivatives

Aerodynamic stability and control derivatives. Relation to geometry, flight configuration. Effects of power, compressibility and flexibility.

Static Longitudinal Stability and Control – Control Fixed

Stick Fixed: Basic equilibrium equation - Stability criterion – Contribution of wing and tail and elevator to pitching moments - Effect of fuselage and nacelles - Effects of center of gravity location - Power effects - Stabilizer setting and center of gravity location – Elevator power– Elevator to trim . Trim gradients. Control fixed static stability – Control fixed neutral point. Stability margins.

UNIT – III

Static Longitudinal Stability – Control Free

Effects of releasing the elevator. Hinge moment coefficients – Control forces to trim. Control free neutral point – Trim tabs. Aerodynamic balancing of control surfaces. Means of augmentation of control.

UNIT – IV

Maneuver Stability

Contribution of pitch damping to pitching moment of flight vehicle - Effect on trim and stability. Control deflections and control forces for trim in symmetric maneuvers and coordinated turns. Control deflection and force gradients. Control fixed and control free maneuver stability. Maneuver points. Maneuver margins.

UNIT – V

Static Lateral and Directional Stability and Control

Dihedral effect - Coupling between rolling and yawing moment - Adverse yaw - Aileron power - Aileron reversal. Weather cocking effects – Rudder power. Lateral and directional stability- definition. Control surface deflections in steady sideslips, rolls and turns one engine inoperative conditions - Rudder lock.

UNIT – VI

Dynamic stability and response to control.

Solutions to the stability quartic of the linearised equations of motion. The principal modes. Phugoid, Short Period Dutch Roll and Spiral modes - Further approximations. Restricted degrees of motion. Solutions. Response to controls. Auto rotation and spin.

TEXT BOOKS

1. Houghton, E.L., and Carruthers, N.B., Aerodynamics for Engineering Students, Edward Arnold Publishers Ltd., London, 1989

2. Mc.Cormic, B.W., Aerodynamics, Aeronautics & Flight Mechanics, John Wiley 1995

REFERENCE BOOKS

1. Perkins C.D., & Hage, R.E., Airplane Performance, Stability and Control, Wiley Toppan 1974.

2. Nelson, R.C., Flight Stability and Automatic Control, McGraw Hill 1989

Course Outcome:

Upon completion of the course the students shall be able to:

1. Change aero plane orientation relative to the passing air.
2. Identify the power-driven heavier than air aircraft, deriving its lift chiefly from aerodynamic reactions on surface which remain fixed under given conditions of flight.
3. Know the actual linkages within the aircraft are discussed in aircraft flight control systems.

III Year – II SEMESTER

T	P	C
3+1*	0	3

AEROSPACE VEHICLE STRUCTURES –II

Course Objective:

The main objective of the subject is to make the students to understand about structural analysis of most commonly used aircraft structures.The type of load come over the members like strigers,stiffeners.logirons,ribs and spars etc.The subject review the all basic structures and its.

UNIT – I

Load Diffision In Stiffned Panels

Wagner's theory of beams. Shear carrying capabilities of panels and introduction to Tension field webs. Semi tension and complete tension field beams. Monocoque and semi Monocoque structures.

SHEET STRINGER COMBINATIONS

Axial Load flow diagrams for boom in stiffened panels. Simple illustrative examples of A/C sheet stringer elements through free body diagrams. Load diffusion in thin walled panels with oblique stiffeners.

UNIT – II

Stability Of Panels

Stability of stiffened panels. Effective width concept. Simple estimations of load carrying capability of stressed skins of Aircraft wing shells.

UNIT – III

Shear Flow In Open Sections Subjected To Pure Bendings

Thin walled beams - Shear centre and Elastic axis Concept of shear flow beams with one axis of symmetry, Unsymmetrical box beam with effective and ineffective skins

UNIT - IV

Stress Analysis Of Wing And Fuselage

Procedure - Shear and bending moment distribution for semi cantilever and other types of wings and fuselages – Thin webbed beam with parallel and non parallel flanges - Shear resistant web beams.

UNIT - V

Torsion Bending Of Opend Tubes

Torsion bending phenomena. Torsion bending constant and specific torsion bending strength Simple derivation of torsion bending equation. The phenomena of warping. Stresses in cantilever, I-beam by solution of general differential equation for torsion beam.

UNIT – VI

Inhibition Of Axil Constraint Stress

Torsion of thin walled beams with open sections effect of axial constraints. Primary and Secondary warping phenomena. Computation of torsion bending constant for open tubes with cross sections such as Channel, T and Angle.

Aircraft Skin Stiffners

Methods of improving torsion bending strength by lipping, as an effective means of improving torsion bending constant. Computation of improvement of specific torsion bending strength in lipped Channel, T, I, L, sections over the unlipped counter parts

TEXT BOOKS

1. Megson, T.M.G., Aircraft Structures for Engineering Students, Edward Arnold, 1985.

2. J.T. Oden, “Mechanics of Elastic Structures”, McGraw-Hill. 1967

3. Scheler.E.E and Dunn L.G, “Airplane Structural Analysis and Design”, John Wiley & Sons.1963

REFERENCE BOOKS

1. Peery, D.J, and Azar, J.J., Aircraft Structures, 2nd edition, Mc Graw-Hill, N.Y., 1993.

2. Rivello, R.M., Theory and Analysis of Flight Structures, McGraw Hill, 1993.

3. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, tri -state off set company, USA, 1965.

4. Kuhn.P, “Stresses in Aircraft and Shell Structure”, McGraw-Hill.

5. William.D, “An Introduction to the Theory of Aircraft Structures”, Edward Arnold.

Course Outcome:

Upon completion of the course the students shall be able to:

1. Understand about structural analysis of most commonly used aircraft structures.
2. Describe the different type loads come over aircraft
3. Appreciate the role of strigers, stiffeners, logirons, ribs and spars etc.
4. Review the all basic structures and its behavior during service

III Year – II SEMESTER

T	P	C
3+1*	0	3

AEROSPACE PROPULSION – II

Course Objective:

The main objective of the subject is to impart the gas turbine theories ie the principles of operations and performance of impulse and reaction turbine blades. The subject also considers the overall performance of gas turbine and different cooling methods adapted to turbine balding to improve the performance of gas turbine. Thrust control ramjet propulsion, Chemical rockets and advanced propulsive techniques are comprehensively dealt in this subject

UNIT - I

Gas Turbine Theories

Impulse and reaction blading of gas turbines - Velocity triangles and power output - Elementary theory - Vortex theory -Choice of blade profile, pitch and chord - Estimation of stage performance.

Design Consilretions

Limiting factors in gas turbine design - Overall turbine performance - Methods of blade cooling - Matching of turbine and compressor - Numerical problems.

UNIT – II

Thrust Control

Thrust Augmentation through after burning, thrust vector control methods.

Ramjet Propulsion

Operating principle- Subcritical, critical and supercritical operation - Combustion in ramjet engine - Ramjet performance - Sample ramjet design calculations – Introduction to SCRAMJET - Preliminary concepts in supersonic combustion - Integral ram - Rocket - Numerical problems.

UNIT -III

Fundamentals Of Rocket Propulsion

Operating principle - Specific impulse of a rocket - Internal ballistics - Rocket nozzle classifications – Rocket performance considerations - Numerical problems.

UNIT - IV

Chemical Rockets

Solid propellant rockets - Selection criteria of solid propellants - Important hardware

components of solid rockets – Propellant grain design considerations.

UNIT - V

Liquid propellant rockets - Cooling in liquid rockets - Limitations of hybrid rockets - Relative advantages of liquid rockets over solid rockets.

UNIT - VI

Advanced Propulsion Techniques

Electric rocket propulsion - Ion propulsion techniques - Nuclear rocket - Types - Solar sail- Preliminary concepts in nozzle less propulsion.

TEXT BOOKS

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

2. Philipa Hill and Carl Peterson, Mechanics and Thermodynamics of Propulsion,

   Addison Wesley Longman Inc, 1999.

REFERENCE BOOKS

1. Marcl Bacare et. al. Rocket Propulsion, Elsevier Pub Co, 1960.

2. Zucrow M J, Aircraft & Missile Propulsion, John Wiley & Sons, NY, 1964.

3. Gorden, C.V., Aerothermodynamics of gas turbine and Rocket Propulsion, AIAA Education Series, New York, 1986.

4. Oates G C, AeroThermodyanamics of Aircraft Engine Components, AIAA Edn. Services, NY, 1986.

5. Rolls- Royce, Jet Engine, 3rd edition, 1983.

6. Cohen. H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., Gas turbine theory, Longman Co., ELBS Ed., 1989.

7. Ganesan V, Gas Turbines, TMGH Pub Co & ed, Delhi, 1999.

8. Mathur, M., and Sharma, R.P., Gas Turbines and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1988.

9. S M Yahya, Fundamentals of Compressible Flow with Aircraft and Rocket propulsion, New Age International Pub, Delhi, 2003.

Course Outcome:

Upon completion of the course the students shall be able to:

1. Imports the gas turbine theories ie the principles of operations and performance of impulse and reaction turbine blades.
2. Considers the overall performance of gas turbine and different cooling methods adapted to turbine balding to improve the performance of gas turbine.
3. Control ramjet propulsion, Chemical rockets
4. Advanced propulsive techniques are comprehensively learnt.

III Year – II SEMESTER

T	P	C
3+1*	0	3

FLIGHT VEHICLE DESIGN

Course Objective:

The main objective of the subject is to study the aspects related to aircraft design and analysis. The method of estimation of size of aircraft parts, visualization and drawing of aerodynamic shapes and efficient internal layouts. The subject also considers different phases of aircraft design process

UNIT-I

Objectives Requirements Of The Vehicle: Type, role, mission. Payload, performance and other requirements. Study of comparable aircraft - principal design and constructional and performance. Data collection and statistical analysis.

UNIT-II

Conceptual Sketch And First Estimate Of Weight: Conceptual sketch of candidate design- alternative configurations. First estimate of takeoff weight.

Initial Sizing: Airfoil and wing geometry selection. Estimate of thrust to weight ratio and wing loading.

UNIT-III

Fuselage And Control Surfaces : Sizing of Fuselage and control surfaces.

UNIT-IV

Configuration Layout: Layout and drawing of the configuration. Weight balance

Performance and Stability Estimate: Performance and stability estimate.

UNIT-V

Load Estimates : Airload distribution on the wing. Preliminary structural Layout.

UNIT-VI

Review: Review and evaluation of the design.

TEXT BOOK

1. Raymer, Daniel P. Aircraft Design: A Conceptual Approach (Third Edition) AIAA Educational Series. AIAA 1999

REFERENCE BOOKS

1. Torenbeek E. Synthesis of Subsonic Airplane Design. Delft University Press 1986

2. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, tri -state off set company, USA, 1965

3. Scheler.E.E and Dunn L.G, “Airplane Structural Analysis and Design”, John Wiley & Sons.1963

Course outcome:

At the end of the course the students shall be able to:

1. Understand the aspects related to aircraft design and analysis.
2. Estimates of size of aircraft parts,
3. Visualize the drawing of aerodynamic shapes and efficient internal layouts.
4. Learn different phases of aircraft design process.

III Year – II SEMESTER **T P C**
3+1* 0 3

SYSTEM MODELING AND SIMULATION

UNIT I

Basic Concepts

Hierarchy Types – Elements of a system – system description – Modeling definition – Functions, classification.

Simulation

Structure of Simulation Models – Modeling approaches – System simulation – Definition – The Simulation process –Advantages

UNIT II

Techniques For Random Number Generation

Simulation of random phenomena – Monte-Carlo sampling – Random number generation – Mid square method – Mid product method – Multiplicative congruential method – Additive congruential method,

UNIT III

Randomness Testing

Testing for randomness – Chi-square method – Kolmogrov method – Runs test – Gasp test.

UNIT IV

Data Preparation

Correlation and regression analysis – Curve fitting – Fitting of known distributions – Uniform, normal, exponential Poisson, Weibull empirical distribution – Time flow mechanism – Flow diagram

UNIT V

Simulation Of Discrete System

Simulation of an event occurrence using random number table – Simulation of component failure using exponential and Weibull models Simulation of single server and two server queue – Simulation of an inventory system. Planning of simulation experiments – Tactical planning – Run length determination – Validation of simulation models – Analysis of simulation results

UNIT VI

Simulation Languages

Introduction – Basic Concepts and Advantages of GPSS – Case Example – Basic concepts and advantages of SIMSCRIPT – Case example.

TEXT BOOKS

1 “System Simulation with Digital Computers”, Narasingh Deo, PHI, 1979.

2 “System Simulation”, Geoffrey Gordon, PHI, 1995.

III Year – II SEMESTER

T	P	C
3+1*	0	3

DEPARTMENTAL ELECTIVE – I

EXPERIMENTAL STRESS ANALYSIS

Course objectives:

Objective of the course is to measure strain through various experimental methods like strain gauges, photo elasticity techniques, brittle coatings, moiré methods and birefrigerent coatings to understand the relation between the mechanics theory and experimental stress analysis to learn usage of the experimental techniques on the practical problems

UNIT – I

Introduction: Stress, strain, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, stress functions, mohrs circle for stress strain, Three-dimensional stress strain relations.

UNIT – II

Strain Measurement and Recordings: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits. Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

UNIT – III

Photo elasticity: Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics

Three dimensional Photo elasticity : Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear-difference method in three dimensions, applications of the Frozen-stress method, the scattered-light method.

UNIT – IV

Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.

UNIT – V

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

UNIT – VI

Birefringent Coatings:

Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

TEXT BOOKS :

1. Theory of Elasticity by Timoshenke and Goodier Jr
2. Experimental stress analysis by Dally and Riley,Mc Graw-Hill

REFERENCE BOOKS:

1. A treatise on Mathematical theory of Elasticity by LOVE .A.H
2. Photo Elasticity by Frocht
3. Experimental stress analysis, Video course by K.Ramesh / NPTEL

Course Outcomes:

The intended learning outcomes are that on completion of this course the student should be able to:

1. Student should be able to chose the appropriate method for measuring strain
2. Students should be able to apply optical techniques for measurement of strain & stress
3. Analyze the results obtained from coating techniques and corroborated with theoretical results.
4. Correlate experimental and analytically derived results.

SPACE MECHANICS

(DEPARTMENTAL ELECTIVE-I)

Course Objective:

This course is designed with an objective to provide a comprehensive overview of spaceflight mechanics, including both orbit and attitude dynamics. The two-body problem will be solved from first principles to allow the solution of the two-body position-time problem. This analysis will then be used to investigate various modes of orbit transfer. Attitude stabilization will be investigated for both spin- and 3-axis stabilized spacecraft. Finally, the various elements of the class will be brought together to illustrate the mission analysis and design process.

UNIT-I

Basic Concepts:

The solar system-Reference frames and coordinate systems-The celestial sphere- The ecliptic-Motion of vernal equinox-Sidereal time-Solar Time-Standard Time-The earths atmosphere

The General N-Body Problem:

The many body problem-Lagrange-Jacobi identity-The circular restricted three- body problem-Libration points-Relative Motion in the N-body problem

UNIT-II

The Two-Body Problem:

Equations of motion-General characteristics of motion for different orbits-Relations between position and time for different orbits-Expansions in elliptic motion-Orbital Elements-Relation between orbital elements and position and velocity

UNIT-III

The Launching Of A Satellite:

Launch vehicle ascent trajectories-General aspects of satellite injection-Dependence of orbital parameters on in-plane injection parameters-Launch vehicle performances- Orbit deviations due to injection errors

UNIT-IV

Perturbed Satellite Orbits:

Special and general perturbations- Cowell's Method-Encke's method-Method of variations of orbital elements-General perturbations approach

UNIT-V

Interplanetary Trajectories:

Two-dimensional interplanetary trajectories-Fast interplanetary trajectories-Three-dimensional interplanetary trajectories- Launch of interplanetary spacecraft-Trajectory about the target planet

UNIT-VI

Ballistic Missile Trajectories:

The boost phase-The ballistic phase-Trajectory geometry-Optimal flights-Time of flight-Re-entry phase-The position of the impact point-Influence coefficients.

Low-Thrust Trajectories:

Equations of Motion-Constant radial thrust acceleration-Constant tangential thrust (Characteristics of the motion, Linearization of the equations of motion- Performance analysis

TEXT BOOKS

1. ”Rocket Propulsion and Spaceflight Dynamics”, J.W.Cornelisse, H.F.R. Schoyer, and K.F. Wakker, Pitman, 1979

2. ”Spaceflight Dynamics”, William E.Wiesel, McGraw-Hill, 1997

REFERENCE BOOKS

1. "Spacecraft Mission Design”, Charles D.Brown, AIAA Education Series, Published by AIAA, 1998

2. “Orbital Mechanics”, Vladimir A. Chobotov, AIAA Education Series, AIAA Education Series, Published by AIAA, 2002

3. ”Fundamentals of Astrodynamics and Applications”, David.A. Vellado, Microcosm and Kluwer, 2001

Course Outcomes:

Upon completion of the module the student is expected to be able to

1. An understanding of the methods employed in spaceflight mechanics.
2. The ability to solve the two-body problem and two-body orbit transfer problems.
3. The ability to analyse the dynamics and control of spin- and 3-axis stabilised spacecraft.
4. An appreciation of the importance of spaceflight mechanics in space systems engineering.

ROCKETS AND MISSILES

(DEPARTMENTAL ELECTIVE-I)

Course Objective:

The main objective of the subject is to introduce the importance of rockets and missiles with their plan of action and major field of application. The fuels used in the rockets and missiles and their properties and performance estimated through two-dimensional rocket motion in vacuum. The aerodynamic aspects of rockets and missiles while passing through atmosphere is calculated. Multistage rockets its materials were discussed.

UNIT-I

Solid Propellant Rocket Systems

Ignition system in rockets-Types of igniters-Igniter design considerations- Combustion system of solid rockets

Liquid Propellant Rocket Systems

Design consideration of liquid rocket combustion chamber, injector, and propellant feed lines, valves, propellant tank outlet and helium pressurized and turbine feed systems- Propellant slosh - Propellant hammer- Geysering effect in cryogenic rocket engines.

UNIT-II

Aerodynamics Of Rockets and Missiles

Airframe components of rockets and missiles- Forces acting on a missile while passing through atmosphere-Classification of missiles- Method of describing aerodynamic forces and moments-Lateral aerodynamic moment-Lateral damp in moment and longitudinal moment of a rocket-Lift and drag forces-Drag estimation- Body up wash and downwash in missiles-Rocket dispersion.

UNIT-III

Two-Dimensional Rocket Motion In Vacuum

Equations of motion-Rocket Motion in free space (Tsiokovsky's equation, Rocket Parameters, Burnout range)-Rocket Motion in a homogeneous gravitational field (Vertical flight, Constant Pitch angle, Gravity turns)

UNIT-IV

Multi-Stage Rocket

Nomenclature of the multi-stage rocket-Ideal Velocity of the multi-stage rocket-Vertical ascent in a homogeneous gravitational field and in vacuum (Burnout velocity- Culmination altitude-Vertical ascent of a two-stage rocket)

UNIT-V

Attitude Control Of Rockets And Missiles

Rocket thrust vector control - Methods of thrust vector control-Thrust magnitude control, Thrust Termination

Separation Systems For Rockets And Missiles

Stage separation dynamics-Separation techniques

UNIT-VI

Materials For Rockets And Missiles

Criteria for Selection of materials for rockets and missiles-Choice of materials at cryogenic temperatures, extremely high temperatures - Requirement of materials for thermal protection and pressure vessels.

TEXT BOOKS

1. "Rocket Propulsion Elements", George P. Sutton and Oscar Biblarz, Wiley- Interscience, 2000

2. "Rocket Propulsion and Spaceflight Dynamics", J.W. Cornelisse, H.F.R.Schoyer, and K.F.Wakker, Pitman, 1979

REFERENCE BOOKS

1. "Missile Configuration Design", SS Chin, McGraw Hill, NY, 1961

2. "Space Vehicle Dynamics", K.J.Ball and G.F.Osborne, Oxford University Press, 1967

Course Outcomes:

The intended learning outcomes are that on completion of this course the student should be able to:

1. Introduce the importance of rockets and missiles with their plan of action and major field of application.
2. Understands the fuels used in the rockets and missiles and their properties and performance estimated through two-dimensional rocket motion in vacuum.
3. Describe the aerodynamic aspects of rockets and missiles while passing through atmosphere know the different rocket and Missile materials.

AIRCRAFT MAINTENANCE MANAGEMENT

(DEPARTMENTAL ELECTIVE – I)

Course Objective:

The main objective of the subject is to study the concepts related to aviation industry which involves airline management, airport management etc. 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.

UNIT-I

Necessity To Do Maintenance

Role of engineer-Role of mechanic-types of maintenance-reliability-redesign-failure rate patterns-establishing a maintenance program

Development Of Maintenance Programs

Maintenance steering group approach-process oriented maintenance-task oriented maintenance-maintenance program documents-maintenance intervals-changing basic intervals-Goals and objectives of in maintenance-maintenance program content

UNIT-II

Certification Requirements & Documentation For Maintenance

Aircraft certification-delivery inspection-operator certification-certification of personnel-aviation industry interaction; Manufacture's documentation-Regulatory documentation-Airline generated documentation

Maintenance And Engineering Organization

M&E organizational chart-manager level functions-organizational structure-variation of the typical organization

UNIT-III

Production Planning and Control

Forecasting-production planning-production control-feedback for planning

UNIT-IV

Line Maintenance, Hangar Maintenance & Maintenance Overhaul Shops

Makeup of line maintenance-maintenance center responsibilities-line operations-aircraft logbooks-ramp and terminal operations-line station activities; Organization of hangar maintenance-problem areas of hangar maintenance, maintenance support shops-ground support equipment-a typical C check; Organization of overhaul shops-operation of overhaul shops-shop data collection

UNIT-VI

Quality Control & Quality Assurance

Quality control organization-basic inspection policies-requirement for quality assurance-quality audits-ISO 9000 standards-technical records

UNIT- VI

Reliability, Maintenance Safety &Trouble Shooting

Types of reliability- typical reliability program-administration of reliability program; Industrial safety-safety regulations maintenance safety program-accident and injury reporting; 3 levels of trouble shooting-knowledge of malfunctions building a knowledge base-understanding the sequence of events-8 concepts of trouble shooting

TEXT BOOK

1. Harry A Kinnison, and Harry Kinnison, "Aviation Maintenance Management", McGraw-Hill, 2004

REFERENCE

1. C.H.Friend, "Aircraft Maintenance management", Longman, 1992

Course Outcome:

Upon completion of the course the students shall be able to:

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

III Year – II SEMESTER

T	P	C
0	3	2

AEROSPACE STRUCTURES LAB

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

Reference Books

1. Megson, T.M.G., Aircraft Structures for Engineering Students, Edward Arnold, 1985.
2. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, tri -state off set company, USA, 1965

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

T	P	C
0	3	2

FLIGHT VEHICLE DESIGN LAB

1. Objectives Requirements of the vehicle
2. Conceptual Sketch and first estimate of weight
3. Initial Sizing
4. Fuselage and control surfaces
5. Configuration layout.
6. Performance and stability Estimate
7. Load estimates

IV Year – I SEMESTER

T	P	C
3+1*	0	3

VIBRATIONS AND STRUCTURAL DYNAMICS

COURSE OBJECTIVES

1. To prepare the student to understand the fundamentals of vibrations of various physical models for single and multi degree freedom systems
2. To make the student apply numerical methods to various physical systems and their response to vibrations.
3. Exposure to vibration measurement of industrial equipment using instruments
4. Applications: To acquaint with various practical problems.

UNIT I

INTRODUCTION

Simple harmonic motion, terminology, Newton's Law, D'Alembert's Prinicple, Resonance, Introduction to mechanism of damping. Damped and Undamped oscillations. Degrees of freedom. Various mechanisms of damping. Equivalent viscous damping.

UNIT II

Single Degree Of Freedom Systems:

Free vibrations, free damped vibrations, forced vibrations with and without damping. Support excitation and vibration measuring instruments. Amplitude and Phase response diagrams. Generalized single degree of freedom systems for continuous structures and computation of K, M and C.

UNIT III

Multi Degree Of Freedom Systems:

Two / Three degree of freedom systems, static and dynamic coupling, vibration absorbers, Principal coordinates, Principal modes, Othogonality conditions Hamilton's Principle, Lagrange's equation and application. Longintudinal vibration, lateral vibration, torsional vibration of shafts, dynamical equations of equilibria of elastic bodies, natural frequencies and mode shapes determination.

UNIT IV

Methods determining natural frequencies and mode shape. Natural Vibrations of solid continua. Determination of Eigen Values and Eigen modes. Natural frequency of rotating shafts Whirling of shafts. Dynamic balancing of rotating shafts. Dynamic dampers.

UNIT V

Introduction to approximate methods for frequency analysis Rayleigh Ritz method for vibration analysis. Diagonalization of stiffness, mass and damping matrices using orthogonality conditions. Matrices for dynamic analysis. Kinematically consistent Load systems and determination of [K], [M], [C] and [L] matrices. Normalization and formulation of modal equations.

UNIT VI

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

TEXT BOOKS:

1. R.W. Clough and Penzien, "Dynamics of Structures". McGraw Hill 2nd Edition 1993

2. Mechanical Vibrations by Singiresure.S.Rao, Pearson Education LPE-2004.

3. Rao, J.S and Gupta .K., Theory and practice of Mechanical vibrations, Wiley Eastern

Ltd., New Delhi, 2002.

REFERENCE BOOKS:

1. Fug, Y.C., An Introduction to Theory of Aeroelasticity, John Wiley & Sons, NewYork,1984

2. Timoshenko, S., Vibration Problems in Engineering, John Wiley and Sons, New York,1987.

3. Shock and Vibrations by Harris & Creed Mc-Graw Hill book company, third edition.

4. Mechanical Vibrations by V.P.Singh, Dhanapati Rai and Co. 2003 edition.

5. Mechanical Vibrations by S.Grahamkelly- TMH 2004 edition.

6. Mechanical Vibrations G.K.Groover, Nemchand and Brothers 2001 edition.

7. Vibrations and waves CBS Publishers and Distributors MIT series 1987.

8. Scanlon, R.H., & Rosenbaum, R., "Introduction to the Study of Aircraft Vibration & Flutter." John Wiley and Sons, New York, 1982

COURSE OUTCOMES

Understand the physical response of the various models of the one degree of freedom systems & multi degree freedom systems with & without damping.

1. Analyze the various probes used for measurement of displacement, velocity and accelerations of any vibrating system.
2. To able to determine the vibratory response of the various engineering applications such as strings, beams and shafts.
3. To get exposure to energy methods
4. To impart knowledge of the various physical systems and their vibratory response

IV Year – I SEMESTER

T	P	C
3+1*	0	3

COMPUTATIONAL FLUID DYNAMICS

Course Objectives:

The course aims at providing required numerical and software techniques for solving various engineering problems involving fluid flow.

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.

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.

REFERENCE BOOKS:

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

Course Outcomes:

After undergoing the course the student shall be able to apply various numerical tools like finite volume, finite difference etc for solving the different fluid flow problems.

AVIONICS

Course Objective:

The main objective of the subject is to study the concepts related to aviation industry which involves airline management, airport management etc. 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

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.

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 glideslope.

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 – 429.

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.

REFERENCE BOOKS

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.

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

IV Year – I SEMESTER

T	P	C
3+1*	0	3

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.

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.

REFERENCE BOOKS:

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

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 isoparametric 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.

IV Year – I SEMESTER

T	P	C
3+1*	0	3

OPEN ELECTIVE

AIRPORT MANAGEMENT

Course Objective:

The main objective of the subject is to provide the legal rules ownership authorization norms study the concepts related to the airfield-Navigation aids (NAVAIDS) located on airfields, and the traffic instruction in the air will be covered. The different types of air craft Hazards are introduced and remedial action for stringent safety is practiced theoretically. Airport financial issues and overall airport administration will be clearly introduced.

UNIT-I

Airports And Airport Systems

Introduction-Airport Management on an international level- Rules that govern airport management-Airport ownership and organization-Airport organization chart-Airport manager and public relations

UNIT-II

The Airfield

Components of an airport-The airfield-Navigation aids(NAVAIDS)located on airfields-Air traffic Control and surveillance facilities located on the airfield-Weather reporting facilities located on airfields-security infrastructure on airfields

UNIT-III

Airspace and Air Traffic Control

Air traffic control management and operating infrastructure-Basics of air traffic control-Current and future enhancements to air traffic control

Airport Terminals and Ground Access

Historical development of airport terminals-Components of airport terminal-Airport ground access

UNIT-IV

Airport Operations Management

Pavement management-Aircraft rescue and fire fighting (ARFF)=Snow and ice control-Safety inspection programs-Bird and wildlife hazard management

Airport Security

Transportation Security Administration-Security at commercial service airports-Security at general aviation airports

UNIT-V

Airport Financial Management

Airport financial accounting-Revenue strategies at commercial airports-Pricing of airport facilities and services-Variation in the sources of operating revenues-Rise in airport financial burdens-Airport funding-Airport financing-Private investment-Sale of the airport

UNIT-VI

Airport Capacity and Delay

Defining capacity-Factors affecting capacity and delay-estimating capacity-Simulation Models-Defining delay-Estimating delay-Analytical estimates of delay: queuing diagram-Approaches to reducing delay-administrative and demand management

TEXT BOOK

1. Alexander T. Wells and Seth B. Young, "Airport Planning and Management", (Fifth Edition), McGraw-Hill,2004

REFERENCE BOOKS

1. Norman Ashford and H. P. Martin Stanton, "Airport Operations", Mc-Graw-Hill, 1999

2. Anne Graham, "Managing Airports: An International Perspective", Butterworth-Heinemann, 2003

3. Rigas Doganis, "The Airport Business", Routledge, 1992

4.Richard D Neufville, "Airport Systems: Planning, Design and Management", McGraw-Hill,

Course Outcomes

After undergoing the course the student shall be able to:

1. Get the legal rules ownership authorization norms.
2. Know the airfield-Navigation aids (NAVAIDS) located on airfields, and the traffic instruction in the air will be covered.
3. Identify the types of air craft Hazards.
4. Carry out the remedial action for stringent safety guidelines.
5. Comprehend Airport financial issues and overall airport administration will be clearly introduced.

NANO TECHNOLOGY
(OPEN ELECTIVE)

Course objective:

On successful completion of the course, students should be able to: Understand the basic scientific concepts of nanoscience. Understand the properties of nano materials, characterization of materials, synthesis and fabrication. Understand the applications of nano technology in various science, engineering and technology fields.

UNIT-I

INTRODUCTION: History of nano science, definition of nano meter, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure.

UNIT-II

Properties of materials:

Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

UNIT-III

SYNTHESIS AND FABRICATION: Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures.

UNIT-IV

Charecterization Techniques: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

UNIT-V

Carbon Nano Technology:

Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalling diamond films, grapheme, applications of carbon nano tubes.

UNIT-VI

Applications Of Nano Technology:

Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin fins, applications of quantum dots.

TEXT BOOK:

1. Nano science and nano technology by M.S Ramachandra Rao, Shubra Singh, Wiley publishers.

REFERENCE BOOKS:

1. Introduction to Nano Technology by Charles P. Poole, Jr., Frank J.Owens, Wiley publishers.
2. Nanotechnology by Jermy J Ramsden, Elsevier publishers
3. Nano Materials- A.K.Bandyopadhyay/ New Age Introdu.
4. Nano Essentials- T.Pradeep/TMH
5. Nanotechnology the Science of Small by M.A Shah, K.A Shah, Wiley Publishers.
6. Principles of Nanotechnology by Phani Kumar, Scitech

Course outcomes:

Upon successful completion of this course the student shall be able to:

1. Identify the essential concepts used in nanotechnology.
2. Identify the materials, properties, syntheses and fabrication,
3. Characterize and understands applications Nano materials in various fields.

IV Year – I SEMESTER

T	P	C
3+1*	0	3

STRUCTURAL ANALYSIS AND DETAILED DESIGN

Course Objective:

The main objective of the subject is to make the student to know about the common engineering structures particularly dealt with design of structures for a given loading conditions. Also complete analysis structure worthy to be safe in entire service life. This subject also consider all aircraft structures such as landing gear, wing, fugelage, nose cone etc.

UNIT I

Design Philosophy of aircraft systems, Principles of design, Configuration design, Arriving design specification for detailed design

Design Methodologies:

Emphasis on design procedures for the design of wings, fuselage, landing gear, pressure vessels including manevouring loads.

UNIT II

Engineering Design:

Design of Aircraft parts and landing gears using engineering design methods/codes and standards to arrive at design for detailed analysis.

Fuselage Design:

Loads, effective cross-section, bending strength shearflow analysis. Ultimate strength of stiffend Cylindrical Shells.

UNIT III

Modelling and Simulation Of Wing Surfaces:

Estimation of wing loading, wing idelization, mesh generation, element formulation, consistent load vectors, solutions and stress distribution.

UNIT IV

Analysis Of Landing Gear:

Evaluation of reaction loads on the members of the landing gear and analysis of lauding gear system, oleo strut, and torque links.

UNIT V

Reliability Based Design:

Reliability concepts, bath tub curve, design improvements for reliability.

UNIT VI

Failure Theories:

Maximum stress theory, Von Mices theory, Minimum strain energy theory as applicable to aerospace structure and criteria for selection

TEXT BOOKS

1. Peery, D.J, and Azar, J.J., Aircraft Structures, 2nd edition, Mc Graw-Hill, N.Y., 1993.

2. Rivello, R.M., Theory and Analysis of Flight Structures, McGraw Hill, 1993.

3 J.T. Oden, "Mechanics of Elastic Structures", McGraw-Hill. 1967

4. Scheler.E.E and Dunn L.G, "Airplane Structural Analysis and Design", JohnWiley & Sons.

REFERENCE BOOKS

1. Megson, T.M.G., Aircraft Structures for Engineering Students, Edward Arnold,

1985.

2. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, tri -state off set

company, USA, 1965. J.T. Oden, "Mechanics of Elastic Structures", McGrawHill.

3. Kuhn.P, "Stressess in Aircraft and Shell Structure", McGrawHill.

4. William.D, "An Introduction to the Theory of Aircraft Structures", Edward Arnold.

5. Kermode.A.C, "The Airplane Structure", Sir Issacc Pitman Publication.

6. Dowty G.H, "Structural Principles and Data", The new ERA Publishing Cp, 1980.

7. Shigley JE, "Mechanical Engineering Design".

8. Pandya & Shah, "Machine Design"

Course Outcomes:

At the end of this course, students should be able to:

1. Get the Knowledge on the most common engineering structures.
2. Particularly deal with design of structures for a given loading conditions.
3. Analyze structure worthy to be safe in entire service life. This subject also consider all aircraft structures such as landing gear, wing, fugelage, nose cone etc

IV Year – I SEMESTER

T	P	C
0	3	2

COMPUTATIONAL STRUCTURAL AND AERODYNAMICS LAB

A. FINITE ELEMENT METHODS LAB

UNIT-I

One of the following

a) Exercises on discretization

b) Grid generation and element/node numbering

UNIT-II

Element Generation Exercises (two of the following) 1-D elements (rods, shafts and beams)

Plane Stress /Plane Strain Quadrilateral elements Triangular plate elements

UNIT-III

FEM Solutions using any one of the following

MATLAB

ANSYS

NASTRAN

PRO - E

Any one of the normal procedures:

a) Gauss Quadrature for unit 1 and 2-D domes

b) Generation of stiffness and load vector matrices.

c) Use of eigen value solvers for frequency and mode shapes determination

B. CFD LAB

UNIT – I

Numerical solutions for any one of the following, using Finite difference method.

Elliptic Equations Parabolic Equations Hyperbolic Equations

UNIT – II

Grid Generations for any one of the following Algebraically stretched Cartesian grids. Elliptic grids

UNIT – III

Numerical solutions for any one of the following

Vortex panel method

Source panel method

Incompressible coutte flow

Supersonic flow over a flat plate

Grid Generation of Aerofoil NACA 0012

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) MAT lab b) Ansys c) NASTRAN d) Pro – e e) FLUENT OR STAR CD or CFX

IV Year – I SEMESTER

T	P	C
0	3	2

STRUCTURAL ANALYSIS AND DETAILED DESIGN LAB

Design and Analysis of the following Aircraft Components:-

1. Landing Gear
2. Wings
3. Fuselage
4. Propeller Shaft
5. Propeller Blades
6. Nose Cone

IV Year – II SEMESTER

T	P	C
3+1*	0	3

AIRCRAFT SYSTEMS AND INSTRUMENTATION

Course Objective:

The main objective of the subject is to study the concepts related to aircraft instruments, Instruments display panels, layouts plans and air data instruments. He/She able to distinguish different mechanisms in the different aircraft instruments. The subject also includes the different types of sensors works while the landing and take-off period of aero plane. It also helps the students to design different types of display sensors systems

UNIT – I

Flight Control Systems:

Principles of flight control, flight control surfaces, control surface actuation, flight control linkage systems, trim and feel. Power control, mechanical, direct drive, electromechanical, electro-hydrostatic actuation ,multiple redundancies. The fly by wire system. Airbus and Boeing implementations. Inter-relationship of flight control, guidance and vehicle management systems.

UNIT – II

Engine Control Systems:

The engine control problem, fuel flow control, air flow control, control system parameters, example systems, design criteria. Engine starting, fuel control, ignition control, engine rotation, throttle levers, engine indications. Engine control on a modern civil aircraft. Integrated flight and propulsion control.

Fuel Systems:

Characteristics of aircraft fuel systems, fuel system components, fuel transfer pumps, fuel booster pumps, fuel transfer valves, non return valves. Fuel quantity measurement systems, level sensors, fuel gauging probes. Fuel system operation, fuel pressurisation, engine feed, fuel transfer, use of fuel as heat sink, external fuel tanks, fuel jettison, inflight refuelling. Integrated civil aircraft fuel systems.

UNIT – III

Hydraulic Systems:

Importance of hydraulic systems, functions to be performed, the hydraulic circuit, actuation, the hydraulic fluid, hydraulic piping, hydraulic pump, fluid conditioning, the reservoir, emergency power sources. Aircraft applications, examples of B Ae, Airbus, Boeing implementations. The landing gear system for retraction, steering, braking and anti-skid.

UNIT - IV

Electrical Systems:

Aircraft electrical system characteristics, power (AC and DC) generation. Power generation control, voltage regulation, parallel operation, supervisory and protection functions. Modern electrical power generation types, constant frequency, variable frequency, variable speed constant frequency types. Primary power distribution, power conversion and energy

storage. Secondary power distribution, power switching, load protection. Electrical loads, motors and actuators, lighting, heating, subsystem controllers, ground power. Emergency power generation. Electrical load management system.

UNIT – V

Pneumatic Systems And Environmental Control Systems:

Use of pneumatic power in aircraft. Sources of pneumatic power, the engine bleed air, engine bleed air control. Users of pneumatic power, wing and engine anti-ice, engine start, thrust reversers, hydraulic system, pitot static systems. The need for controlled environment in aircraft. Sources of heat. Environmental control system design, ram air cooling, fuel cooling, engine bleed, bleed flow and temperature control. Refrigeration systems, air cycle and vapour cycle systems, turbo fan, boot strap, reversed boot strap systems. Humidity control. Air distribution systems. Cabin pressurization, g tolerance, rain dispersal, anti-misting and demisting.

UNIT VI

Aircraft Instrumentation - Sensors and Displays:

Air data sensors, magnetic sensing, inertial sensing, radar sensors. The electromechanical instrumented flight deck, early flight deck instruments, attitude direction indicator, horizontal situation indicator, altimeter, airspeed indicator. Advanced flight deck display system architectures, display systems, display media, future flight deck displays.

TEXT BOOKS:

1. Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration,, Moir, I. and Seabridge, A., AIAA (American Institute of Aeronautics & Astronautics) 2001
2. Civil Avionics Systems, , Moir, I. and Seabridge, A., AIAA (American Institute of Aeronautics & Astronautics) 2002

REFERENCE BOOK

1. Ground Studies for Pilots: Flight Instruments and Automatic Flight Control Systems, , Harris, D., Blackwell Science, ISBN 0-632-05951-6 sixth edition 2004.

Course outcome:

At the end of this course, students should be able to:

1. Define the importance of aircraft instruments; Instruments display panels, layouts plans and air data instruments.
2. Distinguish different mechanisms in the different aircraft instruments.
3. Identify the different types of sensors works while the landing and take-off period of aero plane.
4. Make the students capable enough to design different types of display sensors systems.

IV Year – II SEMESTER

T	P	C
3+1*	0	3

DEPARTMENTAL ELECTIVE-II

ANALYSIS OF COMPOSITE STRUCTURE

Course Objective:

This course mainly deals with imparting knowledge in the analysis of Multi-layered composite laminated plates using Micromechanics properties of composites materials, derivation of mechanical properties of laminates, generalized Hooke's Law & Stresses in Classical and laminated plates with symmetric, anti-symmetric and un-symmetric layered 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.

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.

REFERENCE BOOKS:

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

AIR LINE MANAGEMENT

(DEPARTMENTAL ELECTIVE-II)

Course Objective:

The main objective of the subject is to introduce the range of aircraft industry along with its levels operational management. The technical aspect on the airline planning fleet planning and route evaluation will be thoroughly dealt. Aircraft mission scheduling, crew scheduling passenger and cargo charges estimating processes will be learnt.

UNIT-I

Airline Industry:

Structure of Airline Industry (Domestic & International)-Growth and Regulation-Deregulation-Major and National Carriers-Regional Carriers-Economic characteristics of the Airlines

Airline Management and Organization:

Levels of Management-Decision Making-Functions of Management-Staff Departments-Line Departments

UNIT-II

Introduction to Airline Planning:

Airline Planning Process-Airline Terminology and Measures: airline demand, airline supply, average load factor, unit revenue, Airline Planning Decisions: Fleet Planning, Route Evaluation, Schedule Development, Pricing, and Revenue Management.

UNIT-III

Fleet Planning and Route Evaluation:

Factors in Fleet Planning-Hub-and-Spoke System-Technical Aspects-Fleet Rationalization-Fleet Commonality-Long Range Aircraft-Noise Restrictions-Factors in Design and Development-Fleet Planning Process; Route Evaluation in Hub Networks-Route profitability estimation issues-Demand Driven Dispatch

UNIT-IV

Airline Scheduling:

The Mission of Scheduling-Equipment Maintenance-Flight Operations and Crew Scheduling—Ground Operations and Facility Limitations-Schedule Planning and Coordination-Equipment Assignment and Types of Schedules-Hub-and- Spoke Scheduling-Data Limitations in Airline Scheduling

Airline Pricing, Demand and Output:

Airline pricing and demand-Determinants of demand-changes in demand-Elasticity of demand-determinants of elasticity; Types of passenger fares-Pricing process-Airline costs-Pricing and output determination

UNIT-V

Air Cargo:

Introduction-Market for Airfreight-Types of Airfreight rates: General Commodity rates, Specific commodity rates, Exception rates, joint rates, Priority reserves air freight, speed package service, container rates-Specific Air freight services: assembly service, distribution service, pickup and delivery service-Factors affecting air freight rates:costs of service, volume of traffic, directionality, characteristics of traffic, value of service, competition.

UNIT-VI

Revenue Management:

Revenue Management Objectives-Airline revenue maximization-Differential Pricing –Yield Management-Revenue Management Techniques-Flight Overbooking-Flight Leg Revenue Management-Origin-Destination Control

TEXT BOOK:

1. Alexander T.Wells and John G.Wensveen,"Air Transportation:A Management Perspective", (Fifth Edition),Brooks Cole,2003.

REFERENCE BOOKS

1. Charles Banfe, "Airline Management", Prentice-Hall, 1991,

2. Rigas Doganis, "The Airline business", Routledge, 2005

3. John .Wensveen, "Wheels Up:Airlines Business Plan Development", Brooks Cole,2003

4. Stephen Holloway, "Straight and Level:Practical Airline Economics",Ashgate Publishing, 2003

5. Stephen Shaw, "Airline Marketing and Management", Ashgate Publishing, 2004

6. William O' Connor, "An Introduction to Airline Economics" , (Sixth Edition), Praeger Publishers,2000

7. Peter P Belobaba,"Airline Management", MIT Open Courseware Lecture Notes, 2006

8. Massoud Bazargan, "Airline Operations and Scheduling", Ashgate Publishing, 2004

Course outcome:

Upon successful completion of this course the student shall be able to:

1. Know the range of aircraft industry along with its levels operational management.
2. Understand technical aspect on the airline planning fleet planning and route evaluation will be thoroughly dealt.
3. Conceptualize Aircraft mission scheduling, crew scheduling passenger and cargo charges estimating processes will be learnt.

HELICOPTER ENGINEERING
(DEPARTMENTAL ELECTIVE-II)

Course Objective:

The main objective of the subject is to make the students to know about basic helicopter components, basic control mechanisms, helicopter aerodynamics and helicopter stability. It also helps in the estimation of ground effect on Hovercraft and ground vehicles. The students are imparted with the knowledge of performance of helicopter for various flight conditions. Also one unit of course is dedicated to VTOL/STOL aircrafts and GEM's.

UNIT - I

ELEMENTS OF HELICOPTER AERODYNAMICS

Configurations based on torque reaction - Jet rotors and compound helicopters.

UNIT – II

ROTOR CONTROL

Methods of control - Collective and cyclic pitch changes - Lead-lag and flapping hinges.

IDEAL ROTAR THEORY

Hovering performances - Momentum and simple blade element theories.

UNIT – III

ROTOR PERFORMANCE

Figures of merit - Profile and induced power estimation - Constant chord and ideal twist rotors.

POWER ESTIMATES

Induced, Profile and Parasite power requirements in forward flight - Performances curves with effects of altitude.

UNIT – IV

STABILITY AND TRIM

Preliminary ideas on helicopter stability.

UNIT - V

LIFT AND CONTROL OF V/STOL AIRCRAFT

Various configurations - Propeller, Rotor ducted fan and jet lift - Tilt wing and vectored thrust - Performances 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 machines – 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.

Course outcome:

After successful completion of this course the student shall be able to

1. Know about basic helicopter components, basic control mechanisms,
2. Appreciate the impotence of helicopter aerodynamics and helicopter stability.
3. Estimate the ground effect on Hovercraft and ground vehicles.
4. Learn the knowledge of performance of helicopter for various flight conditions.
5. Describe the VTOL/STOL aircrafts and GEM's.

QUALITY AND RELIABILITY ENGINEERING

(DEPARTMENTAL ELECTIVE – II)

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.

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)

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

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

IV Year – II SEMESTER

T	P	C
3+1*	0	3

DEPARTMENTAL ELECTIVE-III

ENGINEERING OPTIMIZATION

Course Objectives:

Introduce methods of optimization to engineering students, including linear programming, network flow algorithms, integer programming, interior point methods, quadratic programming, nonlinear programming, and heuristic methods. Numerous applications are presented in civil, environmental, electrical (control) engineering, and industrial engineering. The goal is to maintain a balance between theory, numerical computation, and problem setup for solution by optimization software, and applications to engineering systems**.** □□

UNIT-I

Introduction to Optimization:

Statement of an Optimization Problem-Classification of Optimization Problems-Local and Global Optima

Classical Optimization Techniques:

Single Variable Optimization-Multivariable Optimization with Equality Constraints- Direct Substitution-Method of Constrained Variation- Method of Lagrange Multipliers

UNIT-II

Linear Programming:

Applications of Linear Programming-Standard form of a Linear Programming Problem-Solution by graphical method-Simplex Method; Two phase and Big M methods-Revised simplex method- Duality in Linear Programming

UNIT-III

Transportation and Assignment Problems:

Transportation Problem- North west corner method-Vogel's approximation method- MOD method-Assignment problems

UNIT-IV

Non-Linear Programming-Unconstrained Optimization Techniques:

Classification of Unconstrained Minimization-Powell's M-Steepest Dscent Method- Conjugate Gradient Method-Marquardt Method,Davidon-Fletcher-Powell Method, Broyden-Fletcher-Goldfarb-Shanno Method

Non-Linear Programming -Constrained Optimization Techniques:

Characteristics of a Constrained Problem-Rosen's Gradient Projection Method- Penalty Function Method

UNIT-V

Integer Programming:

Graphical Representation-Cutting Plane Method-Branch and Bound Method

UNIT-VI

Dynamic Programming:

Multi-stage decision process-Computational Procedures in dynamic programming

TEXT BOOKS

1. "Engineering Optimization: Theory and Practice", S.S.Rao, New Age International(P) Ltd.

2. "Optimization for Engineering Dsign:Algorithms and Examples", K.Deb, Prentice-Hall, New Delhi,1995.

REFERENCE BOOKS

1. **"**Introduction to Optimum design", J.S.Arora, McGraw Hill

2. "Numerical Optimization Techniques for Engineering Design", Vanderplatts, G.N., McGraw Hill

Course Outcomes:

Upon successful completion of this course, the student will be able to understand:

1. Basic theoretical principles in optimization;
2. Formulation of optimization models;
3. Solution methods in optimization;
4. Methods of sensitivity analysis and post processing of results
5. Applications to a wide range of engineering problems

PROPELLANT TECHNOLOGY
(DEPARTMENTAL ELECTIVE-III)

Course Objective:

The main objective of the course is to know about the family of aviation fuels. The subject encompasses several varieties of liquid and solid propellants and their burning capabilities. The properties of cryogenic fuels will also be considered as a first pace. 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.

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.

REFERENCE BOOKS

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.

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.

BOUNDARY LAYER THEORY

(DEPARTMENTAL ELECTIVE-III)

Course Objective:

This course is designed to give graduate students more in-depth understanding and experience of the fundamentals and practical solutions of viscous dominated flows in general and boundary layer theory in particular. In addition, approximate solutions methods are explored along with introductions to turbulence and boundary layer control.

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.

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 – Eddyviscosity 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

REFERENCE BOOKS

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.

Course Outcomes:

Upon completion of this course students are expected to:

1. Formulate low Reynolds number flow approximation equations to a variety of flow geometries and conditions.
2. Solve for velocity and pressure fields within a viscous flow subjected to steady and transient conditions.
3. Formulate boundary layer approximations and understand the differential and integral solution methods for boundary layer analysis
4. Predict flow separation conditions in external flow environments and develop concepts for flow control.

HYPERSONIC AERODYNAMICS

(DEPARTMENTAL ELECTIVE-III)

Course Objectives:

Develop an understanding of inviscid hypersonic flows, viscous hypersonic flows and high temperature effects as they apply to hypersonic aerodynamics.

UNIT-I - Fundamentals Of Hypersonic Flows:

Importance/properties of hypersonic flow-Basic equations boundary conditions for inviscid flow, shock wave shapes, flow over a wedge

UNIT-II - Hypersonic Approximations:

Prandtl-Meyer flow- Axi-symmetric flow over a cone - Flow over a flat plate

Hypersonic Small Disturbance Theory:

Flow over a wedge and a cone- Blast wave analogy,-Newtonian impact theory- Busemann centrifugal correction - Shock expansion method- Tangent cone and tangent wedge methods

UNIT-III - Basic Aspects Of Hypersonic Viscous Flows:

Introduction to viscous flow and pressure interactions over flat plate- Boundary layers

Hypersonic Viscous Interactions:

Strong and weak interactions-Shock wave/ boundary layer interactions

UNIT-IV - Hypersonic Aerodynamic Heating:

Reference temperature method-Entropy layer effects on aerodynamic heating

UNIT-V - Hypersonic Vehicle Design:

Hypersonic propulsion and vehicle design

UNIT-VI- Rarefied Gas Dynamics:

Rarefied flow regimes-Kinetic theory of gases-Gas-surface interaction- Aerodynamic forces in hypersonic free molecular flow around simple geometries

TEXT BOOKS

1. “Hypersonic and High Temperature Gas Dynamics”, Anderson, J.D,McGraw-Hill, 1989.

2. “Hypersonic Aerothermodynamics”, Bertin, J.J., AIAA, 1994.

REFERENCE BOOKS

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

Course Outcomes:

Students who successfully complete the course will demonstrate the following outcomes

1. An ability to solve problems involving inviscid hypersonic flows
2. An ability to solve problems involving viscous hypersonic flows.
3. An understanding of high temperature effects in hypersonic aerodynamics.
4. An understanding of the design issues for hypersonic wings.
5. An ability to use computational tools to evaluate hypersonic flows.
6. Knowledge of recent developments in hypersonic aerodynamics with application to aerospace systems.

IV Year – II SEMESTER

T	P	C
3+1*	0	3

DEPARTMENTAL ELECTIVE-IV

AEROELASTICITY

Course Objective:

To elucitate the aero elastic Phenomena, formulations and solutions techniques for aerospace vehicles in flight and to incorporate the spin off benefits. Formulations of Structural Dynamics Equation and Coupling effects for panels and plates considered for structural integrity. The process of 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

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

Nondimentional 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 Book:

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

Course Outcomes:

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

1. Elucitate 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.

INDUSTRIAL AERODYNAMICS

(DEPARTMENTAL ELECTIVE-IV)

Course Objective:

The main objective of the course is to know effect of atmosphere and its boundary layer (Various Terrains) on the aerodynamic performance of flight vehicle. Design of axial machines power requirement, drag co-efficient estimation during unfavorable flight mode will be discussed. The vibrations and chimney designs also emphasized in this course as per the aviation industry regulation.

UNIT-I - ATMOSPHERE

Types of winds, Causes of variation of wind, Effect of terrain on gradient height.

Atmospheric Boundary Layer:

Pressure and velocity distribution over the rising car, Wind tunnel model for atmospheric boundary layer, variation of drag force for various positions of the rising car.

UNIT –II -Wind Energy Collectors-I

Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory. Working principles of horizontal and vertical axis machines, Design of axial machines.

UNIT –III-Vehicle Aerodynamics

Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and hovercraft.

UNIT –IV-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, Interference effect of Building.

UNIT–V -Flow Induced Vibrations

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

UNIT-VI-Design Of Chimney

Height of chimney for various gas effluents, Effective height of chimney, flume rise, Different types of flume rise for various climatic conditions.

TEXT BOOKS:

1. Blevins, R.D., Flow Induced Vibrations, Van Nostard, 1990.

2. Calvert, N.G., Wind Power Principles, Charles Griffin & Co., London, 1979.

REFERENCE BOOKS

1. Scorer, R.S., Environmental Aerodynamics, Ellis Harwood Ltd, England, 1978

2. Sovran, M., Aerodynamics Drag Mechanisms of Bluff Bodies and Road Vehicles, Plenum Press, N.Y., 1978.

3. Sachs. P., Wind Forces in Engineering, Pergamon Press, 1988.

Course Outcomes:

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

1. Design against the effect of atmosphere and its boundary layer (Various Terrains) on the aerodynamic performance of flight vehicle.
2. Design of axial machines power requirement, drag co-efficient estimation during unfavorable flight mode will be discussed.
3. Comphrened the vibrations and chimney designs

ADVANCED COMPUTATIONAL AERODYNAMICS

Course Objective:

The main objective of the subject is to study the aspects related to aircraft design and analysis. The method of estimation of size of aircraft parts, visualization and drawing of aerodynamic shapes and efficient internal layouts. The subject also considers different phases of aircraft design process when it overcomes high velocity fluid.

UNIT - I

Panel Methods:

Introduction to panel method, Basic aspects of uniform source and vortex flows, Source panel method – Non-lifting flows over arbitrary two-dimensional bodies.

Vortex Panel Method:

Vortex panel method – Lifting flows over arbitrary two-dimensional bodies.

UNIT – II

Method Of Characteristics:

Introduction to numerical techniques for steady supersonic flows, Philosophy of method of characteristics. Determination of characteristic lines – Two-dimensional irrotational flow. Determination of the compatibility equationand unit processes. Regions of influence and Domains of dependence.

Applications Of Method Of Characteristics:

Supersonic nozzle design using method of characteristics - Description of Mc Cormack's predictors – Corrector techniques.

UNIT - III

Transonic Relaxation Method:

Theoretical aspects of transonic flows, Small Perturbation flows - Transonic small perturbation equations – Central and Backward difference schemes, Shock capturing vs. shock fitting techniques: Conservation vs. non conservation forms of governing equations, Line relaxation techniques.

UNIT - IV

Boundary Layer Equation:

Introduction to boundary layer equations and their solutions. Description of the boundary layer equations. Transformation of boundary layer equations and the numerical solution method. Choice of discretization model and the generalized Crank- Nicholson Scheme. Discretization of boundary layer equations and illustration of solutions of a tridiagonal system of linear algebraic equations.

UNIT - V

Time Dependent Methods – I

Stability of Solution, Explicit time dependent methods - Euler, Backward Euler, One step trapezoidal, Backward differencing, methods, Leap Frog method.

UNIT – VI

Time Dependent Methods – II

Description of Lax-Wendroff Scheme and Mac Cormack's two-step predictor – Corrector method. Description of time split methods and Approximate factorization schemes

TEXT BOOKS:

1. John .D. Anderson " Computational Fluid Dynamics", McGraw Hill

2. Anderson, Dale A., John C. Tanhill and Richard H.P Letcher, "Computational Fluid Mechanics and Heat transfer", McGraw Hill, New York 1984, Volumes I & II.

REFERENCE BOOKS

1. Hoffmann, K.A: Computational Fluid Dynamics for Engineers, Engineering Education System, Austin, Tex., 1989

2. Kreyszig, E., Advanced Engineering Mathematics, Wiley, New York

3. Introduction to Computational Fluid Dynamics, Chow CY, John Wiley, 1979

4. Bose, T.K., Computation Fluid Dynamics, Wiley Eastern Ltd., 1988.

5. Chow, C.Y., Introduction to Computational Fluid Dynamics, John Wiley, 1979.

6. Hirsch, A.A., Introduction to Computational Fluid dynamics, Mcgraw Hill, 1989.

7. Fletcher, Computational Fluid Dynamics, Vol I & II, Springer Verlag, 1993.

8. Patankar, S.V., Numerical heat Transfer and Fluid Flow. Hemispher Publishing Corporation, 1992

Course Outcomes:

1. Describe the aspects related to aircraft design and analysis.
2. Understands the method of estimation of size of aircraft parts, visualization and drawing of aerodynamic shapes and efficient internal layouts.
3. Identify different phases of aircraft design process when it overcomes high velocity fluid.
4. Apply Grid Generation techniques, Elliptic Grid Generator to solve prolems with high accuracy.

FATIGUE AND FRACTURE MECHANICS
(DEPARTMENTAL ELECTIVE-IV)

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.

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 - 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.

REFERENCE BOOKS

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.

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

IV Year – II SEMESTER

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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.