Where talent meets opportunity

SRI SATYA SAI UNIVERSITY
OF TECHNOLOGY AND MEDICAL SCIENCES

SYLLABUS REVISION

Name of School-School of Engineering

Department-Aeronautical Engineering

2017-18 TO 2021-22

www.sssutms.co.in

Opp.Oilfed Plant, Bhopal-Indore Road,Sehore (M.P), Pin - 466001

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NOTATIONS :

EMPLOYABILITY-PINK

ENTERPRENEURSHIP-BRIGHT GREEN

SKILL DEVELOPMENT-TORQUOISE

Sri Satya Sai
University of Technology and Medical Sciences

(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Name of Faculty: School of Engineering

Name of Department: **Aeronautical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **20/05/2017**

The Board of Studies Committee Meeting was held in the room of Dean of SOE at 2:30 PM. on **20/05/2017**, Following members were present.

1. Dr.Sanjay Rathore
2. Dr.Sonal Bharti
3. Mr.Vijay Prakash Singh
4. Mr.Prabodh Khampariya
5. Mr. Kailash Patidar
6. Mr.Manoj Gandwane
7. Ms.Sheetal Verma
8. Ms.Alka Thakur
9. Mr. Prashant Singh
10. Mr. Sanjay Kalraiya,
11. Mrs.Priyanka Jhavar

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda 1. Approval of (i) SOE-III Semester Scheme & Syllabus as Per CBCS

(ii)SOE-VII Semester Scheme and Syllabus Non-CBCS

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Discussion (if any): Syllabus should be prepared as per current demand in industry.

Resolution of the Discussion: Syllabus should be prepared as per current demand in industries and was approved for forthcoming III Semester CBCS & VII Semester Non-CBCS.

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

1. Dr.Sanjay Rathore
2. Dr.Sonal Bharti
3. Mr.Vijay Prakash Singh
4. Mr.Prabodh Khampariya
5. Mr. Kailash Patidar
6. Mr.Manoj Gandwane
7. Ms.Sheetal Verma
8. Ms.Alka Thakur
9. Mr. Prashant Singh
10. Mr. Sanjay Kalraiya,
11. Mrs.Priyanka Jhavar

Chairman

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Scheme of Examination - CBCS Pattern

Academic Year 2016– 2017

Branch : Aeronautical Engineering **Semester - III**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	**MTH - 301**	Computational Techniques	60	30	10	-	-	2	1	-	3	100
2	AEC- 302	Elements of Aeronautics	60	30	10	30	20	2	1	2	4	150
3	AEC - 303	Fluid Mechanics	60	30	10	30	20	2	1	2	4	150
4	AEC - 304	Thermodynamics	60	30	10	30	20	2	1	2	4	150
5	AEC - 305	Strength of Materials	60	30	10	30	20	2	1	2	4	150
6	AEC - 306	Mechanics of Machine	60	30	10	30	20	2	1	2	4	150
TOTAL			**360**	**180**	**60**	**150**	**100**	**12**	**6**	**10**	**23**	**850**

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BE-301 ENGINEERING MATHEMATICS – I

Unit I

Numerical analysis: Errors& Approximations, Solution of Algebraic &Trancedental Equations (RegulaFalsi ,Newton-Raphson, Secant Method), Solution of simultaneous linear equatins by GaussElimination, Gauss Jordan, Crout's methods , Jacobi's and Gauss-Siedel Iterative methods
Definite Integrals : Definite Integrals as a limit of a sum, its application in Summation of Series.

Unit II

Calculus :Expansion of functions by Maclaurin's and Taylor's theorem. Partial differentiation, Euler'stheorem and its application in approximation and errors, Maxima and Minima of function oftwo variables, Curvature : Radius of curvature.

Unit III

Differential Equations : Solution of Ordinary Differential Equations(Taylor's Series, Picard's Method, Modified Euler's Method, Runge-KuttaMethod,Milne's Predictor & Corrector method), Correlation and Regression, Curve Fitting (Method of Least Square).Linear Differential Equations withConstant Coefficients, Cauchy's Homogeneous differential Equation, Simultaneousdifferential Equations, Method of Variation of Parameters

Unit IV

Matrices :Rank, Nullity, Solution of Simultaneous equation by elementary transformation, Consistency of System of Simultaneous Linear Equation, Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem and its Application to find the inverse.

Unit V

Graph Theory : Graphs, Subgraphs, Degree and Distance, Tree, cycles and Network, Algebra of Logic, Boolean Algebra, Principle of Duality, Basic Theorems, Boolean Expressions and Functions. Elementary Concept of Fuzzy Logic

References:

1)Higher Engineering Mathematics by B.S. Grewal, Khanna Publication.
2)Engineering Mathematics volume I & III by D.K. Jain
3)Engineering Mathematics volume I by D.C.Agrawal

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AE-302 ELEMENTS OF AERONAUTICS

UNIT I-

HISTORICAL EVALUATION

History of aviation, History of space flight, History of Indian space experience, Pre Wright Brothers era,Wright Flyer, Conventional airplane, progress in airplane design and applications, Current status. Early airplanes, biplanes and monoplanes. Structures and propulsion over the years.

UNIT II-

AIRCRAFT CONFIGURATIONS

Components of an airplane and their functions. Different types of flight vehicles,classifications. Conventional control, Powered control, Basic instruments for flying, typical systems for control Actuation.

UNIT III –

INTRODUCTION TO PRINCIPLES OF FLIGHT

Physical properties and structure of the atmosphere, Nomenclature used in Aerodynamics, different parts of airplane. Wing as lifting surface, Types of wing plan forms, Aerodynamic features like Aerofoil pressure distribution, Aerodynamic forces and moments, Lift and Drag, Mach number, Manoeuvres.

UNIT IV –

INTRODUCTION TO AIRPLANE STRUCTURES

General types of construction, Monocoque, semi-monocoque and geodesic construction, Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials

UNIT V –

POWER PLANTS USED IN AIRPLANES

Basic ideas about piston, Jet engine, turbo-prop, turbo-fan, turbo-shaft, Prop-fan ,Possible locations of power plant on airplane, Rocket Propulsion, Classification of rockets like liquid and solid propellant rockets.

TEXT BOOKS

1. Anderson, J.D., *"Introduction to Flight"*, McGraw-Hill, 1995.
2. Fundamentals of Flight; By Dr. O. P. Sharma and Lalit Gupta.

REFERENCE

1. Kermode, A.C., *"Flight without Formulae"*, McGraw-Hill, 1997.
2. Jet Aircraft Power Sysytem : Jack V.Casamassa & Ralph D.Bent

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AE/ME-303 Thermodynamics

UnitI

Fundamental Concepts and Definitions :
Thermodynamics,Property,Equilibrium,State,Process,Cycle,Zerothlawof thermodynamics, statement and significance, concept fan Ideal gas, Gas laws , Avogadro ' hypothesis,
Heatandworktransfer.Firstlawof thermodynamics-Statementoffirstlawof thermodynamics,firstlaw appliedtoclosedsystem,firstlawappliedtoaclosedsystemundergoingacycle,processesanalysisof closed system ,flowprocess,flowenergy,steady flow process , Relations for flow processes ,limitations of first law of thermodynamics.

UnitII

Second lawof thermodynamics :heat engine, heat reservoir, Refrigerator ,heat pump ,COP ,EPR, Available energy ,Carnot' stheorem, Carnot's cycle, efficiency Carnot'scycle,statementofsecondlaw Reversibleand irreversibleprocesses,consequenceof secondlaw,Entropy,Entropychangeforideal gas, T-S diagrams,Availabilityand Irreversibility.Gibbs andHelmholtzfunctions

UnitIII

Real gas :Deviationwith ideal gas,Vander-wall'sequation,evaluationof itsconstants, limitationsoftheequation.Thelawofcorrespondingstates Compressibility factor,Generalized compressibilitychart, P-V-Tsurface of aReal gas, Thermodynamicsrelations,Maxwell relationsand thereapplications.

UnitIV

PureSubstance :Phase,Phase-transformations,formationof steam,propertiesof steam,PVTsurface, HS,TS,PV,PH,TVdiagram,processesof vapormeasurementof drynessfraction,Useof steamtableand Mollierchart.

UnitV

Airstandard cycles :Carnot,Otto,Diesel,Dual cyclesandtherecomparison,twostrokeand fourstroke engines,Braytoncycle,nonreactive gasmixture,PVTrelationship,mixtureofidealgases,propertiesof mixtureof ideal gases,internalenergy,Enthalpyandspecificheatofgasmixtures,Enthalpyofgas-mixtures.

References:

1. P.K.Nag;EngineeringThermodynamics; TMH
2.CengelY;Thermodynamics; TMH
3.AroraCP;Thermodynamics;TMH
4. Thermal EngineeringbyRYadav
5.EngineeringThermodynamicsbyOmkarSinghNewAge International.
6. Basic EngineeringThermodynamics,Joel,Pearson
7.EngineeringThermodynamicsbyM.Achuthan,PHI India.

ListofExperiments(Pl.expandit):

1. To findmechanicalequivqlentofheatusingJoules apparatus
2. Tostudyworkingofimpulseandreactionsteamturbine.
3. Tostudyworkingof Gasturbines .
4. To calculateCOPof vapourcompression refrigerationsystemandtoplotonT-s,p-Hdiagrams.

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AE-304 Control Systems & Engineering

Unit-I : Control system & Component

Open loop and close loop control systems. Block diagram algebra and transfer function. Differential equations, Determination of transfer function by block diagram reduction technique & signal flow graph method. Mason gain formula and calculation of transfer function. Basic component of electrical control system, Armature and field control methods for Speed control

Unit-II : Time response analysis

Transient and steady state response analysis. Steady state error & error constants. Dynamic error and dynamic error coefficient, Performance Indices. Effects of pole and zero addition on transient and steady state response.

Unit-III : stability analysis

Absolute stability and relative stability. Routh's and Hurwitz criterion of stability. Root locus method of analysis. Polar plots,

Unit-IV : Approaches to system design

Design problem, types of compensation, design of phase-lag, phase lead and phase lead-lag compensators in time and frequency domain, proportional, derivative, integral and PID compensation.

Unit-V Digital control systems

System with digital controller, difference equations, the z-transform, pulse transfer function, inverse ztransform, the s and z domain relationship.

References:

1. Nagrath and Gopal: Control System Engineering, New Age International Publishers.
2. Manke: Linear Control System, Khanna Publishers.
3. Ogata: Modern Control Engineering, PHI Learning.

List of Practical :

1. Designing of transfer function for different type of control system
2. Designing and modeling of different control system.
3. Determination of stability with Root Local, Nyquest Criteria, Bode Plot etc.
4. Transient and steady state analysis of control system.
5. To implement a PID controller for temperature control of a pilot plant.
6. To study behavior of 1 order,2 order type 0,type 1 system.
7. To study control action of light control device.
8. Determine transpose, inverse values of given matrix.
9. Plot the pole-zero configuration in s-plane for the given transfer function.
10. Plot unit step response of given transfer function and find peak overshoot, peak time.
11. Plot unit step response and to find rise time and delay time.

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AE/CE/ME-305Strength ofmaterials

UNITI

Simple Stress andstrain:stressesinmembersof astructure,axial loading,normal stress,shearstress,bearing stress, analysisof simplestructures,steppedrods,membersinseriesandparallel:stressstraindiagram, Hooke'slaw,modulusofelasticity, Poisson's ratio, Rotation between the elastic modulii, Thermal stress and strain,

UNITII

Compound stressandstrain:principal stresses and principal planes,normal andshearstress, Graphical method-Mohr'scircle, Mohr's circle construction for like stresses, unlike stresses, two perpendicular direct stresses as the state of simple shear,ductileandbrittlefailures,

UNITIII

Deflection of beam: purebending,symmetricmember,deformationand stress,bendingof compositesections, eccentric axial loading,shearforceand BMdiagram,relationshipamongload,shearand BM,shear stressesin beams,strain energy inbending,deflectionofbeams,equationofelastic curve,Macaulay's method.

UNITIV

Torsioninshafts: stressesinashaft,deformationin circularshaft,angleof twist,stepped-hollow,thin walled-hollowtransmissionshafts, comparison of solid and hollow shaft, shafts in series, shaft in parallel, combined bending and torsion,

UNITV

Theoriesoffailures:maximum normal stress&shearstresstheory;maximum normal andshearstrain energytheory;maximum distortionenergytheory; applicationof theoriestodifferentmaterials and loadingconditions. Columns: stabilityof structures,Euler'sformulaforcolumnswithdifferentend conditions,Rankin'sformula.

References:

1.Er. R.K.Rajput; Strength of materials; S.Chand& Company PVT.LTD.
2. Rattan;Strengthofmaterials;TMH
3.Nash William;Schaum'sOutlineSeries;Strengthof Materials; TMH.
4.Negi;strengthofmaterials;TMH
5. SinghArbind K;Mechanicsof Solids;PHI
6. Sadhu Singh;Strengthof Materials;KhannaPub.
7.Kamal KandGhaiRC;AdvancedMechanicsof Materials;KhannaPub.

Listofexperiments(Pl.expandit):

1. StandardtensiletestonMSandCI testspecimen
2.Direct/crossSheartestonMSandCI specimen
3. Transversebendingtestonwoodenbeamstoobtainmodulusofrupture 4. Fatiguetest
5.Brinell Hardnesstests
6.Vickerhardnesstest
7. Rockwell *hardness test*
8.Izod/Charpyimpacttest

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Scheme of Examination

Seventh Semester –BE (Aeronautical Engineering)

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted							Credits Allotted Subject wise			Total Credits	Remark
			Theory Slot			Practical Slot			Total Marks	Period per week				
			End Sem.	Mid Sem. MST (Two tests average)	Quiz, Assig-nment	End Sem	Term work			L	T	P		
							Lab work & sessional	Assignment/ quiz						
1	AE-701	Elective -I	70	20	10	-	-	-	100	3	1	-	04	
2	AE -702	Industrial Aerodynamics	70	20	10	-	-	-	100	3	1	-	04	
3	AE-703	Finite Element Method	70	20	10	30	10	10	150	3	1	2	06	
4	AE -704	Avionics	70	20	10	30	10	10	150	3	1	2	06	
5	AE -705	Aircraft Materials & Composites	70	20	10	30	10	10	150	3	1	2	06	
6	AE -706	Minor Project & Seminar	-	-	-	60	20	20	100	0	0	4	04	
7	AE -707	Industrial Training (Two Week)	-	-	-	30	10	10	50	0	0	2	02	Grand Total
		Total	350	100	50	180	60	60	800	15	5	12	32	800

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MST: Mid Semester Tests Taken at Least twice Per Semester

L: Lecture - T: Tutorial - P: Practical

Elective –I

AE-701(A) Total Quality Management
AE-701(B) Wind Tunnel Techniques
AE-701(C) Theory of Plates and Shells

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AE -701(A) Elective

Total Quality Management

UNIT I: INTRODUCTION

Time Management, Stress Management, Goals and Career Planning – Interpersonal interaction. Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques, Basic concepts of Total Quality Management, Principles of TQM, Leadership Concepts, Role of Senior Management, Quality Council, Deming Philosophy, Barriers to TQM Implementation.

UNIT II: TQM PRINCIPLES

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III: STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV: QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

UNIT V: MANGEMEMENT

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

TEXT BOOK

1. Dale H. Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES

1. James R. Evans & William M. Lidsay, "The Management and Control of Quality", (5thEdition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum. A.V. "Total Quality Management", McGraw-Hill, 1991
3. Oakland. J.S. "Total Quality Management", Butterworth Heinemann Ltd., 1989
4. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International.

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AE -701(B) Elective
Wind Tunnel Techniques

UNIT I: PRINCIPLES OF MODEL TESTING
Buckingham Theorem – Non-Dimensional Numbers – Scale Effect Types of Similarity.

UNIT II: WIND TUNNELS
Classification – Special problems of Testing in Subsonic, Transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.

UNIT III: CALIBRATION OF WIND TUNNELS
Test section speed – Horizontal buoyancy – Flow angularities – Turbulence measurements – Associated instrumentation – Calibration of supersonic tunnels.

UNIT IV: WIND TUNNEL MEASUREMENTS
Pressure and velocity measurements – Force measurements – Three component and six component balances – Internal balances.

UNIT V: FLOW VISUALIZATION TECHNIQUES
Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.

TEXT BOOK

1. Rae, W.H. and Pope, A. "Low Speed Wind Tunnel Testing", John Wile Publication, 1914.

REFERENCE

1. Pope, A., and Goin, L., "High Speed wind Tunnel Testing", John Wiley, 1915

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AE – 701(C) Elective
Theory of plates and shells

UNIT I: INTRODUCTION TO CLASSICAL PLATE THEORY
Classical Plate Theory – Assumptions – Differential Equation – Boundary Conditions.

UNIT II: PLATES OF VARIOUS SHAPES
Navier's Method of Solution for Simply Supported Rectangular Plates – Leavy's Method of Solution for Rectangular Plates under Different Boundary Conditions. Governing Equation – Solution for Axi - symmetric loading – Annular Plates – Plates of other shapes.

UNIT III: STABILITY ANALYSIS
Stability and free Vibration Analysis of Rectangular Plates.

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

UNIT V: THEORY OF SHELLS
Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.

TEXT BOOK
1. Timoshenko, S.P. Winowsky S., and Kreger, "Theory of Plates and Shells", McGraw-Hill Book Co. 1990.

REFERENCES

1. Flugge, W. "Stresses in Shells", Springer – Verlag, 1985.
2. Timoshenko, S.P. and Gere, J.M., "Theory of Elastic Stability", McGraw-Hill BookCo. 1999.

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AE -702

Industrial Aerodynamics

UNIT I: ATMOSPHERIC WIND

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

UNIT II: WIND TURBINE

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

UNIT III: VEHICLE AERODYNAMICS

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

UNIT IV: 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.

UNIT V: AIR FLOW INDUCED VIBRATIONS

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

TEXT BOOKS

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

REFERENCES

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

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AE-703
FINITE ELEMENT METHODS

UNIT I: INTRODUCTION TO FEM AND ITS APPLICABILITY

Review of mathematics: Matrix algebra, Gauss elimination method, Uniqueness of solution, Banded symmetric matrix and bandwidth. Structure analysis Two-force member element, Local stiffness matrix, coordinates transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix.

UNIT II: ONE-DIMENSIONAL FINITE ELEMENT ANALYSIS

Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, General steps of FEM, Finite element model concept /Discretization, Derivation of finite elements equations using potential energy approach for linear and quadratic 1-D bar element and beam element, shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain.

UNIT III: TWO DIMENSIONAL FINITE ELEMENT ANALYSIS

Finite element formulation using three nodded triangular (CST) element and four nodded rectangular element, Plane stress and Plain strain problems, Shape functions, node numbering and connectivity, Assembly, Boundary conditions, Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation of stress and strain.

UNIT IV: FINITE ELEMENT FORMULATION

Method of Weighted Residuals ,Collocation, Sub domain method, Least Square method and Galerkin's method, Application to one dimensional problems, one-dimensional heat transfer, etc. introduction to variation formulation (Ritz Method.)

UNIT V: HIGHER ORDER ELEMENTS

Lagrange's interpolation formula for one and two independent variable, Convergence of solution, compatibility, element continuity, static condensation, p and h methods of mesh refinement, Aspect ratio and element shape, Application of FEM, Advantages of FEM, Introduction to concept of element mass matrix and Damping matrix in dynamic analysis, Calculation of natural frequencies and modes.

TEXT BOOK

1. Text Book of Finite Element Analysis, Seshu P., Prentice Hall India.
2. Finite Element Procedure in Engineering Analysis, Bathe K.J., Prentice Hall India.

REFERENCE BOOKS

1. An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw-Hill, New Delhi.
2. Concepts & Applications of Finite Element Analysis, Cook, Malkus, Plesha and Witt.

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Willey India, New Delhi.
3. Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall.

LIST OF EXPERIMENTS

1. Write flow chart of finite element steps.
2. Study and understand the convergence of the problem.
3. Solve stiffness matrix for bar, beam and frame problems using suitable boundary condition.
4. Plane stress and plane strain condition are used to understand 2d structures.
5. Analysis of beams and frames (bending problems)
6. Analysis of beams and frames (torsion problems)
7. Nodal analysis problem.
8. Heat transfer problems.
9. Problems leading to analysis of three dimensional solids.
10. Problems leading to analysis of axisymmetric solids.

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AE -704
Avionics - I

UNIT I: INTRODUCTION
Need for avionics in civil and military aircraft and space systems – Integrated avionics and weapon systems – Typical avionics subsystems, design, technologies.

UNIT II: PRINCIPLE OF DIGITAL SYSTEMS
Digital computer – Microprocessors – Memories.

UNIT III: AVIONICS ARCHITECTURE
Avionics system architecture – Data buses – MIL – STD - 1553B – ARINC – 420 – ARINC – 629.

UNIT IV: FLIGHT DECKS AND COCKPITS SYSTEM
Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT V: INTODUCTION TO AVIONICS SYSTEMS
Communications systems- Navigation systems – Flight control systems – Radar –Electronic Warfare – Utility systems Reliability and maintainability – Certification.

TEXT BOOKS
1. Middleton, D.H., Ed., Avionics systems, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
2. Spitzer, C.R. Digital Avionics Systems, Prentice-Hall, Englewood Cliffs, N.J., U.S.A. 1987.

REFERENCES
1. Malvino, A.P. and Leach, D.P. Digital Principles and Applications, Tata McGraw-Hill, 1990.
2. Gaokar, R.S. Microprocessors Architecture-Programming and Applications, Wileyand Sons Ltd., New Delhi, 1990.

LIST OF EXPERIMENTS
1. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.
2. Study of Different Avionics Data Buses.
3. MIL-Std - 1553 Data Buses Configuration with Message transfer.
4. MIL-Std - 1553 Remote Terminal Configuration.
5. Multiplexer/ Demultiplexer Circuits.
6. Encoder/Decoder Circuits.
7. Timer Circuits, Shift Registers, Binary Comparator Circuits.
8. Addition and Subtraction of 8-bit and 16-bit numbers.
9. Greatest in a given series & Multi-byte addition in BCD mode.
10. Interface programming with 4 digit 7 segment Display & Switches & LED's

AE-705
Aircraft Materials and Composite

UNIT I: METALS AND ALLOYS

Introduction to Aerospace materials: Classification, composition, properties, heat treatment & application in plain carbon steels, Alloy steels. Stainless steels, heat treatment & application in aluminium and its alloys. Introduction to oxidation and hot corrosion.

UNIT II: COMPOSITE MATERIALS AND PROPERTIES

Introduction to composite materials: Definition – Classification of Composite materials based on structure – based on matrix. Advantages of composites – application of composites – functional requirements of reinforcement and matrix. FIBERS: properties and applications of glass fibers, carbon fibers, Kevlar fibers and metal fibers.

UNIT III: MANUFACTURING OF ADVANCED COMPOSITES

Polymer matrix composites: Metal Matrix Composites, manufacturing and application, Casting – Solid State diffusion technique, Cladding – Hot-iso static pressing.

UNIT IV: CREEPAND FRACTURE

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate. Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship. Various types of fracture, brittle & ductile, low temperature & high temperature, cleavage fracture, ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides. Fatigue of aircraft materials.

UNIT V: SUPERALLOYS AND HIGH TEMPERATURE MATERIALS

Iron base, Nickel base and Cobalt base super alloys, titanium alloys composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, high temperature ceramics.

TEXT BOOKS

1. Material Science and Technology – Vol 13 – Composites by Cahn – VCH, West Germany Composite Materials – K.K. Chawla.
2. Calcote, L R. "The Analysis of laminated Composite Structures", Von – Noastrand Reinhold Company, New York 1998.
3. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 1985.
4. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.
5. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.

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LIST OF EXPERIMENTS

1. Determination of mechanical properties of plain carbon steel using heat treatment techniques.
2. Solution treatment and hardening of Al-Mg and Al-Cu base alloys.
3. Fatigue and creep behavior iron base alloys.
4. Convert the Load-Displacement data to Stress-Strain data and plot out the Stress versus Strain curve for each specimen.
5. From the Stress-Strain curves, determine the Elastic Modulus (E1) and Ultimate Strength (SU1) for each sample tested.
6. Compare the theoretically determined Longitudinal and Transverse Moduli (EL and ET) obtained in step 2 with the experimentally determined Longitudinal and Transverse Moduli (EL and ET) in step 6. Comment on any differences.
7. Calculate the Elastic Modulus along the loading axis, E1, and the In-Plane Poisson's Ratio along the loading axis, ν 12, for each orientation tested based on the experimentally obtained values of Longitudinal and Transverse Moduli and the calculated values of the In-Plane Shear Modulus and the Major Poisson's Ratio.
8. Compare the stiffness and strength results of the polymers tested with the results of the Graphite /epoxy composite.
9. Calculate the Longitudinal and Transverse Moduli (EL and ET respectively) based on the fiber and matrix property data for IM7/8551.
10. Calculate the Major In-Plane Shear Modulus (GLT) and the Major Poisson's Ratio (ν LT) for the IM7/8551 unidirectional composite being investigated.

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AE -706
Minor Project & Seminar

The objective of the project work phase – I/ Minor project is to prepare students for undertaking useful/application oriented project on current topic of the subject concerned. Preparation of the project work involves.

- ✓ Form a team / group of likeminded students (not more than 6 in numbers) to carry out the project.
- ✓ Make a literature survey and data collection or literature review of the project proposed.
- ✓ Publish or present a paper on the proposed work in any one of the National/ International Seminars or Journals.

Plan for necessary supports, facilities, analytical tools and fixation of faculties /supervisors for the final semester Major project/ project work phase – II.

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Name of Faculty: School of Engineering

Name of Department: **Aeronautical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **10/11/2017**

The Board of Studies Committee Meeting was held in the room of Dean of SOE at 2:30 PM. on **10/11/2017**, Following members were present.

1. Dr.Sanjay Rathore
2. Dr.Sonal Bharti
3. Mr.Vijay Prakash Singh
4. Mr.Prabodh Khampariya
5. Mr. Kailash Patidar
6. Mr.Manoj Gandwane
7. Ms.Sheetal Verma
8. Ms.Alka Thakur
9. Mr. Prashant Singh
10. Mr. Sanjay Kalraiya,
11. Mrs.Priyanka Jhavar
12. Dr.Ajay Swaroop
13. Mr.Devendra Patle

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda 1. Approval of (i)SOE-IV Semester Scheme & Syllabus as Per CBCS

(ii)SOE-VIII Semester Scheme and Syllabus Non-CBCS

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Discussion (if any): Syllabus should be prepared as per current demand in industry.

Resolution of the Discussion: Syllabus should be prepared as per current demand in industries and was approved for forthcoming IV Semester CBCS & VIII Semester Non-CBCS.

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

1. Dr.Sanjay Rathore
2. Dr.Sonal Bharti
3. Mr.Vijay Prakash Singh
4. Mr.Prabodh Khampariya
5. Mr. Kailash Patidar
6. Mr.Manoj Gandwane
7. Ms.Sheetal Verma
8. Ms.Alka Thakur
9. Mr. Prashant Singh
10. Mr. Sanjay Kalraiya,
11. Mrs.Priyanka Jhavar
12. Dr.Ajay Swaroop
13. Mr.Devendra Patle

Chairman

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Scheme of Examination - CBCS Pattern

Academic Year 2017– 2018 (For BE 2016 Batch)

Branch : Aeronautical Engineering Semester - IV

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	AEC- 401	Aircraft System & Instrumentation	60	30	10	30	20	2	1	2	4	150
2	AEC- 402	Aircraft Structure -I	60	30	10	30	20	2	1	2	4	150
3	AEC- 403	Aircraft Propulsion -I	60	30	10	30	20	2	1	2	4	150
4	AEC- 404	Aerodynamics-I	60	30	10	30	20	2	1	2	4	150
5	AEC- 405	Aircraft Performance	60	30	10			2	1		3	100
6	AEC- 406	Aircraft Materials & Composite	60	30	10	30	20	2	1	2	4	150
TOTAL			**360**	**180**	**60**	**150**	**100**	**12**	**6**	**10**	**23**	**850**

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B.E. VIII Semester (Aeronautical Engineering)

Scheme of Examination

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted							Credits Allotted Subject wise			Total Credits	Remark
			Theory Slot			Practical Slot			Total Marks					
			End Sem.	Mid Sem. MST (Two tests average)	Quiz, Assig-nment	End Sem	Term work			Period per week				
							Lab work & sessional	Assignment/ quiz		L	T	P		
1	Refer Table Below	Elective -II	70	20	10	-	-	-	100	3	1	-	04	
2	AE -802	Helicopter Aerodynamics	70	20	10	-	-	-	100	3	1	-	04	
3	AE-803	Computational Fluid Dynamics	70	20	10	30	10	10	150	3	1	2	06	
4	AE-804	Air Transportation and Aircraft Maintenance	70	20	10	30	10	10	150	3	1	2	06	
5	AE-805	Major Project	-	-	-	100	50	50	200	0	0	8	8	
	AE-806	Energy Conversion Lab				30	10	10	50	0	0	2	02	
6	AE-807	Seminar & Group Discussion	-	-	-	-	-	50	50	0	0	2	02	Grand Total
		Total	280	80	40	190	80	130	800	12	4	16	32	800

MST: Mid Semester Tests Taken at Least twice Per Semester

L: Lecture - T: Tutorial - P: Practical

Elective –II

AE-801(1)	Rockets and Missiles
AE-801(2)	Fatigue and Fracture Mechanics
AE-801(3)	Airframe Maintenance and Repair
AE-801(4)	Air Traffic Control and Aerodrome Design

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BE-401 (AE)
ENGINEERING MATHEMATICS – II

Unit 1

Concept of Probability : Probability Mass function, Probability density function. Discrete
Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential
Distribution,Testing of Hypothesis |:Students t-test, Fisher's z-test, Chi-Square Method.

Unit 2

Functions of complex variables : Analytic functions, Harmonic Conjugate, Cauchy-Riemann
Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula, Singular Points, Poles
& Residues, Residue Theorem , Application of Residues theorem for evaluation of real integrals.

Unit 3

Introduction of Fourier series: Fourier series for Discontinuous functions, Fourier series
for even and odd function, Half range series Fourier Transform: Definition and properties of Fourier. Fourier transform, Sine and Cosine transform.

Unit 4

Laplace Transform: Introduction of Laplace Transform, Laplace Transform of elementary functions,properties of Laplace Transform, Change of scale property, second shifting property, Laplace transformof the derivative, Inverse Laplace transform & its properties, Convolution theorem, Applications of L.T. to solve the ordinary differential equations.

Unit 5

Vector Calculus: Differentiation of vectors, scalar and vector point function, geometrical meaning ofGradient, unit normal vector and directional derivative, physical interpretation of divergence and Curl. Line integral, surface integral and volume integral, Green's, Stoke's and Gauss divergence theorem.

References:

1)Higher Engineering Mathematics by B.S. Grewal, Khanna Publication.
2)Engineering mathematics volume II & III by D.K. Jain
3)Engineering mathematics volume II by D.C.Agrawal

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AE-402
AERODYNAMICS - I

UNIT I

TWO DIMENSIONAL FLOWS

Basic flows – Source, Sink, Free and Forced vortex, uniform parallel flow.Their combinations,Pressureand velocity distributions on bodies with and without circulation in ideal and real fluid flows.Kutta Joukowski's theorem.

UNIT II

CONFORMAL TRANSFORMATION

Joukowski transformation and its application to fluid flow problems, Kutta condition, Blasius theorem.

UNIT III

AIRFOIL AND WING THEORY

Circulation and the generation of Lift, Bound vortex and starting vortex, Kutta condition, Glauert's thin airfoil, theory, thin symmetric flat plate airfoil, Circular arc foil, general thin airfoil section, the flapped airfoil. Determination of mean camber line shapes for uniform and linear distribution of circulation, flow about multi element airfoils.Vortexline,Horse shoe vortex, Biot and Savart law, Lifting line theory and its limitations

UNIT IV

VISCOUS FLOW

Newton's law of viscosity, Boundary Layer Concept and properties, derivation of Prandtl's Boundary Layer equations, Blasius solution, Karman's Integral equation. Navier-Stokes equation, Turbulent Boundary Layer over a plate, skin friction drag, Boundary Layer control.

UNIT V

Computational fluid dynamics :- Basic equation of fluid dynamics, physical classification of fluid dynamics problem, well proposed problems, initial value methods, finite difference methods, integration method, ɵ method , finite element method (Galerkin and collocation) . panel method for compressible subsonic and super sonic flow.

TEXT BOOKS

1. Anderson, J.D., *"Fundamentals of Aerodynamics"*, McGraw-Hill Book Co., New York, 1985.

REFERENCES

1. Houghton, E.L., and Carruthers, N.B., *"Aerodynamics for Engineering students"*, Edward Arnold Publishers Ltd., London, 1989.
2. Milne Thomson, L.H., "*Theoretical aerodynamics*", Macmillan, 1985.
3. Clancey, L.J., "*Aerodynamics"*, Pitman, 1986

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AERODYNAMICS LABORATORY

To study experimentally the aerodynamic forces on different bodies at low speeds.

LIST OF EXPERIMENTS

1. Calibration of subsonic wind tunnel.
2. Pressure distribution over smooth and rough cylinder.
3. Pressure distribution over symmetric airfoil.
4. Pressure distribution over cambered airfoil& thin airfoils
5. Force measurement using wind tunnel balance.
6. Flow over a flat plate at different angles of incidence
7. Flow visualization studies in low speed flow over cylinders
8. Flow visualization studies in low speed flow over airfoil with different angle of incidence
9. Calibration of supersonic wind tunnel.
10. Supersonic flow visualization with Schlieren system.

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AE-403
PROPULSION - I

UNIT I

AIRCRAFT PISTON ENGINES

The internal combustion engine process, brief historical sketch, spark ignition and compression ignition, engines, 4-stroke and 2-stroke engines. Combustion processes various types of arrangements for multi cylinder aircraft engines. Intake and Exhaust manifolds. IHP, BHP and Engine performance, Effect of altitude and speed, power required and power available. Super charging, types of super chargers.

UNIT II

PROPELLERS

Ideal momentum theory, blade element theory, activity factor, airscrew coefficients, numerical problems on the performance of propellers, selection of propellers, fixed, variable and constant speed propellers, material for propellers, momentum theory applied to helicopter rotor.

UNIT III

ELEMENTS OF HEAT TRANSFER

a) Conduction: Heat Transfer process, Heat conduction, Thermal conductivity, General equation of heat conduction in 1-D and 2-D.

b) Convection and Radiation Heat Transfer: Convection process, free convection heat transfer from vertical flat plate, planes, cylinder and sphere, free convection.

c) Thermal Radiation and Emissive power. The Plank distributive law, Radiation properties

UNIT IV

FUNDAMENTALS OF GAS TURBINE ENGINES

Illustration of working of gas turbine engine–Thrust equation–Factors affecting thrust. Effect ofpressure, velocity and temperature changes of air entering compressor,After burner arrangements for thrust augmentation..High and Low by pass ratio, turbo-fan engines, dual shaft gas turbine engines, its merits over single shaft engines.Characteristics of turboprop, turbofan and turbojet – Performance characteristics

UNIT V

COMPONENTS OF GAS TURBUNE ENGINE

Centrifugal and axial type of compressors, their compressive action, relative merits in operations. Diffuser vane design considerations .Classification of combustion chambers, simplex and duplex burners, expansion process, turbine and its action, constructional details of turbine ,compressor and turbine efficiencies, subsonic and supersonic engine intake and exhaust nozzles .Materials for different components.

TEXT BOOKS

1. Heat transfer: J.P.Holman, McGraw Hill.
2. I.C.Engines: V Ganesan, McGraw Hill.
3. Gas Turbine Theory: Cohen, Rogers and Saravanamuttu, Pearson Education .
4. Heat transfer: B.Gebhart,McGraw Hill.

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5. Elements of Gas Turbine Propulsion: J.D. Mattingly, McGraw Hill.

REFERENCES

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "*Gas Turbine Theory*", Longman, 1919.
2. Oates, G.C., "*Aero thermodynamics of Aircraft Engine Components*", AIAA Education Series, New York,1915.
3. "Rolls Royce Jet Engine" – Third Edition – 1913.
4. Mathur, M.L. and Sharma, R.P., *"Gas Turbine, Jet and Rocket Propulsion"*, Standard Publishers &Distributors, Delhi, 1999.
5. I.C.Engines: L.C.Litchy, McGraw Hill

LIST OF EXPERIMENTS

1. Study of an aircraft piston engine - assembly of sub systems.
2. Study of an aircraft piston engine - various components, their functions and operating principles.
3. Study of an aircraft jet engine - assembly of sub systems.
4. Study of an aircraft jet engine - various components, their functions and operating principles.
5. Study of forced convective heat transfer.
6. Study of free convective heat transfer.

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AE-404
Microprocessor, Microcontroller & Embedded System Design

Unit 1 : Introduction to microprocessors

Architecture, block diagram of 8086, details of subblocks such as EU, BIU; memory segmentation and physical address computations, program relocation, addressing modes, instruction formats, pin diagram and description of various signals.

Unit II : Instruction Sets

Instruction execution timing, assembler instruction format, data transfer instructions, arithmetic instructions, branch instructions, looping instructions, NOP and HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators, programming examples.

Unit III : Introduction of Microcontroller:

Different types of microcontrollers: Embedded, microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : clocking, i/o pins, interrupts, timers, peripherals. Introduction to PIC microcontrollers, Architecture and pipelining, program memory considerations, Addressing modes, CPU registers, Instruction set, simple operations.

Unit IV : Microcontroller 8051

Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing, Instruction Set, Assembly Language Programming, Real Time Applications of Microcontroller- Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors.

Unit V : Embedded System

Introduction, Classification, Processors, Hardware Units, Software Embedded into System, Applications and Products of Embedded Systems, Structural Units in Processor, Memory Devices, I/O Devices, Buses, Interfacing of Processor Memory and I/O Devices, Case Study of an Embedded System for a Smart Card.

References

1. Muhammad Ali Mazidi, The 8051 Microcontroller, Pearson Education.
2. Kenneth J Ayala, The 8051 Microcontroller, Penram International
3. Ramesh S Goankar, Microprocessors and Architecture:
4. John Uffenbeck, Microcomputers and Microprocessors, PHI
5. V. Deshmukh: Microcontroller (Theory and Application), TMH.
6. D. V. Hall: Microprocessors and Interfacing, TMH
7. Predko, Programming and Customizing the 8051 Microcontroller, TMH.

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AE-405

Fluid Mechanics

Unit-I

Review of Fluid Properties: Engineering units of measurement, mass, density, specific weight, volume and gravity, surface tension, capillarity, viscosity, bulk modulus of elasticity, pressure and vapor pressure. Fluid Static's : Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on gravity dams and Tainter gates); buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

Unit-II

FLIUD KINEMATICS AND FLUID DYNAMICS :

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms).Equation of streamline – stream function - velocity potential function – circulation.

Fluid dynamics - equations of motion -Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter,Pitot tube - dimensional analysis - Buckingham's π theorem-applications - similarity laws and models.

Unit-III

Introduction to Viscous Flows: Introduction to laminar & turbulent flow, Reynolds experiment & Reynoldsnumber, relation between shear & pressure gradient, laminar flow through circular pipes,laminar flow between parallel plates, laminar flow through porous media, Stokes law, lubrication principles.Transition from laminar to turbulent flow.Turbulent flow in circular pipe.

Unit - IV

Elements of Compressible Flows: Compressible flow properties, total Enthalpy, total temperature, temperature and pressure ratio as function of mach number. Mass flow parameter (MFP), velocity - area variation, 2-D small amplitude wave propagation,. Description of flow regimes,

Unit –V

HYDRAULIC TURBINES AND HYDRAULIC PUMPS:

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine – Kaplan turbine - working principles.

Pumps: definition and classifications - Centrifugal pump: Classifications, working principles.

References: -

1. Modi& Seth; Fluid Mechanics; Standard Book House, Delhi
2. Streeter VL, Wylie EB, Bedford KW; Fluid Mechanics; TMH
3. Som and Biswas; Fluid Mechnics and machinery; TMH
4. Cengal; Fluid Mechanics; TMH
5. White ; Fluid Mechanics ; TMH
6. Gupta; Fluid Mechanics; Pearson
7. JNIK DAKE; Essential of EnggHyd; Afrikan Network &ScInstt. (ANSTI)
8. R Mohanty; Fluid Mechanics; PHI
9. S W Yuan, Foundations of Fluid Mechanics, Prentice Hall

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List of Experiments (Pl. expand it)

1. To determine the local point pressure with the help of pitot tube.
2. To find out the terminal velocity of a spherical body in water.
3. Calibration of Orifice meter and Venturi meter
4. Determination of Cc, Cv, Cd of Orifices
5. Calibration of Nozzle meter and Mouth Piece
6. Reynolds experiment for demonstration of stream lines & turbulent flow
7. Determination of meta-centric height
8. Determination of Friction Factor of a pipe
9. To study the characteristics of a centrifugal pump.
10. Verification of Impulse momentum principle.

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AE-801(1)
ROCKETS AND MISSILES

UNIT-I ROCKETS SYSTEM

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

UNIT-II AERODYNAMICS OF ROCKETS AND MISSILES

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

UNIT-III MOTION IN SPACE AND GRAVITATIONAL FIELD

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

UNIT-IV STAGING AND CONTROL

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

UNIT-V MATERIALS USED FOR ROCKETS AND MISSILES

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

TEXT BOOKS

1. Sutton G. P, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 1993.
2. Cornelisse, J.W., "Rocket Propulsion and Space Dynamics", J.W., Freeman & Co. Ltd., London, 1982.

REFERENCES

1. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1998.
2. Parker, E. R., "Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1982.
3. M. J. Zucrow, "Missile Propulsion", John Wiley & sons.
4. H. S. Mukunda, "Understanding Aerospace Chemical Propulsion", Interline Publishing Company Bangalore.

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AE-801(2)
FATIGUE AND FRACTURE MECHANICS

UNIT-I FATIGUE OF MATERIALS

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors – Plastic stress concentration factors - Notched S.N. curves.

UNIT-II FATIGUE BEHAVIOUR

Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life – cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques –Cumulative damage.

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, extension of Griffith's theory to ductile materials - stress analysis of cracked bodies - Effect of thickness on fracture toughness - stress intensity factors for typical geometries.

UNIT-V FATIGUE DESIGN AND TESTINIG

Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

TEXT BOOKS

1. Prasanth Kumar – "Elements of fracture mechanics" – Wheeter publication, 1999.
2. Barrois W, Ripely, E.L., "Fatigue of aircraft structure", Pegamon press. Oxford, 1983.

REFERENCES

1. Sin, C.G., "Mechanics of fracture" Vol. I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1989.
2. Knott, J.F., "Fundamentals of Fracture Mechanics", Buterworth & Co., Ltd., London, 1983

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AE-801(3)
AIRFRAME MAINTENANCE AND REPAIR

UNIT-I WELDING IN AIRCRAFT STRUCTURE

Equipments used in welding shop and their maintenance – Ensuring quality welds –Welding jigs and fixtures – Soldering and brazing.

SHEET METAL REPAIR AND MAINTENANCE

Inspection of damage – Classification – Repair or replacement – Sheet metal inspection – N.D.T. Testing – Riveted repair design, Damage investigation.

UNIT-II PLASTICS AND COMPOSITES IN AIRCRAFT

Review of types of plastics used in airplanes – Maintenance and repair of plastic components – Repair of cracks, holes etc., various repair schemes – Scopes. Inspection and Repair of composite components – Special precautions.

UNIT-III AIRCRAFT JACKING AND RIGGING

Airplane jacking and weighing and C.G. Location. Balancing of control surfaces –Inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

UNIT-IV REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM

Trouble shooting and maintenance practices–Service and inspection–Inspection and maintenance of landing gear systems. – Inspection and maintenance of air-conditioning and pressurization system, water and waste system. Installation and maintenance of Instruments –handling– Testing – Inspection. Inspection and maintenance of auxiliary systems. Position and warning system

UNIT-V SAFETY PRACTICES

Hazardous materials storage and handling, Aircraft furnishing practices – Equipments. Trouble Shooting - Theory and practices.

TEXT BOOK

1. KROES, WATKINS, DELP, "Aircraft Maintenance and Repair", McGraw-Hill, New York, 1992.

REFERENCES

1. LARRY REITHMEIR, "Aircraft Repair Manual", Palamar Books, Marquette, 1992.
2. BRIMM D.J. BOGGES H.E., "Aircraft Maintenance", Pitman Publishing corp. New York,

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AE-801(4)
AIR TRAFFIC CONTROL AND AERODROME DESIGN

UNIT-I BASIC CONCEPTS ATC

Objectives of ATS - Parts of ATC service – Scope and Provision of ATCs–VFR & IFR operations – Classification of ATS air spaces – Varies kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS– Division of responsibility of control.

UNIT-II AIR TRAFFIC SERVICES

Area control service, assignment of cruising levels minimum flight altitude ATS routes and significant points – RNAV and RNP – Vertical, lateral and longitudinal separations based on time / distance –ATC clearances – Flight plans – position report.

UNIT-III FLIGHT INFORMATION ALERTING SERVICES AND RULES OF THE AIR

Radar service, Basic radar terminology – Identification procedures using primary /secondary radar – performance checks – use of radar in area and approach control services – assurance control and co ordination between radar / non radar control –emergencies – Flight information and advisory service – Alerting service – Co-ordination and emergency procedures – Rules of the air.

UNIT-IV AERODROME DATA AND PHYSICAL CHARACTERISTICS

Aerodrome data - Basic terminology – Aerodrome reference code – Aerodrome reference point – Aerodrome elevation – Aerodrome reference temperature – Instrument runway, physical Characteristics; length of primary / secondary runway – Width of runways – Minimum distance between parallel runways etc.

UNIT-V VISUAL AIDS FOR NAVIGATION, VISUAL AIDS FOR DENOTING OBSTACLES EMERGENCY

Visual aids for navigation Wind direction indicator – Landing direction indicator – Location and characteristics of signal area –Markings, general requirements–Various markings–Lights, general requirements – Aerodrome beacon, identification beacon –Simple approach lighting system and various lighting systems – VASI & PAPI – Visual aids for denoting obstacles; object to be marked and lighter – Emergency.

TEXT BOOK

1. AIP (India) Vol. I & II, "The English Book Store", 17-1, Connaught Circus, New Delhi.

REFERENCES

1. "Aircraft Manual (India) Volume I", latest Edition –The English Book Store, 17-1, Connaught Circus, New Delhi.
2. "PANS – RAC –ICAO DOC 4444", Latest Edition, the English Book Store, 17-1, Connaught Circus, New Delhi

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AE 802
HELICOPTER AERODYNAMICS

UNIT I-ELEMENTS OF HELICOPTER AERODYNAMICS

Configurations based on torque reaction-Jet rotors and compound helicopters- Methods of control — Collective and cyclic pitch changes - Lead - Lag and flapping hinges.

UNIT II- ROTOR THEORY

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

UNIT III -POWER ESTIMATES

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

UNIT IV-LIFT, PROPULSION AND CONTROL OF VTOL and STOL AIRCRAFT

Various configuration - Propeller, rotor, ducted fan and jet lift - Tilt wing and vectored thrust - Performance of VTOL and STOL aircraft in hover, transition and forward motion.

UNIT V-GROUND EFFECT

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

TEXTBOOKS

1. Gessow, A., and Myers, G, C., "Aerodynamics of Helicopter", Macmillan & Co., N.Y. 1987.
2. McCormick, B, W., "Aerodynamics of V/STOL Flight", Academic Press, 1987

REFERENCES

1. Johnson, W., "Helicopter Theory," Princeton University Press, 1980.
2. McCormick, B, W., "Aerodynamics, Aeronautics and Flight Mechanics" John Wiley, 1995.
3. Gupta, L., "Helicopter Engineering

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AE-803
COMPUTATIONAL FLUID DYNAMICS

UNIT-I FUNDAMENTAL OF COMPUTATIONAL FLUID DYNAMICS

Introduction - Basic Equations of Fluid Dynamics - Incompressible In viscid flows: Source, vortex and doublet panel, methods - lifting flows over arbitrary bodies. Mathematical properties of Fluid Dynamics Equations -Elliptic, Parabolic and Hyperbolic equations - Well posed problems - Discretization of partial Differential Equations -Transformations and grids.

UNIT-II PANEL METHODS

Introduction to Panel Methods – Source panel method – Vortex panel method – advantages of Panel Methods and Applications.

UNIT-III DISCRETIZATION

Boundary layer Equations and methods of solution -Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation –Stability properties of explicit and implicit methods - Conservative upwind discretization for Hyperbolic systems.

UNIT-IV FINITE ELEMENT TECHNIQUES

Finite Element Techniques in Computational Fluid Dynamics; introduction - Strong and Weak Formulations of a Boundary Value Problem-Strong formulation–Weighted Residual Formulation-Galerkin Formulation - Weak Formulation – Variational Formulation - Piecewise defined shape functions - Implementation of the FEM.

UNIT-V FINITE VOLUME TECHNIQUES

Finite Volume Techniques - Cell Centered Formulation - ~ Lax - Vendor off Time Stepping - Runge - Kutta Time Stepping - Multi - stage Time Stepping -Accuracy- Cell Vertex Formulation - Multistage Time Stepping - FDM -like Finite Volume Techniques - Central and Up-wind Type Discretizations - Treatment of Derivatives.

TEXT BOOK

1. Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics", Vols. I and II, Springer - Verlag, Berlin, 1988.
2. "Computational Fluid Dynamics", T. J. Chung, Cambridge University Press, 2002.

REFERENCES

1. John F. Wendt (Editor), "Computational Fluid Dynamics - An Introduction", Springer – Verlag, Berlin, 1992.
2. Charles Hirsch, "Numerical Computation of Internal and External Flows", Vols. I and II, John Wiley & Sons, New York, 1988.
3. Klaus A Hoffmann and Steve T. Chiang. "Computational Fluid Dynamics for Engineers", Vols. I & II Engineering Education System, P.O. Box 20078, W. Wichita, K.S., 67208 – 1078 USA, 1993.
4. Anderson, John D., "Computational Fluid Dynamics", McGraw-Hill, 1995.

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LIST OF EXPERIMENT

1. Introduction to Modeling and Simulation Software to Aerodynamic problems.
2. Solution for the one dimensional wave equations using explicit method of Lax Using Finite Difference Method (code development)
3. Solution for the one dimensional Heat Conduction Equation using Explicit Method using Finite Difference Method (Code Development)
4. Generation of the Algebraic Grid (Code Development)
5. Generation of the Elliptic Grids (Code Development)
6. Numerical Simulation of flow over an airfoil using commercial software Packages.
7. Numerical Simulation of supersonic flow over a Wedge using commercial Software packages.
8. Numerical Simulation of flat Plate Boundary Layer using commercial Software packages.
9. Numerical Simulation of laminar flow through pipe using commercial Software packages.
10. Numerical Simulation of flow past cylinder using Commercial Software packages.

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AE-804
AIR TRANSPORTATION AND AIRCRAFT MAINTENANCE

UNIT-I INTRODUCTION

Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft, airport: airline management and organisation – levels of management, functions of management, Principles of organisation planning the organisation –chart, staff departments & line departments

UNIT-II AIRLINE ECONOMICS AND PLANNING

Forecasting – Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. – Passenger fare and tariffs – Influence of geographical, economic & political factors on routes and route selection.

FLEET PLANNING: The aircraft selection process – Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition – Valuation & Depreciation – Budgeting, Cost planning – Aircrew evaluation – Route analysis – Aircraft evaluation.

UNIT-III AIRLINES SCHEDULING

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipments and types of schedule –hub & spoke scheduling, advantages/ disadvantages & preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT-IV AIRCRAFT RELIABILITY

Aircraft reliability – The maintenance schedule & its determinations – Condition monitoring maintenance – Extended range operations (EROPS) & ETOPS – Ageing aircraft maintenance production.

UNIT-V TECHNOLOGY IN AIRCRAFT MAINTENANCE

Airlines scheduling (with reference to engineering) – Product support and spares –Maintenance sharing – Equipment and tools for aircraft maintenance – Aircraft weight control – Budgetary control. On board maintenance systems – Engine monitoring – Turbine engine oil maintenance – Turbine engine vibration monitoring in aircraft – Life usage monitoring – Current capabilities of NDT – Helicopter maintenance – Future of aircraft maintenance.

TEXT BOOKS

1. FEDRIC J.H., "Airport Management", 2000.
2. C.H. FRIEND, "Aircraft Maintenance Management", 2000.

REFERENCES

1. Gene Kropf, "Airline Procedures".
2. Wilson & Bryon, "Air Transportation".
3. Philip Locklin D, "Economics of Transportation".
4. "Indian Aircraft manual" – DGCA Pub.
5. Alexander T Wells, "Air Transportation", Wadsworth Publishing Company, California, 1993.

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LIST OF EXPERIMENT

1. Aircraft "Jacking Up" procedure
2. Aircraft "Leveling" procedure
3. Control System "Rigging check" procedure
4. Aircraft "Symmetry Check" procedure
5. "Flow test" to assess of filter element clogging
6. "Pressure Test" To assess hydraulic External/Internal Leakage
7. "Functional Test" to adjust operating pressure
8. "Pressure Test" procedure on fuel system components
9. "Brake Torque Load Test" on wheel brake units
10. Maintenance and rectification of snags in hydraulic and fuel systems.

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AE-805
MAJOR PROJECT

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the Aeronautical branch of study. Every project work shall have a guide who is the assigned faculty member of the institution. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines. The continuous assessment shall be made as prescribed by the regulation.

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AE-807
SEMINAR & GROUP DISCUSSION

Objective of GD and seminar is to improve the mass communication and convincing / understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves. Evaluation will be done by assigned faculty based on group discussion and power point presentation.

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AE-806
Energy Conversion Lab

LIST OF EXPERIMENT

- Study of direct and diffused beam solar radiation
- Study of green house effect
- Performance evaluation of solar flat plate collector
- External flow over Ahmed body
- Performance evaluation of solar funnel

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Name of Faculty: School of Engineering

Name of Department: **Aeronautical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **15/05/2018**

The Board of Studies Committee Meeting was held in the room of Department of Aeronautical Engineering at 2:30 PM. on **15/05/2018**, Following members were present.

1. Mr. Prashant Singh, Asst. Prof.(Aeronautical Engineering) – Chairman
2. Mr.Dhananjay Yadav, Asstt. Prof. (Mech.), Member
3. Mr. Anil Verma,Assist. Prof. (Mech.), Member
4. Mrs.Priyanka Jhavar,Asst Prof (Mech.)Member

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda Preparation of syllabus and Scheme for VII and VIII Sem.

Discussion Scheme

Scheme and syllabus was put up before the member as per recent CBCS Guidelines, It was discussed in Detail by the Members and some modifications were suggested.

Resolution of the Discussion:

It was resolved that the scheme and syllabus as proposed with some modification and may be accepted .

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

Mr. Prashant Singh, Asst. Prof.(Aeronautical Engineering) – Chairman

Mr..Dhananjay Yadav Asstt. Prof. (Mech.), Member Dyadav

Mr. Anil Verma,Assist. Prof. (Mech.), Member Anil Verma.

Mrs.Priyanka Jhavar,Asst Prof (Mech.)Member

Chairman

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Scheme of Examination - CBCS Pattern

Academic Year 2016– 2017

Branch : Aeronautical Engineering

Semester - VII

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	AEC - 701	Rockets and Missiles	60	30	10	30	20	2	1	2	4	150
2	AEC - 702	Computational Fluid Dynamics	60	30	10	30	20	2	1	2	4	150
3	AEC - 703	Aircraft Design	60	30	10	30	20	2	1	2	4	150
4	AEC - 704 (A)	Hydraulics and Pneumatics	60	30	10			2	1		3	100
	AEC - 704 (B)	Guidance and Navigation										
	AEC - 704 (C)	Flight Testing										
5	AEC - 705 (A)	Refrigeration & Air Conditioning	60	30	10			2	1		3	100
	AEC - 705 (B)	Aerospace Quality Assurance										
	AEC - 705 (C)	Optimisation Techniques										
6	AEC - 706 (A)	Micro and Smart SystemsTechnology	60	30	10			2	1		3	100
	AEC - 706 (B)	Total Quality Management										
	AEC - 706 (C)	Nondestructive Testing										
7	AEC - 707	Industrial Training - II					100			4	2	100
TOTAL			**360**	**180**	**60**	**90**	**160**	**12**	**6**	**10**	**23**	**850**

Department Elective are AEC 704 & AEC 705

Open Elective - AEC 706

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Scheme of Examination - CBCS Pattern

Academic Year 2016– 2017

Branch : Aeronautical Engineering **Semester - VIII**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	AEC - 801	Finite Elements Methods	60	30	10	30	20	2	1	2	4	150
2	AEC - 802	Avionics-I	60	30	10	30	20	2	1	2	4	150
4	AEC - 803 (A)	Industrial Aerodynamics	60	30	10			2	1		3	100
	AEC - 803 (B)	Agile Manufacturing										
	AEC - 803 (C)	Aircraft Production										
5	AEC - 804 (A)	Air Navigation & Communication	60	30	10			2	1		3	100
	AEC - 804 (B)	Fuels & Combustion										
	AEC - 804 (C)	Maintenance of Radio & Communication systems										
6	AEC - 805 (A)	Renewable Energy Sources	60	30	10			2	1		3	100
	AEC - 805 (B)	Cyber Security										
	AEC - 805 (C)	Cryogenic Engineering										
7	AEC - 806	Industrial Training Project - II				50	100			8	4	150
8	AEC - 807	General Proficiency					100		2		2	100
TOTAL			**300**	**150**	**50**	**110**	**240**	**10**	**7**	**12**	**23**	**850**

Department Elective are AEC - 803 & AEC-804

Open Elective - AEC 805

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AE -701(A) Elective

Total Quality Management

UNIT I: INTRODUCTION

Time Management, Stress Management, Goals and Career Planning – Interpersonal interaction. Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques, Basic concepts of Total Quality Management, Principles of TQM, Leadership Concepts, Role of Senior Management, Quality Council, Deming Philosophy, Barriers to TQM Implementation.

UNIT II: TQM PRINCIPLES

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III: STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV: QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

UNIT V: MANGEMEMENT

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

TEXT BOOK

1. Dale H. Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES

1. James R. Evans & William M. Lidsay, "The Management and Control of Quality", (5thEdition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum. A.V. "Total Quality Management", McGraw-Hill, 1991
3. Oakland. J.S. "Total Quality Management", Butterworth Heinemann Ltd., 1989
4. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International.

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AE -701(B) Elective
Wind Tunnel Techniques

UNIT I: PRINCIPLES OF MODEL TESTING
Buckingham Theorem – Non-Dimensional Numbers – Scale Effect Types of Similarity.

UNIT II: WIND TUNNELS
Classification – Special problems of Testing in Subsonic, Transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.

UNIT III: CALIBRATION OF WIND TUNNELS
Test section speed – Horizontal buoyancy – Flow angularities – Turbulence measurements – Associated instrumentation – Calibration of supersonic tunnels.

UNIT IV: WIND TUNNEL MEASUREMENTS
Pressure and velocity measurements – Force measurements – Three component and six component balances – Internal balances.

UNIT V: FLOW VISUALIZATION TECHNIQUES
Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.

TEXT BOOK

1. Rae, W.H. and Pope, A. "Low Speed Wind Tunnel Testing", John Wile Publication, 1914.

REFERENCE

1. Pope, A., and Goin, L., "High Speed wind Tunnel Testing", John Wiley, 1915

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AE – 701(C) Elective
Theory of plates and shells

UNIT I: INTRODUCTION TO CLASSICAL PLATE THEORY
Classical Plate Theory – Assumptions – Differential Equation – Boundary Conditions.

UNIT II: PLATES OF VARIOUS SHAPES
Navier's Method of Solution for Simply Supported Rectangular Plates – Leavy's Method of Solution for Rectangular Plates under Different Boundary Conditions. Governing Equation – Solution for Axi - symmetric loading – Annular Plates – Plates of other shapes.

UNIT III: STABILITY ANALYSIS
Stability and free Vibration Analysis of Rectangular Plates.

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

UNIT V: THEORY OF SHELLS
Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.

TEXT BOOK
1. Timoshenko, S.P. Winowsky S., and Kreger, "Theory of Plates and Shells", McGraw-Hill Book Co. 1990.

REFERENCES

1. Flugge, W. "Stresses in Shells", Springer – Verlag, 1985.
2. Timoshenko, S.P. and Gere, J.M., "Theory of Elastic Stability", McGraw-Hill BookCo. 1999.

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AE -702

Industrial Aerodynamics

UNIT I: ATMOSPHERIC WIND

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

UNIT II: WIND TURBINE

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

UNIT III: VEHICLE AERODYNAMICS

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

UNIT IV: 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.

UNIT V: AIR FLOW INDUCED VIBRATIONS

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

TEXT BOOKS

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

REFERENCES

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

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AE-703
FINITE ELEMENT METHODS

UNIT I: INTRODUCTION TO FEM AND ITS APPLICABILITY
Review of mathematics: Matrix algebra, Gauss elimination method, Uniqueness of solution, Banded symmetric matrix and bandwidth. Structure analysis Two-force member element, Local stiffness matrix, coordinates transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix.

UNIT II: ONE-DIMENSIONAL FINITE ELEMENT ANALYSIS
Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, General steps of FEM, Finite element model concept /Discretization, Derivation of finite elements equations using potential energy approach for linear and quadratic 1-D bar element and beam element, shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain.

UNIT III: TWO DIMENSIONAL FINITE ELEMENT ANALYSIS
Finite element formulation using three nodded triangular (CST) element and four nodded rectangular element, Plane stress and Plain strain problems, Shape functions, node numbering and connectivity, Assembly, Boundary conditions, Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation of stress and strain.

UNIT IV: FINITE ELEMENT FORMULATION
Method of Weighted Residuals ,Collocation, Sub domain method, Least Square method and Galerkin's method, Application to one dimensional problems, one-dimensional heat transfer, etc. introduction to variation formulation (Ritz Method.)

UNIT V: HIGHER ORDER ELEMENTS
Lagrange's interpolation formula for one and two independent variable, Convergence of solution, compatibility, element continuity, static condensation, p and h methods of mesh refinement, Aspect ratio and element shape, Application of FEM, Advantages of FEM, Introduction to concept of element mass matrix and Damping matrix in dynamic analysis, Calculation of natural frequencies and modes.

TEXT BOOK

1. Text Book of Finite Element Analysis, Seshu P., Prentice Hall India.
2. Finite Element Procedure in Engineering Analysis, Bathe K.J., Prentice Hall India.

REFERENCE BOOKS

1. An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw-Hill, New Delhi.
2. Concepts & Applications of Finite Element Analysis, Cook, Malkus, Plesha and W

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Willey India, New Delhi.
3. Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall.

LIST OF EXPERIMENTS

1. Write flow chart of finite element steps.
2. Study and understand the convergence of the problem.
3. Solve stiffness matrix for bar, beam and frame problems using suitable boundary condition.
4. Plane stress and plane strain condition are used to understand 2d structures.
5. Analysis of beams and frames (bending problems)
6. Analysis of beams and frames (torsion problems)
7. Nodal analysis problem.
8. Heat transfer problems.
9. Problems leading to analysis of three dimensional solids.
10. Problems leading to analysis of axisymmetric solids.

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AE -704
Avionics - I

UNIT I: INTRODUCTION

Need for avionics in civil and military aircraft and space systems – Integrated avionics and weapon systems – Typical avionics subsystems, design, technologies.

UNIT II: PRINCIPLE OF DIGITAL SYSTEMS

Digital computer – Microprocessors – Memories.

UNIT III: AVIONICS ARCHITECTURE

Avionics system architecture – Data buses – MIL – STD - 1553B – ARINC – 420 – ARINC – 629.

UNIT IV: FLIGHT DECKS AND COCKPITS SYSTEM

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT V: INTODUCTION TO AVIONICS SYSTEMS

Communications systems- Navigation systems – Flight control systems – Radar –Electronic Warfare – Utility systems Reliability and maintainability – Certification.

TEXT BOOKS

1. Middleton, D.H., Ed., Avionics systems, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
2. Spitzer, C.R. Digital Avionics Systems, Prentice-Hall, Englewood Cliffs, N.J., U.S.A. 1987.

REFERENCES

1. Malvino, A.P. and Leach, D.P. Digital Principles and Applications, Tata McGraw-Hill, 1990.
2. Gaokar, R.S. Microprocessors Architecture-Programming and Applications, Wileyand Sons Ltd., New Delhi, 1990.

LIST OF EXPERIMENTS

1. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.
2. Study of Different Avionics Data Buses.
3. MIL-Std - 1553 Data Buses Configuration with Message transfer.
4. MIL-Std - 1553 Remote Terminal Configuration.
5. Multiplexer/ Demultiplexer Circuits.
6. Encoder/Decoder Circuits.
7. Timer Circuits, Shift Registers, Binary Comparator Circuits.
8. Addition and Subtraction of 8-bit and 16-bit numbers.
9. Greatest in a given series & Multi-byte addition in BCD mode.
10. Interface programming with 4 digit 7 segment Display & Switches & LED's

AE-705
Aircraft Materials and Composite

UNIT I: METALS AND ALLOYS

Introduction to Aerospace materials: Classification, composition, properties, heat treatment & application in plain carbon steels, Alloy steels. Stainless steels, heat treatment & application in aluminium and its alloys. Introduction to oxidation and hot corrosion.

UNIT II: COMPOSITE MATERIALS AND PROPERTIES

Introduction to composite materials: Definition – Classification of Composite materials based on structure – based on matrix. Advantages of composites – application of composites – functional requirements of reinforcement and matrix. FIBERS: properties and applications of glass fibers, carbon fibers, Kevlar fibers and metal fibers.

UNIT III: MANUFACTURING OF ADVANCED COMPOSITES

Polymer matrix composites: Metal Matrix Composites, manufacturing and application, Casting – Solid State diffusion technique, Cladding – Hot-iso static pressing.

UNIT IV: CREEPAND FRACTURE

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate. Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship. Various types of fracture, brittle & ductile, low temperature & high temperature, cleavage fracture, ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides. Fatigue of aircraft materials.

UNIT V: SUPERALLOYS AND HIGH TEMPERATURE MATERIALS

Iron base, Nickel base and Cobalt base super alloys, titanium alloys composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, high temperature ceramics.

TEXT BOOKS

1. Material Science and Technology – Vol 13 – Composites by Cahn – VCH, West Germany Composite Materials – K.K. Chawla.
2. Calcote, L R. "The Analysis of laminated Composite Structures", Von – Noastrand Reinhold Company, New York 1998.
3. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 1985.
4. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.
5. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.

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LIST OF EXPERIMENTS

1. Determination of mechanical properties of plain carbon steel using heat treatment techniques.
2. Solution treatment and hardening of Al-Mg and Al-Cu base alloys.
3. Fatigue and creep behavior iron base alloys.
4. Convert the Load-Displacement data to Stress-Strain data and plot out the Stress versus Strain curve for each specimen.
5. From the Stress-Strain curves, determine the Elastic Modulus (E1) and Ultimate Strength (SU1) for each sample tested.
6. Compare the theoretically determined Longitudinal and Transverse Moduli (EL and ET) obtained in step 2 with the experimentally determined Longitudinal and Transverse Moduli (EL and ET) in step 6. Comment on any differences.
7. Calculate the Elastic Modulus along the loading axis, E1, and the In-Plane Poisson's Ratio along the loading axis, ν 12, for each orientation tested based on the experimentally obtained values of Longitudinal and Transverse Moduli and the calculated values of the In-Plane Shear Modulus and the Major Poisson's Ratio.
8. Compare the stiffness and strength results of the polymers tested with the results of the Graphite /epoxy composite.
9. Calculate the Longitudinal and Transverse Moduli (EL and ET respectively) based on the fiber and matrix property data for IM7/8551.
10. Calculate the Major In-Plane Shear Modulus (GLT) and the Major Poisson's Ratio (ν LT) for the IM7/8551 unidirectional composite being investigated.

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AE -706
Minor Project & Seminar

The objective of the project work phase – I/ Minor project is to prepare students for undertaking useful/application oriented project on current topic of the subject concerned. Preparation of the project work involves.

- ✓ Form a team / group of likeminded students (not more than 6 in numbers) to carry out the project.
- ✓ Make a literature survey and data collection or literature review of the project proposed.
- ✓ Publish or present a paper on the proposed work in any one of the National/ International Seminars or Journals.

Plan for necessary supports, facilities, analytical tools and fixation of faculties /supervisors for the final semester Major project/ project work phase – II.

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AE-801(1)
ROCKETS AND MISSILES

UNIT-I ROCKETS SYSTEM

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

UNIT-II AERODYNAMICS OF ROCKETS AND MISSILES

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

UNIT-III MOTION IN SPACE AND GRAVITATIONAL FIELD

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

UNIT-IV STAGING AND CONTROL

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

UNIT-V MATERIALS USED FOR ROCKETS AND MISSILES

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

TEXT BOOKS

1. Sutton G. P, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 1993.
2. Cornelisse, J.W., "Rocket Propulsion and Space Dynamics", J.W., Freeman & Co. Ltd., London, 1982.

REFERENCES

1. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1998.
2. Parker, E. R., "Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1982.
3. M. J. Zucrow, "Missile Propulsion", John Wiley & sons.
4. H. S. Mukunda, "Understanding Aerospace Chemical Propulsion", Interline Publishing Company Bangalore.

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AE-801(2)
FATIGUE AND FRACTURE MECHANICS

UNIT-I FATIGUE OF MATERIALS

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors – Plastic stress concentration factors - Notched S.N. curves.

UNIT-II FATIGUE BEHAVIOUR

Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life – cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques –Cumulative damage.

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, extension of Griffith's theory to ductile materials - stress analysis of cracked bodies - Effect of thickness on fracture toughness - stress intensity factors for typical geometries.

UNIT-V FATIGUE DESIGN AND TESTINIG

Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

TEXT BOOKS

1. Prasanth Kumar – "Elements of fracture mechanics" – Wheeter publication, 1999.
2. Barrois W, Ripely, E.L., "Fatigue of aircraft structure", Pegamon press. Oxford, 1983.

REFERENCES

1. Sin, C.G., "Mechanics of fracture" Vol. I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1989.
2. Knott, J.F., "Fundamentals of Fracture Mechanics", Buterworth & Co., Ltd., London, 1983

AE-801(3)
AIRFRAME MAINTENANCE AND REPAIR

UNIT-I WELDING IN AIRCRAFT STRUCTURE

Equipments used in welding shop and their maintenance – Ensuring quality welds –Welding jigs and fixtures – Soldering and brazing.

SHEET METAL REPAIR AND MAINTENANCE

Inspection of damage – Classification – Repair or replacement – Sheet metal inspection – N.D.T. Testing – Riveted repair design, Damage investigation.

UNIT-II PLASTICS AND COMPOSITES IN AIRCRAFT

Review of types of plastics used in airplanes – Maintenance and repair of plastic components – Repair of cracks, holes etc., various repair schemes – Scopes. Inspection and Repair of composite components – Special precautions.

UNIT-III AIRCRAFT JACKING AND RIGGING

Airplane jacking and weighing and C.G. Location. Balancing of control surfaces –Inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

UNIT-IV REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM

Trouble shooting and maintenance practices–Service and inspection–Inspection and maintenance of landing gear systems. – Inspection and maintenance of air-conditioning and pressurization system, water and waste system. Installation and maintenance of Instruments –handling– Testing – Inspection. Inspection and maintenance of auxiliary systems. Position and warning system

UNIT-V SAFETY PRACTICES

Hazardous materials storage and handling, Aircraft furnishing practices – Equipments. Trouble Shooting - Theory and practices.

TEXT BOOK

1. KROES, WATKINS, DELP, "Aircraft Maintenance and Repair", McGraw-Hill, New York, 1992.

REFERENCES

1. LARRY REITHMEIR, "Aircraft Repair Manual", Palamar Books, Marquette, 1992.
2. BRIMM D.J. BOGGES H.E., "Aircraft Maintenance", Pitman Publishing corp. New York,

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AE-801(4)
AIR TRAFFIC CONTROL AND AERODROME DESIGN

UNIT-I BASIC CONCEPTS ATC

Objectives of ATS - Parts of ATC service – Scope and Provision of ATCs–VFR & IFR operations – Classification of ATS air spaces – Varies kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS– Division of responsibility of control.

UNIT-II AIR TRAFFIC SERVICES

Area control service, assignment of cruising levels minimum flight altitude ATS routes and significant points – RNAV and RNP – Vertical, lateral and longitudinal separations based on time / distance –ATC clearances – Flight plans – position report.

UNIT-III FLIGHT INFORMATION ALERTING SERVICES AND RULES OF THE AIR

Radar service, Basic radar terminology – Identification procedures using primary /secondary radar – performance checks – use of radar in area and approach control services – assurance control and co ordination between radar / non radar control –emergencies – Flight information and advisory service – Alerting service – Co-ordination and emergency procedures – Rules of the air.

UNIT-IV AERODROME DATA AND PHYSICAL CHARACTERISTICS

Aerodrome data - Basic terminology – Aerodrome reference code – Aerodrome reference point – Aerodrome elevation – Aerodrome reference temperature – Instrument runway, physical Characteristics; length of primary / secondary runway – Width of runways – Minimum distance between parallel runways etc.

UNIT-V VISUAL AIDS FOR NAVIGATION, VISUAL AIDS FOR DENOTING OBSTACLES EMERGENCY

Visual aids for navigation Wind direction indicator – Landing direction indicator – Location and characteristics of signal area –Markings, general requirements–Various markings–Lights, general requirements – Aerodrome beacon, identification beacon –Simple approach lighting system and various lighting systems – VASI & PAPI – Visual aids for denoting obstacles; object to be marked and lighter – Emergency.

TEXT BOOK

1. AIP (India) Vol. I & II, "The English Book Store", 17-1, Connaught Circus, New Delhi.

REFERENCES

1. "Aircraft Manual (India) Volume I", latest Edition –The English Book Store, 17-1, Connaught Circus, New Delhi.
2. "PANS – RAC –ICAO DOC 4444", Latest Edition, the English Book Store, 17-1, Connaught Circus, New Delhi

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AE 802
HELICOPTER AERODYNAMICS

UNIT I-ELEMENTS OF HELICOPTER AERODYNAMICS

Configurations based on torque reaction-Jet rotors and compound helicopters- Methods of control — Collective and cyclic pitch changes - Lead - Lag and flapping hinges.

UNIT II- ROTOR THEORY

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

UNIT III -POWER ESTIMATES

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

UNIT IV-LIFT, PROPULSION AND CONTROL OF VTOL and STOL AIRCRAFT

Various configuration - Propeller, rotor, ducted fan and jet lift - Tilt wing and vectored thrust - Performance of VTOL and STOL aircraft in hover, transition and forward motion.

UNIT V-GROUND EFFECT

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

TEXTBOOKS

1. Gessow, A., and Myers, G, C., "Aerodynamics of Helicopter", Macmillan & Co., N.Y. 1987.
2. McCormick, B, W., "Aerodynamics of V/STOL Flight", Academic Press, 1987

REFERENCES

1. Johnson, W., "Helicopter Theory," Princeton University Press, 1980.
2. McCormick, B, W., "Aerodynamics, Aeronautics and Flight Mechanics" John Wiley, 1995.
3. Gupta, L., "Helicopter Engineering

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AE-803
COMPUTATIONAL FLUID DYNAMICS

UNIT-I FUNDAMENTAL OF COMPUTATIONAL FLUID DYNAMICS

Introduction - Basic Equations of Fluid Dynamics - Incompressible In viscid flows: Source, vortex and doublet panel, methods - lifting flows over arbitrary bodies. Mathematical properties of Fluid Dynamics Equations -Elliptic, Parabolic and Hyperbolic equations - Well posed problems - Discretization of partial Differential Equations -Transformations and grids.

UNIT-II PANEL METHODS

Introduction to Panel Methods – Source panel method – Vortex panel method – advantages of Panel Methods and Applications.

UNIT-III DISCRETIZATION

Boundary layer Equations and methods of solution -Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation –Stability properties of explicit and implicit methods - Conservative upwind discretization for Hyperbolic systems.

UNIT-IV FINITE ELEMENT TECHNIQUES

Finite Element Techniques in Computational Fluid Dynamics; introduction - Strong and Weak Formulations of a Boundary Value Problem-Strong formulation–Weighted Residual Formulation-Galerkin Formulation - Weak Formulation – Variational Formulation - Piecewise defined shape functions - Implementation of the FEM.

UNIT-V FINITE VOLUME TECHNIQUES

Finite Volume Techniques - Cell Centered Formulation - ~ Lax - Vendor off Time Stepping - Runge - Kutta Time Stepping - Multi - stage Time Stepping -Accuracy- Cell Vertex Formulation - Multistage Time Stepping - FDM -like Finite Volume Techniques - Central and Up-wind Type Discretizations - Treatment of Derivatives.

TEXT BOOK

1. Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics", Vols. I and II, Springer - Verlag, Berlin, 1988.
2. "Computational Fluid Dynamics", T. J. Chung, Cambridge University Press, 2002.

REFERENCES

1. John F. Wendt (Editor), "Computational Fluid Dynamics - An Introduction", Springer – Verlag, Berlin, 1992.
2. Charles Hirsch, "Numerical Computation of Internal and External Flows", Vols. I and II, John Wiley & Sons, New York, 1988.
3. Klaus A Hoffmann and Steve T. Chiang. "Computational Fluid Dynamics for Engineers", Vols. I & II Engineering Education System, P.O. Box 20078, W. Wichita, K.S., 67208 – 1078 USA, 1993.
4. Anderson, John D., "Computational Fluid Dynamics", McGraw-Hill, 1995.

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LIST OF EXPERIMENT

1. Introduction to Modeling and Simulation Software to Aerodynamic problems.
2. Solution for the one dimensional wave equations using explicit method of Lax Using Finite Difference Method (code development)
3. Solution for the one dimensional Heat Conduction Equation using Explicit Method using Finite Difference Method (Code Development)
4. Generation of the Algebraic Grid (Code Development)
5. Generation of the Elliptic Grids (Code Development)
6. Numerical Simulation of flow over an airfoil using commercial software Packages.
7. Numerical Simulation of supersonic flow over a Wedge using commercial Software packages.
8. Numerical Simulation of flat Plate Boundary Layer using commercial Software packages.
9. Numerical Simulation of laminar flow through pipe using commercial Software packages.
10. Numerical Simulation of flow past cylinder using Commercial Software packages.

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AE-804
AIR TRANSPORTATION AND AIRCRAFT MAINTENANCE

UNIT-I INTRODUCTION

Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft, airport: airline management and organisation – levels of management, functions of management, Principles of organisation planning the organisation –chart, staff departments & line departments

UNIT-II AIRLINE ECONOMICS AND PLANNING

Forecasting – Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. – Passenger fare and tariffs – Influence of geographical, economic & political factors on routes and route selection.

FLEET PLANNING: The aircraft selection process – Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition – Valuation & Depreciation – Budgeting, Cost planning – Aircrew evaluation – Route analysis – Aircraft evaluation.

UNIT-III AIRLINES SCHEDULING

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipments and types of schedule –hub & spoke scheduling, advantages/ disadvantages & preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT-IV AIRCRAFT RELIABILITY

Aircraft reliability – The maintenance schedule & its determinations – Condition monitoring maintenance – Extended range operations (EROPS) & ETOPS – Ageing aircraft maintenance production.

UNIT-V TECHNOLOGY IN AIRCRAFT MAINTENANCE

Airlines scheduling (with reference to engineering) – Product support and spares –Maintenance sharing – Equipment and tools for aircraft maintenance – Aircraft weight control – Budgetary control. On board maintenance systems – Engine monitoring – Turbine engine oil maintenance – Turbine engine vibration monitoring in aircraft – Life usage monitoring – Current capabilities of NDT – Helicopter maintenance – Future of aircraft maintenance.

TEXT BOOKS

1. FEDRIC J.H., "Airport Management", 2000.
2. C.H. FRIEND, "Aircraft Maintenance Management", 2000.

REFERENCES

1. Gene Kropf, "Airline Procedures".
2. Wilson & Bryon, "Air Transportation".
3. Philip Locklin D, "Economics of Transportation".
4. "Indian Aircraft manual" – DGCA Pub.
5. Alexander T Wells, "Air Transportation", Wadsworth Publishing Company, California, 1993.

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LIST OF EXPERIMENT

1. Aircraft "Jacking Up" procedure
2. Aircraft "Leveling" procedure
3. Control System "Rigging check" procedure
4. Aircraft "Symmetry Check" procedure
5. "Flow test" to assess of filter element clogging
6. "Pressure Test" To assess hydraulic External/Internal Leakage
7. "Functional Test" to adjust operating pressure
8. "Pressure Test" procedure on fuel system components
9. "Brake Torque Load Test" on wheel brake units
10. Maintenance and rectification of snags in hydraulic and fuel systems.

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AE-805
MAJOR PROJECT

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the Aeronautical branch of study. Every project work shall have a guide who is the assigned faculty member of the institution. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines. The continuous assessment shall be made as prescribed by the regulation.

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AE-807
SEMINAR & GROUP DISCUSSION

Objective of GD and seminar is to improve the mass communication and convincing / understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves. Evaluation will be done by assigned faculty based on group discussion and power point presentation.

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AE-806
Energy Conversion Lab

LIST OF EXPERIMENT

- Study of direct and diffused beam solar radiation
- Study of green house effect
- Performance evaluation of solar flat plate collector
- External flow over Ahmed body
- Performance evaluation of solar funnel

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Name of Faculty: **School of Engineering**

Minutes of Board of Studies Committee Meeting held on Dated **11/06/2018**

The Board of Studies Committee Meeting was held in the Board Room at **2:30 PM.** on **11/06/2018**. Following members were present.

1. Dr. G.R.Selokar, Professor (Mechanical), Chairman
2. Dr. Sanjay Rathore, Professor (Physics), Member
3. Mr. Vijay Prakash Singh, Associate Professor (Electronics and Communication), Member
4. Dr. Ajay Swarup Associate Professor (Civil Engineering), Member
5. Mr. Sanjay Kalraiya, Associate Professor (Mechanical Engineering), Member
6. Dr. Prabodh Khampariya, Associate Professor (Electrical and Electronics Engineering), Member
7. Mr. Kailash patidar , Assistant Professor (Computer Science and Engineering), Member
8. Ms. Alka Thakur, Associate Professor (Electrical Engineering), Member
9. Mr. Anil Verma, Assistant Professor (Mechanical Engineering), Member
10. Mr. Manoj Kumar Gandwane, Assistant Professor (Chemical Engineering), Member
11. Mr. Prashant Singh, Assistant Professor (Aeronautical Engineering), Member
12. Mr. Devendra Patle, Assistant Professor (Electronics and Communication), Member

All the member elected Dr. G.R.Selokar chairman for today's Board of Studies Meeting The Chairman welcomed the members of all department of SOE and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed.

Agenda: - Preparation of Syllabus and Scheme for BE First Year. As Per AICTE Norms

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Discussion:

Committee member discussed the first (I) and second (II) Semester scheme and syllabus. It is decided that first year scheme should be applicable in group manner that is I Semester for Group A (July to December) and II Semester for Group B (July to December) student similarly for January to June session that is II nd Semester for group A and first Semester for group B

Scheme and syllabus was put up before the committee members as per guidelines of ALCTE, It was discussed in detail and some modification was suggested. So as to finalized the scheme

Resolution:

It is unanimously resolved that scheme and syllabus prepared on the guideline of AICTE New Delhi may be applicable w.e.f 2018-2019

The Chairman thanks to the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

1. Dr. G.R. Selokar, Professor (Mechanical), Chairman
2. Dr. Sanjay Rathore, Professor (Physics), Member
3. Mr. Vijay Prakash Singh, Associate Professor (Electronics and Communication), Member
4. Dr. Ajay Swarup Associate Professor (Civil Engineering), Member
5. Mr. Sanjay Kalraiya, Associate Professor (Mechanical Engineering), Member
6. Dr. Prabodh Khampariya, Associate Professor (Electrical and Electronics Engineering), Member
7. Mr. Kailash patidar , Assistant Professor (Computer Science and Engineering), Member
8. Ms. Alka Thakur, Associate Professor (Electrical Engineering), Member
9. Mr. Anil Verma, Assistant Professor (Mechanical Engineering), Member
10. Mr. Manoj Kumar Gandwane, Assistant Professor (Chemical Engineering), Member
11. Mr. Prashant Singh, Assistant Professor (Aeronautical Engineering), Member
12. Mr. Devendra Patle, Assistant Professor (Electronics and Communication), Member

Chairman

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Scheme of Examination

Bachelor of Engineering (CS, CE,ME,AE,MI,EI)

I Semester/ I Year

Academic Year 2019-20

GROUP - B

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	BEBSC-101	Mathematics-I	60	30	10	-	-	100	3		-	3
2	BEBSC- 202	Engineering Physics	60	30	10	30	20	150	2	1	2	4
3	BEESC-203	Basic Computer Engineering	60	30	10	30	20	150	3	-	2	4
4	BEESC-204	Basic Mechanical Engineering	60	30	10	30	20	150	2	-	2	3
5	BEESC-205	Basic Civil Engineering & Mechanics	60	30	10	30	20	150	3	-	2	4
6	BEHSMC-206	Language Lab	-	-	-	30	10	40	-	-	2	1
7	BELC-107	Self Study / GD Seminar					10	10			2	1
		Total	**300**	**150**	**50**	**150**	**100**	**750**	**13**	**1**	**12**	**20**

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Scheme of Examination

Bachelor of Engineering (CS, CE,ME,AE,MI,EI)

II Semester/ I Year **Academic Year 2019-20**

GROUP - B

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	BEBSC-201	Mathematics-II	60	30	10	-	-	100	3		-	3
2	BEBSC-102	Engineering Chemistry	60	30	10	30	20	150	3		2	4
3	BEHSMC-103	English for Communication	60	30	10	30	20	150	3	-	2	4
4	BEESC-104	Basic Electrical & Electronics Engineering	60	30	10	30	20	150	2	-	2	3
5	BEESC-105	Engineering Graphics	60	30	10	30	20	150	2	1	2	4
6	BEESC-106	Manufacturing Practices	-	-	-	30	10	40	-	-	2	1
7	BELC-207	Industrial Training					10	10	-	-	2	1
		Total	**300**	**150**	**50**	**130**	**100**	**750**	**13**	**1**	**12**	**20**

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BEBSC-101
Mathematics-I

UNIT-I

Calculus: Rolle's theorem, Mean Value theorems, Expansion of functions by Mc. Laurin's and Taylor's for one variable; Taylor's theorem for function of two variables, Partial Differentiation, Maxima & Minima (two variables), Method of Lagrange's Multipliers.

UNIT-II

Definite Integral as a limit of a sum and Its application in summation of series; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas, Multiple Integral, Change the order of the integration, Applications of multiple integral for calculating area and volumes of the curves.

UNIT-III

Sequences and series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT-IV

Vector Spaces : Vector Space,Vector Sub Space, Linear Combination of Vectors, Linearly Dependent, Linearly Independent, Basis of a Vector Space,Linear Transformations.

UNIT-V

Matrices :Rank of a Matrix, Solution of Simultaneous Linear Equations by Elementary Transformation, Consistency of Equation, Eigen Values and Eigen Vectors, Diagonalization of Matrices, Cayley-Hamilton theorem and its applications to find inverse.

References:-

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

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BEBSC- 202
Engineering Physics

UNIT-I

Relativistic Mechanics: Frame of reference, Inertial & non-inertial frames, Galilean transformations, Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein's mass energy relation, Relativistic relation between energy and momentum, Massless particle.

UNIT- II

Solid state & Nuclear physics .Free electron theory of metals, Qualitative discussion of Kronig-penny model and origin of energy bands. Intrinsic and Extrinsic Semiconductors. V-I Characteristics of PN junction diode, Zener diode, Hall-effect.

Introduction to Nuclear Physics , Static properties of Nucleus,Nuclear liquid drop model, Nuclear Shell Model, Linear particle accelelerator, Cyclotron, Betatron, Bainbridge mass sprectrograph.

UNIT- III

Quantum Mechanics: Introduction to Quantum mechanics, Wave particle duality, Matter waves, Particle velocity, Phase velocity , Group velocity and their relation. Heisenberg's Uncertainty Principle. Time-dependent and time-independent Schrodinger wave equation, Solution to stationary state Schrodinger wave equation for one-Dimensional particle in a box, Compton effect.

UNIT-IV

Wave Optics: Interference :Coherent sources, Interference in uniform and wedge shaped thin films, Newton's Rings and its applications. Fraunhoffer diffraction at single slit and at double slit, Absent spectra, Diffraction grating, Spectra with grating, Dispersive power of grating, Rayleigh's criterion of resolution. Resolving power of grating and Prism.

UNIT- V

Fibre Optics & Lasers: Fibre Optics: Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency, Classification of fibre, Attenuation and Dispersion in optical fibres.

Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Einstein's coefficients, Population inversion, Various levels of Laser, Ruby Laser, He-Ne Laser, Laser applications.

Reference Books: -

1. Concepts of Modern Physics - AurthurBeiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics - Brijlal& Subramanian (S. Chand)
4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

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List of Experiments: -

1. To determine the wavelength of sodium light by Newton's ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To determine the energy band gap of a given semiconductor material.
4. To determine the plank's constant with help of photocell.
5 .Resolving Power of Telescope.
6 .V-I Charecteristics of P-N Junction diode.
7. Zener diode characteristics.
8. To determine the dispersive power of prism.

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BTEESC-203
Basic Computer Engineering

UNIT-I

Computer: Definition, Classification, Organization i.e. CPU, register, Memory & Storage Systems, I/O Devices, and System & Application Software. Computer application E-Business, Bio-Informatics, health Care, Remote Sensing & GIS, Meteorology and, Computer Gaming, Multimedia and Animation etc.

UNIT-II

Introduction to Algorithms, Complexities and Flowchart, Introduction to Programming, Categories of Programming Languages, Program Design, Programming Paradigms, Characteristics or Concepts of OOP, Procedure Oriented Programming VS object oriented Programming. Introduction to C, Character Set, Tokens, Precedence and Associativity, Program Structure, Data Types, Variables, Operators, Expressions, Statements and control structures, I/O operations, Array, Functions,

UNIT-III

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System. - Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT-IV

Computer Networking: Introduction, Goals, OSI Model, Functions of Different Layers. Internetworking Concepts, Devices, TCP/IP Model. Topology, Introduction to Internet, World Wide Web, E• commerce Computer Security Basics: Introduction to viruses, worms, malware, Trojans, Spyware and Anti-Spyware ´Software, Different types of attacks like Money Laundering, Information Theft, Cyber Pornography, Email spoofing, Denial of Service (DoS), Cyber Stalking, ,Logic bombs, Hacking Spamming, Cyber Defamation, Security measures Firewall,

UNIT-V

Data base Management System: Introduction, File oriented approach and Database approach, Data Models, Architecture of Database System, Data independence, Data dictionary, DBA, Primary Key, Data definition language and Manipulation Languages. Cloud computing: definition, cloud infrastructure, cloud segments or service delivery models (IaaS, PaaS and SaaS), cloud deployment models/ types of cloud (public' private, community and hybrid clouds), Pros and Cons of cloud computing

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Reference books:

1. Introduction of computers: Peter Norton, TMH
2. Object oriented programming with c++ :E.Balaguruswamy,TMH
3. Object oriented programming in C++: Rajesh k.shukla ,Wiley India
4. Computer network: Andrew Tananbaum,PHI
5. Data base management system,Korth,TMH
6. Operating system-silberschatz and Galvin-Wiley India

List Of Experiment:-

1. Study of input and output devices of computer systems .
2. Write a program of addition, subtract, multiplication and division by using C.
3. Write a program to check weather a number is prime or not.
4. Study of various types of Operating System.
5. Study and practice of basic Linux commands-ls, cp, mv, rm, chmod kill, ps etc.
6. Design color coding of straight & crossover cable.
7. Installation of oracle 10g. Also create a employee table.

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BEESC-204
Basic Mechanical Engineering

UNIT-I

Materials : Classification of engineering material, Composition of Cast iron and Carbon steels, Iron Carbon diagram. Alloy steels their applications. Mechanical properties like strength, hardness, toughness ductility, brittleness , malleability etc. of materials , Tensile test- Stress-strain diagram of ductile and brittle materials ,

UNIT-II

Measurement: Concept of measurements, errors in measurement, Temperature, Pressure, Velocity, Flow strain, Force and torque measurement, Vernier caliper, Micrometer, Dial gauge, Slip gauge, Sine-bar and Combination set. Production Engineering: Elementary theoretical aspects of production processes like casting, carpentry, welding etc Introduction to Lathe and Drilling machines and their various operations.

UNIT-III

Fluids : Fluid properties pressure, density and viscosity etc. Types of fluids , Newton's law of viscosity , Pascal's law , Bernoulli's equation for incompressible fluids, Only working principle of Hydraulic machines, pumps, turbines, Reciprocating pumps .

UNIT-IV

Thermodynamics: Thermodynamic system, properties, state, process, Zeroth, First and second law of thermodynamics, thermodynamic processes at constant pressure, volume, enthalpy & entropy.
Steam Engineering: Classification and working of boilers, mountings and accessories of boilers, Efficiency and performance analysis, natural and artificial draught, steam properties, use of steam tables.

UNIT-V

Reciprocating Machines : Working principle of steam Engine, Carnot, Otto, Diesel and Dual cycles P-V & T-S diagrams and its efficiency, working of Two stroke & Four stroke Petrol & Diesel engines. Working principle of compressor.

References : -

1- Kothandaraman & Rudramoorthy, Fluid Mechanics & Machinery, New Age . 2- Nakra & Chaudhary , Instrumentation and Measurements, TMH.
3- Nag P.K, Engineering Thermodynamics , TMH .
4- Ganesan , Internal Combustion Engines, TMH .
5- Agrawal C M, Basic Mechanical Engineering ,Wiley Publication. 6- Achuthan M , , Engineering Thermodynamics ,PHI.

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List of Experiments:-

1- Study of Universal Testing machines.
2- Linear and Angular measurement using, Micrometer, Slip Gauges, Dial Gauge and
3- Study of Lathe Machine.
4- Study of Drilling Machines.
5- Verification of Bernoulli's Theorem.
6- Study of various types of Boilers.
7- Study of different IC Engines.
8- Study of different types of Boilers Mountings and accessories.

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BEESC-205
Basic Civil Engineering & Mechanics

UNIT-I

Building Materials & Construction Stones, bricks, cement, lime, timber-types, properties, test & uses, laboratory tests concrete and mortar Materials: Workability, Strength properties of Concrete, Nominal proportion of Concrete preparation of concrete, compaction, curing. Elements of Building Construction, Foundations conventional spread footings, RCC footings, brick masonry walls, plastering and pointing, floors, roofs, Doors, windows, lintels, staircases – types and their suitability

Unit – II

Surveying & Positioning: Introduction to surveying Instruments – levels, theodolites , plane tables and related devices. Electronic surveying instruments etc. Measurement of distances – conventional and EDM methods, measurement of directions by different methods, measurement of elevations by different methods. Reciprocal levelling .

UNIT-III

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

UNIT-IV

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

UNIT -V

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

Reference Books:

1. S. Ramamrutam & R.Narayanan; Basic Civil Engineering, Dhanpat Rai Pub.
2. Prasad I.B., Applied Mechanics, Khanna Publication.
3. Punmia, B.C., Surveying, Standard book depot.
4. Shesha Prakash and Mogaveer; Elements of Civil Engg & Engg. Mechanics; PHI

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List of Experiments:-

1. To perform traverse surveying with prismatic compass, check for local attraction and determine corrected bearings and to balance the traverse by Bowditch's rule.
2. To perform leveling exercise by height of instrument of Rise and fall method.
3. To measure horizontal and vertical angles in the field by using Theodolite.
4. To determine (a) normal consistency (b) Initial and Final Setting time of a cement Sample.
5. To determine the workability of fresh concrete of given proportions by slump test or compaction factor test.
6. To determine the Compressive Strength of brick .
7. To determine particle size distribution and fineness modulus of course and fine Aggregate.
8. To verify the law of Triangle of forces and Lami's theorem.
9. To verify the law of parallelogram of forces.
10. To verify law of polygon of forces
11. To find the support reactions of a given truss and verify analytically.
12. To determine support reaction and shear force at a given section of a simply Supported beam and verify in analytically using parallel beam apparatus.
13. To determine the moment of inertia of fly wheel by falling weight method.
14. To verify bending moment at a given section of a simply supported beam.

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BEHSMC-206
Language Lab & Seminars

Course objective: This course intends to impart practical training in the use of English Language for Communicative purposes and aims to develop students' personality through language Laboratory.

Topics to be covered in the Language laboratory sessions:

1. Introducing oneself, family, social roles.

2.Public Speaking and oral skills with emphasis on conversational practice, extempore speech, JAM(Just a minute sessions), describing objects and situations, giving directions, debate, telephonic etiquette.

3. Reading Comprehension: Intensive reading skills, rapid reading, and reading aloud (Reading material to be selected by the teacher).

4. To write a book review. Standard text must be selected by the teacher.

5. Role plays: preparation and delivery topic to be selected by teacher/faculty.

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BELC–107
Self Study / GD Seminar

Objective of GD and seminar- is to improve the MASS COMMUNICATION and CONVINCING / understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves. Evaluation will be done by assigned faculty base don group discussion and power point presentation.

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BEBSC-201
MATHEMATICS-II

UNIT-I

Ordinary Differential Equations-I: Differential Equations of First Order and First Degree (Leibnitz linear, Bernoulli"s, Exact), Differential Equations of First Order and Higher Degree, Higher order differential equations with constants coefficients, Homogeneous Linear Differential equations, Simultaneous Differential Equations.

UNIT-II

Ordinary differential Equations-II: Second order linear differential equations with variable coefficients, Method of variation of parameters, Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

UNIT-III

Partial Differential Equations : Formulation of Partial Differential equations, Linear and Non-Linear Partial Differential Equations, Homogeneous Linear Partial Differential Equations with Constants Coefficients.

UNIT-IV

Functions of Complex Variable : Functions of Complex Variables: Analytic Functions, Harmonic Conjugate, Cauchy-Riemann Equations (without proof), Line Integral, theorem ,Cauchy Integral formula (without proof), Singular Points, Poles & Residues, Residue Theorem, Application of Residues theorem for Evaluation of Real Integral.

UNIT-V

Vector Calculus: Differentiation of Vectors, Scalar and vector point function, Gradient, Geometrical meaning of gradient, Directional Derivative, Divergence and Curl, Line Integral, Surface Integral and Volume Integral, Gauss Divergence, Stokes and Green theorems.

REFERENCE:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002
2. Erwin kreyszig , Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. Dip Rima, Elementary Differential Equations and Boundary Value Problems, 9th End., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Codington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Inca, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

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BEBSC-102
ENGINEERING CHEMISTRY

UNIT-I

WATER AND ITS INDUSTRIAL APPLICATIONS : Sources, Impurities, Hardness & its units, Industrial water characteristics, softening of water by various methods (External & Internal treatment), Boiler trouble causes, effect & remedies, Characteristics of municipal water & its treatment, Numerical problems based on softening methods.

UNIT-II

FUELS & COMBUSTION: Fossil fuels & classification, Calorific value, Determination of calorific value by Bomb calorimeter Proximate and Ultimate analysis of coal and their significance, calorific value Computation based on ultimate analysis data, Carbonization, Manufacturing of coke & recovery of by products. Knocking, relationship between' knocking & structure of hydrocarbon, improvement of anti knocking characteristics of IC engine fuels, Diesel engine fuels, Cetane number, combustion and it related numerical problems.

UNIT-III

LUBRICANTS: Introduction, Mechanism of lubrication, Classification of lubricants, Properties and Testing of lubricating oils, Numerical problems based on testing methods.

CEMENT & REFRACTORIES: Manufacture, IS-code, Setting and hardening of cement, Refractory : Introduction, classification and properties of refractories .

UNIT-IV

HIGH-POLYMER: Introduction, types and classification of polymerization, Reaction. Mechanism, Natural & Synthetic Rubber; Vulcanization of Rubber, Preparation, Properties & uses of the following- Polythene, PVC, PMMA, Teflon, Poly acrylonitrile, PVA, Nylon 6, Nylon 6:6, Terylene, Phenol formaldehyde, Urea - Formaldehyde Resin, Glyptal, Silicone Resin, Polyurethanes; Butyl Rubber, Neoprene, Buna N, Buna S.

UNIT-V

INSTRUMENTAL TECHNIQUES IN CHEMICAL ANALYSIS: Introduction, Principle, Instrumentation and applications of IR, NMR, UV, Visible,Gas Chromatography, Lambert's and Beer's Law

WATER ANALYSIS TECHNIQUES: Alkalinity, hardness (Complexo-metric), Chloride, Free chlorine, DO, BOD and COD, Numerical problems based on above techniques.

REFERENCE BOOKS:

1.Chemistry for Environmental Engineering & Science- Sawyer, McCarty and Parkin – McGraw Hill, Education Pvt. Ltd., New Delhi

2. Engineering Chemistry - B.K. Sharma, Krishna Prakashan Media (P) Ltd., Meerut.

3. Basics of Engineering Chemistry - S. S. Dara & A.K. Singh, S. Chand & Company Ltd., Delhi

4. Polymer Science – Ghosh, Tata McGraw Hill.

5. Engg. Chemistry –Shashi Chawla, Dhanpat Rai & company pvt. Ltd, Delhi.

6. Engg. Chemistry –Jain & Jain, Dhanpat Rai & company pvt. Ltd, New Delhi

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LIST OF EXPERIMENTS:

1. Water Testing

(i) Determination of Total hardness by Complexometric titration method.

(ii) Determination of mixed alkalinity

(a) OH- - - & C03- - -

(b) CO3 & HCO3

2. Fuels & lubricant testing:

(i) Flash & fire points determination by

a) Pensky Martin Apparatus,

b) Abel's Apparatus,

c) Cleveland's open cup Apparatus.

(ii) Viscosity and Viscosity index determination by

a) Redwood viscometer No.1

b) Redwood viscometer No.2

(iii) Proximate analysis of coal

a) Moisture content

b) Ash content

c) Volatile matter content

c) Carbon residue

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BEHSMC-103
ENGLISH FOR COMMUNICATION

UNIT-I

Identifying Common errors in writing: Articles, Subject-Verb Agreement, Prepositions, Active and Passive Voice, Reported Speech: Direct and Indirect, Sentence Structure.

UNIT-II

Vocabulary building and Comprehension: Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, synonyms, antonyms, Reading comprehension.

UNIT-III

Communication: Introduction, Meaning and Significance, Process of Communication, Oral and Written Communication, 7 c"s of Communication, Barriers to Communication and Ways to overcome them, Importance of Communication for Technical students, nonverbal communication.

UNIT-IV

Developing Writing Skills: Planning, Drafting and Editing, Precise Writing, Précis, Technical definition and Technical description. Report Writing: Features of writing a good Report, Structure of a Formal Report, Report of Trouble, Laboratory Report, Progress Report.

UNIT-V

Business Correspondence: Importance of Business Letters, Parts and Layout; Application, Contents of good Resume, guidelines for writing Resume, Calling/ Sending Quotation, Order, Complaint, E-mail and Tender.

REFERENCE:

1. „Technical Communication : Principles and practice", Meenakshi Raman and Sangeeta Sharma (Oxford)
2. „Effective Business Communication", Krizan and merrier (Cengage learning)
3. „Communication Skill, Sanjay Kumar and pushlata, OUP2011
4. "Practical English Usage Michael Swan OUP, 1995.
5. "Exercises in spoken English Parts I-III CIEFL, Hyderabad, Oxford University Press
6. On writing well, William Zinsser, Harper Resource Book 2001.
7. Remedial English Grammar, F.T. Wood,Macmillan2007.

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LIST OF EXPERIMENTS:

1. Listening Comprehension.
2. Pronunciation, Intonation, Rhythm
3. Practising everyday dialogues in English
4. Interviews.
5. Formal Presentation

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BEESC-104
BASIC ELECTRICAL & ELECTRONICS ENGINEERING

UNIT-I

Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff's laws, Loop and-delta transformation ,nodal methods Superposition of a theorem, Thevenin theorem, Norton theorem.

UNIT-II

Representation of Sinusoidal waveforms –Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV

DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

UNIT-V

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries.Elementary calculations for energy consumption and savings, battery backup.

REFERENCE:

1. Ritu Sahdev, "Basic Electrical Engineering",
2. S. Singh, P.V. Prasad, "Electrical Engineeri
3. D. P. Kothari andElectricalI.J.Nagrath,Engineering","Basic Tat
4. D. C. Kulshreshtha, "Basic Electrical Engine
5. E. Hughes, "Electrical and Electronics Techn
6. S. Bobrow, "Fundamentals of Electrical En
7. V. D. Toro, "Electrical Engineering Fundamen

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LIST OF EXPERIMENTS:

1. Verification of Kirchhoff's laws
2. Verification of Superposition and Thevenin Theorem.
3. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Connection and measurement of power consumption of a fluorescent lamp (tube light).
6. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
7. Determination of parameters of ac single phase series RLC circuit
8. To observe the B-H loop of a ferromagnetic material in CRO.
9. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer
10. Determination of efficiency of a dc shunt motor by load test
11. To study running and speed reversal of a three phase induction motor and record speed in both directions.
12. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.

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BEESC-105
ENGINEERING GRAPHICS

UNIT-I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, usage of Drawing instruments, Lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales –Plain, Diagonal and Vernier Scales;

UNIT-II

Orthographic Projections: Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projections of Regular Solids those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale.

UNIT-III

Sections and Sectional Views of Right Angular Solids: Prism, Cylinder, Pyramid, Cone –Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only).

UNIT-IV

Isometric Projections: Principles of Isometric projection –Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

UNIT-V

Overview of Computer Graphics: Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension),

OBJECTS:

Isometric Views of lines, Planes, Simple and compound Solids; Customization & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance.

REFERENCE:

1. Bhatt N.D., Paschal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. CAD Software Theory and User Manuals

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LIST OF EXPERIMENTS:

Sketching and drawing of geometries and projections based on above syllabus

Term work: A min. of 30 hand drawn sketches (on size A4 graphic sketch Book) plus 5 CAD-printouts on size A4 sheets plus 10 sheets of size A2 or 6 sheets of size A1, (50% marks to be allotted for this record + 25% marks for attendance +25%marks for Teachers Assessment

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BEESC-106
MANUFACTURING PRACTICES

Manufacturing is fundamental to the development of any engineering product. The course on Engineering Workshop Practice is intended to expose engineering students to different types of manufacturing / fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weightage, some lectures and video clips available on different methods of manufacturing are also included.

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Carpentry
5. Plastic molding, glass cutting
6. Metal casting
7. Welding (arc welding & gas welding), brazing

LIST OF EXPERIMENTS:

1. Carpentry Shop Experiment To Make a T-LAP joint with wood Pieces
2. Machine Shop Experiment To Perform Knurling on Iron Rod
3. WELDING SHOP (LAP Joint) , Tools, Accessories, Diagram And Explanation
4. SHEET METAL SHOP (Square Tray) , Parts, Accessories, Diagram And Explanation
5. FITTING SHOP (Make a Joint) , Parts, Accessories, Diagram And Explanation
6. CARPENTRY SHOP (T-Lap Joint) , Cutting Tools, Accessories, Diagram and Explanation
7. MACHINE SHOP (the lathe machine) , Parts, Accessories, Diagram and Explanation

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BELC-207
INDUSTRIAL TRAINING

- Industrial environment and work culture.

- Organizational structure and inter personal communication.

- Machines/ equipment/ instruments - their working and specifications.

- Product development procedures and phases.

- Project planning, monitoring and control.

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Scheme of Examination - CBCS Pattern

Academic Year 2018– 2019

Branch : Aeronautical Engineering **Semester - V**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	AEC- 501	Aircraft Structure -II	60	30	10	30	20	2	1	2	4	150
2	AEC- 502	Aerodynamics -II	60	30	10	30	20	2	1	2	4	150
3	AEC- 503	Aircraft Propulsion -II	60	30	10	30	20	2	1	2	4	150
4	AEC - 504 (A)	Basics Aircraft Maintenance & Repair	60	30	10			2	1		3	100
	AEC - 504 (B)	Helicopter Aerodynamics										
	AEC - 504 (C)	Theory of Vibration										
5	AEC - 505 (A)	Heat and Mass Transfer	60	30	10			2	1		3	100
	AEC- 505 (B)	Aircraft Rules & regulation										
	AEC- 505 (C)	Wind Energy										
6	AEC - 506 (A)	Nano Science & Technology	60	30	10			2	1		3	100
	AEC - 506 (B)	Experimental Stress Analysis										
	AEC - 506 (C)	Airport Management										
7	AEC - 507	Industrial Training - I					100			4	2	100
TOTAL			**360**	**180**	**60**	**90**	**160**	**12**	**6**	**10**	**23**	**850**

Department Elective are AEC 504 & AEC 505

Open Elective - AEC 506

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University of Technology and Medical Sciences

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Name of Faculty: School of Engineering

Name of Department: **Aeronautical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **22/05/2018**

The Board of Studies Committee Meeting was held in the room of Dean of SOE at 2:30 PM. on **22/05/2018**, Following members were present.

1. Dr.Sanjay Rathore
2. Dr.Sonal Bharti
3. Mr.Vijay Prakash Singh
4. Mr.Prabodh Khampariya
5. Mr. Kailash Patidar
6. Mr.Manoj Gandwane
7. Ms.Sheetal Verma
8. Ms.Alka Thakur
9. Mr. Prashant Singh
10. Mr.Dhananjay Yadav
11. Mr. Sanjay Kalraiya,
12. Mrs.Priyanka Jhavar

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda 1. Approval of (i) SOE-V Semester Scheme & Syllabus as Per CBCS

(ii)SOE-VI Semester Scheme and Syllabus Non-CBCS

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Discussion (if any): Syllabus should be prepared as per current demand in industry.

Resolution of the Discussion: Syllabus should be prepared as per current demand in industries and was approved for forthcoming V Semester CBCS & VI Semester Non-CBCS.

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

1. Dr.Sanjay Rathore
2. Dr.Sonal Bharti
3. Mr.Vijay Prakash Singh
4. Mr.Prabodh Khampariya
5. Mr. Kailash Patidar
6. Mr.Manoj Gandwane
7. Ms.Sheetal Verma
8. Ms.Alka Thakur
9. Mr. Prashant Singh
10. Mr.Dhananjay Yadav
11. Mr. Sanjay Kalraiya,
12. Mrs.Priyanka Jhavar

Chairman

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AE- 501

AERODYNAMICS-II

UNIT-I FUNDAMENTAL ASPECTS OF COMPRESSIBLE FLOW

Compressibility, Continuity, Momentum and energy equation, Calorically perfect gas, Mach number, speed of sound –Velocity relation, Mach cone, Mach angle, One dimensional Isentropic flow through variable area duct, Static and Stagnation properties, Critical conditions, Characteristic Mach number, Area-Mach number relation, Maximum discharge velocity.

UNIT-II SHOCK AND EXPANSION WAVES

Normal shock relations, Prandtl's relation, Hugoniot equation, Rayleigh Supersonic Pitot tube equation, Moving normal shock waves, Oblique shocks, Θ-β-M relation, Shock Polar, Reflection of oblique shocks, left running and right running waves, Interaction of oblique shock waves, slip line, Rayleigh flow, Fanno flow, Expansion waves, Prandtl-Meyer expansion, Maximum turning angle, Simple and non-simple regions, operating characteristics of Nozzles.

UNIT-III TWO DIMENSIONAL COMPRESSIBLE FLOW

Potential equation for 2-dimensional compressible flow, Linearization of potential equation, perturbation potential, Linearized Pressure Coefficient, Linearized subsonic flow, Prandtl-Glauert rule, Linearized supersonic flow, Method of characteristics.

UNIT-IV HIGH SPEED FLOW OVER AIRFOILS, WINGS AND AIRPLANE

Supercritical Airfoil Sections, Transonic area rule, Swept wing, Airfoils for supersonic flows, Lift, drag, Pitching moment and Centre of pressure for supersonic profiles, Shock expansion theory, wave drag, supersonic wings, Design considerations for supersonic aircrafts.

UNIT-V SPECIAL TOPICS

Shock-Boundary layer interaction, Wind tunnels for transonic, Supersonic and hypersonic flows, shock tube, Gun tunnels, Supersonic flow visualization, Introduction to Hypersonic Flows.

TEXT BOOKS

1. Anderson, J. D, Modern Compressible Flow, McGraw-Hill & Co., 2002.
2. Rathakrishnan, E, Gas Dynamics, Prentice Hall of India, 2004.

REFERENCES

1. Shapiro, A. H., Dynamics and Thermodynamics of Compressible Fluid Flow, Ronald Press, 1982.
2. Zucrow, M. J. and Anderson, J. D., Elements of Gas Dynamics, McGraw- Hill &Co.
3. Oosthuizen, P.H., & Carscallen, W.E., Compressible Fluid Flow, McGraw- Hill &Co.

LIST OF EXPERIMENTS

1. The lift and drag over an NACA-0012 Aerofoil
2. Study of shock tube
3. Study of supersonic aircraft vehicle.
4. Shock wave generation over the spacecraft.
5. Study of subsonic compressible flow.

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AE-502
AIRCRAFT PROPULSION –II

UNIT I AIRCRAFT GAS TURBINES
Impulse and Reaction Types of gas turbines – Velocity triangles and power output –Elementary theory Vortex theory – Choice of blade profile, pitch and chord – Estimation of stage performance– Limiting factors in gas turbine design- Overall turbine performance – Methods of blade cooling –Matching of turbine and compressor – Numerical problems.

UNIT II RAMJET PROPULSION
Operating principle – Sub critical, critical and supercritical operation – Combustion in ramjet Engine – Ramjet performance – Sample ramjet design calculations – Introduction to scramjetPreliminary concepts in supersonic combustion – Integral ram- rocket- Numerical problems.

UNIT III FUNDAMENTALS OF ROCKET PROPULSION
Operating principle – Specific impulse of a rocket - Rocket nozzle classification – 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 – Liquid propellant rockets– Selection of liquid propellants – Thrust control in liquid rockets – Cooling in liquid rockets –Limitations of hybrid rockets.

UNIT V ADVANCED PROPULSION TECHNIQUES
Electric rocket propulsion – Ion propulsion techniques – Nuclear rocket – Types – Solar sail- Preliminary Concepts in nozzle less propulsion.

TEXT BOOKS
1. Anderson J.D. 'Introduction to flight' McGraw Hill Education (India) Pvt. Ltd.
2. Ganesan V. 'Gas Turbines' McGraw Hill Education (India) Pvt. Ltd.
3. Sutton, G.P., "*Rocket Propulsion Elements*", John Wiley & Sons Inc., New York, 5thEdn.

REFERENCES
1. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., "*Gas Turbine Theory*", Longman Co., ELBS Ed., 1919.
2. Gorden, C.V., "*Aero thermodynamics of Gas Turbine and Rocket Propulsion*", AIAA Education Series, New York, 1919.

LIST OF EXPERIMENTS:-
1. Water Rocket
2. Water jet study
3. Calorific value estimation
4. Ignition Delay Measurement
5. Identification of burning rate

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AE 503
AIRCRAFT STRUCTURES –I

UNIT I STATICALLY DETERMINATE STRUCTURES
Analysis of plane truss – Method of joints – 3 D Truss - Plane frames

UNIT II STATICALLY INDETERMINATE STRUCTURES
Composite beam - Clapeyron's Three Moment Equation - Moment Distribution Method.

UNIT III ENERGY METHODS
Strain Energy due to axial, bending and Torsional loads – Castiglione's 1st Theorem - Maxwell's Reciprocal theorem, Principle of virtual work (Unit load method) - application to beams, trusses, frames, etc.

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

UNIT V FAILURE THEORY
Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.

TEXT BOOK
1. Ramamrutham S. & Narayan R. 'Theory of Structure' Dhanpat Rai Publishing company.

REFERENCE
1. Timoshenko, S., "*Strength of Materials*", Vol. I and II, Princeton D. Von Nostrand Co, 1990
2. Donaldson, B.K., "*Analysis of Aircraft Structures – An Introduction*", McGraw-Hill, 1993.

LIST OF EXPERIMENTS
1. study the construction of fuselage and identify the primary load carrying members
2. Study the construction of wings.
3. Measurement of deflection of Truss members.
4. Study of Composite structure.
5. Study the construction of landing gears.
6. Measurement of deflection of simply supported beam

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AE504
CIVIL AVIATION REQUIREMENTS

UNIT-I C.A.R. SERIES 'A AND B'

C.A.R. SERIES A –Procedure for Civil Air Worthiness Requirements and Responsibility Operators Vis-À-Vis Air Worthiness Directorate

Responsibilities of operators / owners-Procedure of CAR issue, amendments etc., Objectives and targets of airworthiness directorate; Airworthiness regulations & safety oversight of engineering activities of operators.

C.A.R. SERIES'B' –Issue Approval of Cockpit Check List, MEL, CDL

UNIT-II C.A.R. SERIES 'C' AND 'D'

C.A.R.SERIES'C' –Defect Recording, Monitoring, Investigation and Reporting

Defect recording, reporting, investigation, rectification and analysis; Flight report; Reporting and rectification of defects observed on aircraft; Analytical study of in-flight readings & recordings; Maintenance control by reliability Method.

C.A.R.SERIES'D' – AND AIRCRAFT MAINTENANCE PROGRAMMES

Reliability Programmes (Engines); Aircraft maintenance programme & their approval; on condition maintenance of reciprocating engines; TBO–Revision programme; Maintenance of fuel and oil uplift and consumption records –Light aircraft engines.

UNIT-III C.A.R. SERIES E AND'F'

C.A.R. SERIES E–Approval of Organisation

Approval of organizations in categories A, B, C, D, E, F, & G - Requirements of infrastructure at stations other than parent base.

C.A.R.SERIES'F'–Airworthiness and Continued Air Worthiness

Procedure relating to registration of aircraft; Procedure for issue/revalidation of Type Certificate of aircraft & its engines/propeller; Issue/revalidation of Certificate of Airworthiness;

UNIT-IV C.A.R. SERIES 'L'&'M'

Issue of AME License, its classification and experience requirements, Mandatory Modifications /Inspections.

UNIT-V C.A.R. SERIES 'T'&'X'

Flight testing of (Series) aircraft for issue of C of A; Flight testing of aircraft for which C of A had been previously issued. Registration Markings of aircraft; Weight and balance control of an aircraft; Provision of first aid kits & Physician's kit in an aircraft; Concessions; Aircraft log books; Document to be carried on board on Indian registered aircraft; Procedure for issue of tax permit.

TEXT BOOKS

1. Aeronautical Information Circulars (relating to Airworthiness) from DGCA 2000.

REFERENCES

"Aircraft Manual (India) Volume"–Latest Edition, the English Book Store, 17-1, Connaught Circus, New Delhi

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AE-505
FLIGHT DYNAMICS

Unit- I DRAG ON THE AIRPLANE

International Standard Atmosphere - Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag - Drag Polars of vehicles from low speed to high speeds - Variation of thrust, power with velocity and altitudes for air breathing engines - Power available and power required curves.

Unit- II AIRCRAFT PERFORMANCE

Performance of airplane in level flight - Maximum speed in level flight - Conditions for minimum drag and power required - Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turn radius). Bank angle and load factor - Limitations of pull up and push over - V-n diagram and load factor.

Unit – III STATIC LONGITUDINAL STABILITY

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

Unit – IV LATERAL AND DIRECTIONAL STABILITY

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

Unit –V DYNAMIC STABILITY

Dynamic longitudinal stability: Phugoid and short period oscillation, Equations of motion - Stability derivatives - Characteristic equation of stick fixed case - Modes and stability criterion - Effect of freeing-the stick - Brief description of lateral and directional. Dynamic stability - Spiral, wing torsional divergence, Dutch roll, Autorotation and spin.

Text Books:

1. Anderson J.D. 'Introduction to flight' McGraw Hill Education (India) Pvt. Ltd.
2. *Clancy L.J. 'Aerodynamics' Sterling book house India.*

References:

1 Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son, Inc., New York, 1988.
1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New YBabister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980

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LIST OF EXPERIMENTS

1. Introduction to flight testing (V-n diagram).
2. Evaluation of glider drag polar.
3. Evaluation of cruise and climb performance of a small airplane.
4. Observations of airplane dynamic modes and stall characteristics.
5. Introduction to GPS based navigation.
6. Introduction to auto-pilot.

AE 506
AIRCRAFT STRUCTURES REPAIR LAB

LIST OF EXPERIMENTS

1. Patch repair welding using TIG.
2. Patch repair welding using MIG.
3. Patch repair welding using Plasma Arc.
4. Exercise on pipe bending.
5. Exercise on Riveted joints & repair work.
6. Exercise on composites & repair work.
7. Repair of Sandwich panels.
8. Exercise on Sheet metal forming.
9. Exercise on cable swaging.

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Scheme of Examination

Sixth Semester –BE (Aeronautical Engineering)

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted							Credits Allotted Subject wise			Total Credits	Remark
			Theory Slot			Practical Slot			Total Marks					
			End Sem.	Mid Sem. MST (Two tests average)	Quiz, Assig-nment	End Sem	Term work							
							Lab work & sessional	Assignment/ quiz		L	T	P		
1.	AE-601	Aircraft Structure- II	70	20	10	30	10	10	150	3	1	2	06	
2.	AE-602	Aircraft Systems & Instruments	70	20	10	30	10	10	150	3	1	2	06	
3.	AE-603	Heat and Mass Transfer	70	20	10	30	10	10	150	3	1	2	06	
4.	AE-604	Space Mechanics	70	20	10	-	-	-	100	3	1	-	04	
5.	AE-605	Aircraft Design	70	20	10	30	10	10	150	3	1	2	06	
6.	AE-606	Basic Training Element (Simulator)				30	10	10	50	0	0	2	02	
7.	AE-607	Self-Study	-	-	-	-	-	25	25	0	0	1	01	
8.	AE-608	Seminar / Group Discussion	-	-	-	-	-	25	25	0	0	1	01	
		Total	350	100	50	150	50	100	800	15	5	12	32	Grand Total 800

MST: Mid Semester Tests Taken at Least twice Per Semester

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L: Lecture - T: Tutorial - P: Practical

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AE-601
AIRCRAFT STRUCTURE- II

UNIT-1 FUNDAMENTALS OF STRUCTURAL ANALYSIS
Basic Elasticity: stress, notation for forces and stresses , equation of equilibrium, plane stress, Boundary conditions, determination of stresses on inclined planes, principal stresses, strain, Compatibility equations, plane strain, determination of strains on inclined planes principal Strains, stress-strain relationship.

UNIT-2 BENDING OF THIN WALLED BEAMS
Bending of open and closed thin walled beams: Symmetrical bending, unsymmetrical bending, deflection due to bending, calculation of section properties, application of bending theory, temperature effects, numerical problems.

UNIT-3 TORSION OF THIN WALLED BEAMS
Torsion of beams: torsion of closed section beams, torsion of multi-cell section, shear centre, properties of shear center, numerical problems.

UNIT-4 SHEAR FLOW
Bredt-Batho formula, Shear flow in open section, Shear flow in closed section, shear flow in boom section, combination of open and close section.

UNIT-5 AIRWORTHINESS AND AIRFRAME LOADS
Airworthiness, factor of safety-flight envelope, load factor determination, loads on an aircraft, safe life and fail safe structure, fatigue, creep and relaxation, materials used in an aircraft.

TEXT BOOKS:-
1. Megson T.H.G., Aircraft Structure for engineering students, Edward Arnold.
2. Perry D.J. and Azar J.J., Aircraft Structures, McGraw hill.

REFERENCE BOOKS:-
1. Analysis of A/C Structure by Bruce K. Donaldson (Cambridge Aerospace Series).
2. 'Theory & Analysis of Flight Structure' by Rivello, R.M., McGraw Hill.

LIST OF EXPERIMENTS:-
1. Verification of Maxwell's Reciprocal theorem & principle of superposition.
2. Shear center location for open sections.
3. Deflection of beams with various end conditions for different load.
4. Shear center location for closed sections.

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AE 602
AIRCRAFT SYSTEMS & INSTRUMENTS

UNIT I AIRPLANE CONTROL SYSTEMS
Conventional Systems - Power assisted and fully powered flight controls - Power actuated systems – Engine control systems - Push pull rod system, flexible push pull rod system - Components – Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology, Communication and Navigation systems Instrument landing systems, VOR - CCV case studies.

UNIT II AIRCRAFT SYSTEMS
Hydraulic systems - Study of typical workable system - components - Hydraulic system controllers - Modes of operation - Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system - Typical Pneumatic power system - Components, Landing Gear systems - Classification – Shock absorbers – Retractive mechanism.

UNIT III ENGINE SYSTEMS
Fuel systems for Piston and jet engines, - Components of multi engines. lubricating systems for piston and jet engines - Starting and Ignition systems - Typical examples for piston and jet engines.

UNIT IV AUXILLIARY SYSTEM
Basic Air cycle systems - Vapour Cycle systems, Boost-Strap air cycle system – Evaporative vapour cycle systems - Evaporative air cycle systems - Oxygen systems - Fire protection systems, De-icing and anti icing systems.

UNIT V AIRCRAFT INSTRUMENTS
Flight Instruments and Navigation Instruments – Gyroscope - Accelerometers, Air speed Indicators – TAS, EAS- Mach Meters - Altimeters - Principles and operation - Study of various types of engine instruments - Tachometers - Temperature gauges - Pressure gauges - Operation and Principles.

TEXT BOOKS
1. Lalit Gupta & Sharma O.P. 'Fundamental of Flight (Aircraft Systems)' McGraw Hill Pvt.Ltd.
1. McKinley, J.L., and Bent, R.D., *"Aircraft Maintenance & Repair"*, McGraw-Hill, 1993.
2. *"General Hand Books of Airframe and Powerplant Mechanics"*, U.S. Dept. of Transportation, Federal Aviation Administation, The English Book Store, New Delhi1995.

REFERENCES
1. Mekinley, J.L. and Bent, R.D., *"Aircraft Power Plants"*, McGraw-Hill, 1993.
2. Pallet, E.H.J., *"Aircraft Instruments & Principles"*, Pitman & Co., 1993.
3 .Treager, S., "*Gas Turbine Technology*", McGraw-Hill, 1997.

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LIST OF EXPERIMENTS

1. Aircraft "jacking up" procedure.
2. Aircraft "leveling" procedure
3. Control system "rigging" check procedure
4. Aircraft "symmetry check" procedure
5. Flow test "to assess of filter" element clogging
6. Pressure test to adjust "operating system" components
7. Brake torque load test on wheel brake units
8. Maintenance and rectification of snags in hydraulic and fuel systems.

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AE 603

HEAT AND MASS TRANSFER

UNIT-I FUNDAMENTALS

Modes of heat transfer: Conduction –Convection - Radiation

UNIT-II HEAT CONDUCTION

Steady and unsteady state heat conduction in solids - Effect of variation of thermal conductivity on heat transfer in solids –conduction with heat generation –Heat transfer problems in infinite and semi-infinite solids–Critical radius of insulation-Extended surfaces-Application of numerical techniques.

UNIT-III FREE AND FORCED CONVECTION

Convection fundamentals: Basic equations, Boundary layer concept, Dimensional analysis **Free Convention:** Laminar boundary layer equation- Free convection in atmosphere free Convection on a vertical flat plate –Integral method - Empirical relation in free convection – External flow.

Forced convection: Forced convection - Laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations - numerical techniques in problem solving.

UNIT-IV RADIATIVE HEAT TRANSFER AND HEAT EXCHANGERS

Concept of black body-Intensity of radiation-Laws of Black body Radiation-Radiation from non-black surfaces- real surfaces –Radiation between surfaces-Radiation shape factors-Radiation shields.

HEAT EXCHANGERS: Types-overall heat transfer coefficient- LMTD- NTU method of heat exchanger Analysis.

UNIT-V HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING

Heat transfer problems in gas turbine combustion chambers - Rocket thrust chambers Aerodynamic heating - Ablative heat transfer.

TEXT BOOKS:

1 Sachdeva, S.C. Fundamentals of Engineering, Heat and Mass Transfer, Wiley Eastern Ltd., New Delhi, 1981.
2. Lienhard, J.H., "A Heat Transfer Text Book", Prentice Hall Inc., 1981.
3. Holman, J.P., "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6th Edn, 1991.

REFERENCES

1. Sachdeva, S.C., "Fundamentals of Engineering Heat and Mass Transfer", Wiley Eastern Ltd., New Delhi, 1981.
2. Sutton, G.P., "Rocket Propulsion, JohnElements"WileyandSons,5thEdn.1986.
Mathur, M. and Sharma, R.P., "Gas Turbine and Jet and Rocket Propulsion", Stand.

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LIST OF EXPERIMENTS

1. Heat transfer through composite wall.
2. Critical heat flux apparatus.
3. Measurement of surface emissivity.
4. Heat transfer through forced convection.
5. Heat transfer through lagged pipe
6. Heat transfer through natural convection.
7. Parallel & counter flow heat exchanger.
8. Heat transfer through pin – fin.
9. Stefan boltzman's apparatus.
10. Thermal conductivity of concentric sphere.
11. Thermal conductivity of metal rod.
12. Transient heat conduction apparatus.
13. Heat pipe demonstration.

AE-604
SPACE DYNAMICS

UNIT-1 HISTORY OF SPACE FLIGHT
Introduction: History of space vehicles:- world history, Indian history, comparison, Initial works, first space flight, man in space, profile of flight from earth to a destination in space and back, space shuttle.

UNIT-2 ORBIT EQUATION
Introduction, differential equation, Lagrange's equation, Newton's law of gravitation, orbit equation, energy and angular momentum, Kepler's laws, orbit determination and satellite tracking.

UNIT-3 THE EARTH SATELLITE OPERATIONS
The Hohman transfer, inclination change maneuver, launc to rendezvous, decay life time, earth oblateness effect, low thrust orbit transfer,

UNIT-4 SATELLITE ATTITUDE DYNAMICS
Torque, free axisymmetric rigid body, the general torque free rigid body, semi rigid spacecraft, attitude control, spinning and non spinning spacecraft, the Yo-Yo mechanism, gravity gradient, satellite, the dual spin spacecraft.

UNIT-5 RE-ENTRY DYNAMICS
Introduction, ballistic re-entry, skip re-entry, double dip re-entry, aero braking, lifting reentry. space environment: introduction, atmosphere,light and spacecraft temperature, charged particle motion.

TEXT BOOK:-
1. Space Flight Dynamics, William E.Wiesel, Mcgraw Hill.

REFERENCE BOOK:-
1. Materials for missiles and spacecraft, Parker E.R.

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AE-605
AIRCRAFT DESIGN

UNIT-1

Preliminaries: Aircraft Design Requirements, specifications, role of users. Aerodynamic and Structural Consideration, Importance of weight. Airworthiness requirements and standards. Classifications of airplanes. Special features of modern airplane. Air Loads in Flight: Symmetrical measuring loads in flight, Basic flight loading conditions, Load factor, Velocity - Load factor diagram, gust load and its estimation, Structural limits.

UNI-2

Airplane Weight Estimation: Weight estimation based on type of airplane, trends in wing loading, weight-estimation based on mission requirements, iterative approach. Basic Wing Design: Selection of airfoil selection, influencing factors. Span wise load Distribution and plan form shapes of airplane wing. Stalling take-off and landing Considerations. Wing drags estimation. High lift devices. Structural Design: Cockpit and aircraft passenger cabin layout for different categories, types of associated structure, features of light airplanes using advanced composite materials. Structural aspects of design of airplane, Bending moment and shear force diagram. Design principles of all metal stressed skin wing for civil and military applications.

UNIT-3

Landing Gears: Different kinds of landing gears, and associated arrangement for civil and military airplanes. Preliminary calculations for locating main and nose landing gears.

UNIT-4

Integration of Structure and Power Plant: Estimation of Horizontal and Vertical tail volume ratios. Choice of power plant and various options of locations, considerations of appropriate air-intakes. Integration of wing, fuselage, empennage and power plant. Estimation of center of gravity.

UNIT-5

Introduction of advanced concepts: Supercritical Wings, relaxed static Stability, controlled configured vehicles, V/STOL aircraft and rotary wing vehicles. Design and layout of flying controls and engine controls.

TEXT BOOK

1. Daniel P Raymer, Aircraft Design: A conceptual approach, AIAA Series, 1992.
2. John D Anderson (Jr.), Airplane Performance and Design, mcgraw Hill.

REFERENCE BOOKS:-

1. L M Nicholal, Fundamentals of airplane Design, Univ. Of Dayton DHIO.
2. Aircraft Design K.D.Wood, Johnson Publishing Company.

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LIST OF EXPERIMENTS

To introduce and develop the basic concept of aircraft design. Each student is assigned with the design of an Airplane for given preliminary specifications. The following are the Assignments to be carried out:

1. Comparative configuration study of different types of airplanes.
2. Comparative study on specification and performance details of aircraft.
3. Preparation of comparative data sheets.
4. Work sheet layout procedures.
5. Comparative graphs preparation and selection of main parameters for the design.
6. Preliminary weight estimations, selection of main parameters.
7. Power plant selection, Aerofoil selection, Wing tail and control surfaces.
8. Preparation of layouts of balance diagram and three view drawings.
9. Estimation of various Drags.
10. Detailed performance calculations and stability estimates.

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AE-606
BASIC TRAINING ELEMENTS (SIMULATOR)

LIST OF EXPERIMENTS

A. Trimming an airplane that has three-axis trim (elevator, rudder, and aileron).
B. Introduction to the four step scan.
C. Demonstrating the graveyard spiral and the importance of using the triangles of knowledge
D. Flying with hands-off the yoke.
1. Controlling the airplane with rudder.
2. Pitch trimming with power.
E. Straight and level flight.
1. Slow cruise
2. Normal cruise.
F. Elevator/throttle coordination.
1. When maintaining a constant airspeed.
2. When maintaining constant altitude or vertical speed.
G. Climbs and level-offs.
1. Normal cruise – best rate climb – normal cruise.
2. Normal cruise – cruise climb – normal cruise.
3. Slow cruise – best rate climb – slow cruise.
H. Descents and level-offs
1. Normal cruise – cruise descent – slow cruise
2. Normal cruise – slow cruise descent – slow cruise.
I. Descending and climbing turns with intermediate level-offs and roll-outs to specific headings.
J. Vertical S with and without the attitude indicator.
K. Vertical S-1 with and without the attitude indicator.
L. Oscar pattern with and without the attitude indicator.
M. Multiengine (if applicable)—using the rudder to initiate engine failure procedures.

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Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Name of Faculty: School of Engineering

Name of Department: **Aeronautical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **5/11/2018**

The Board of Studies Committee Meeting was held in the room of Department of Aeronautical Engineering at 2:30 PM. on **5/11/2018**, Following members were present.

1. Mr. Prashant Singh, Asst. Prof.(Aeronautical Engineering) – Chairman
2. Mr.Dhananjay Yadav, Asstt. Prof. (Mech.), Member
3. Mr. Anil Verma,Assist. Prof. (Mech.), Member
4. Mrs.Priyanka Jhavar,Asst Prof (Mech.)Member

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda Preparation of syllabus and Scheme for III and IV Sem.

Discussion Scheme

Scheme and syllabus was put up before the member as per recent CBCS Guidelines, It was discussed in Detail by the Members and some modifications were suggested.

Resolution of the Discussion:

It was resolved that the scheme and syllabus as proposed with some modification and may be accepted .

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

Mr. Prashant Singh, Asst. Prof.(Aeronautical Engineering) – Chairman

Mr.Dhananjay Yadav Asstt. Prof. (Mech.), Member

Mr. Anil Verma,Assist. Prof. (Mech.), Member Anil Verma.

Mrs.Priyanka Jhavar,Asst Prof (Mech.)Member

Chairman

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Scheme of Examination

Bachelor of Engineering (Aeronautical Engineering)

III Semester/ II Year

Academic Year 2019-20

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	BEA-301	Mathematics -III	60	30	10	-	-	100	3	-	-	3
2	AEA-302	Elements of Aeronautics	60	30	10	-	-	100	2	1	-	3
3	AEA-303	Fluid Mechanics	60	30	10	30	20	150	3		2	4
4	AEA-304	Thermodynamics	60	30	10	30	20	150	3	-	2	4
5	AEA-305	Strength of Materials	60	30	10	30	20	150	2	1	2	4
6	AEA-306	Computer Programming	-	-	-	30	20	50	-	-	2	1
7	AEA-307	Self Study /GD Seminar	-	-	-	-	50	50	-	-	2	1
TOTAL			**300**	**150**	**50**	**120**	**130**	**750**	**13**	**2**	**10**	**20**

w.e.f. july 2019

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BEA- 301 Mathematics-III

UNIT-I

Numerical Methods – Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT-II

Numerical Methods - Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.

UNIT-III

Numerical Methods – Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank- Nicholson methods), Finite difference explicit method for wave equation.

UNIT-IV

Transform Calculus - Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.

UNIT-V

Concept of Probability - Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution.

References:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
8. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

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AEA- 302 Elements of Aeronautics

UNIT- I

INTRODUCTION TO FLIGHT Brief history of Aviation-Hot air balloon and heavier than air flying machines-early airplane configurations-Modern Airplanes-Components of airplane and their functions-Rotary wing aircrafts Space vehicles.

UNIT-II

FUNDAMENTALS OF AERONAUTICS International Standard Atmosphere-Pressure, Temperature and Density altitude, Basic Aerodynamics - Continuity, Momentum and Energy equations, Bernoulli's equation-Mach number subsonic, transonic, sonic and supersonic flow regimes, Measurement of pressure and airspeed IAS,EAS and TAS. Airfoil geometry and nomenclature-infinite and finite wing sections-lift, drag and moment coefficients-angle of attack-aspect ratio-Reynolds number-induced drag and parasite drag airfoil characteristics, Elements of Aircraft performance, stability and control.

UNIT-III

AIRCRAFT STRUCTURE AND MATERIALS Structural components of an airplane-monocoque and semi- monocoque structure –materials for structural components – composite materials and their significance in Aviation Technology.

UNIT-IV

AIRCRAFT PROPULSION Propeller Engine – Gas Turbine Engine – Turbo prop, Turbo jet, Turbo fan Engines- specific fuel consumption-variation of thrust and power with speed and altitude – materials for engine components.

UNIT-V

SPACE VEHICLES & ASTRONAUTICS Basics of Rocket Technology-escape velocity-reentry vehicles-heat transfer problems of space vehicles-ablative cooling-Satellite technology– Hypersonic vehicles, Elements of Astronautics.

Reference Books :-

1.Kermode, A. C, Barnard, R. H and Philpott, D. R, Mechanics of Flight, Pearson education, 2012.
2.Shevell, R. C., Fundamentals of Flight., Prentice hall (2nd edition), 1989.
3.Steven, A. Brandt, Randall J. Stiles, John J. Bertin and Ray Whitford, Introduction to Aeronautics:A Design Perspective, AIAA Education series(2nd edition),2004.

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AEA- 303 Fluid Mechanics

UNIT-I

INTRODUCTION Fluid –definition-Fluid properties-Newton's law of viscosity-Classification of fluids-fluid statics Hydrostatic forces on submerged surfaces- Stability of floating bodies.

UNIT-II

FLUID FLOW ANALYSIS AND FLOW MEASUREMENT Ideal and real flow-Concept of continuum-Eulerian and Lagrangian approaches-Velocity field Path line, Streak line, Streamline-Stream tube- Fluid acceleration-Continuity, momentum differential equations-Navier Stokes equation- Stream function – Vorticity –Irrotationality-Potential functionPotential flow-Laplace equation-Bernoulli's equation and its applications-Venturimeter-Orifice meter, Flow Rate and Velocity Measurement.

UNIT-III

DIMENSIONAL ANALYSIS Buckingham Pi Theorem-Non dimensional numbers and their significance-Flow similarity and model studies.

UNIT-IV

FLOW THROUGH PIPES Laminar and turbulent flow- Boundary layer flow – Boundary layer thickness - Reynolds number and its significance-Laminar fully developed pipe flow-Hagen-Poiseuille flow-Coefficient of frictionHead loss – Darcy-Wiesbach equation-Hydraulic gradient-Total energy lines-Moody's diagramTurbulent flow through pipes.

UNIT-V

FLUID MACHINERY Classification of fluid machines-Reciprocating and centrifugal pumps-impulse and reaction turbines Working principle of Pelton, Francis and Kaplan turbines-Velocity triangles-fans and blowers.

TEXT BOOKS

1.Frank M White, Fluid Mechanics, The McGraw Hill companies. 7th edition), 2011.
2.Rathakrishnan, E, Fundamentals of Fluid Mechanics, Prentice-Hall (3rd edition), 2012.
3.Yunus A. Cengel and John M Cimbala, Fluid mechanics: Fundamentals and Applications, Tata McGraw Hill (2nd edition), 2010.

Reference Books :-

1. Irving H Shames, Mechanics of Fluids, The McGraw Hill companies (4th edition), 2003.
2. Yuan, S.W, Foundations of Fluid Mechanics, Prentice-Hall, 1967.

List of Experiments :-

1. To determine the local point pressure with the help of pitot tube.
2. To find out the terminal velocity of a spherical body in water.
3. Calibration of Orifice meter and Venturi meter.
4. Determination of Cc, Cv, Cd of Orifices.
5. Calibration of Nozzle meter and Mouth Piece.

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AEA-304 Thermodynamics

UNIT-I

BASIC THERMODYNAMICS Systems, Zeroth law, First law - Steady flow energy equation - Heat and work transfer in flow and non-flow processes - Second law, Kelvin-Planck statement - Clausius statement – Reversibility and irreversibility - Concept of Entropy, Clausius inequality, Principle of increase of entropy – Absolute entropy – Availability - Entropy change in non-flow processes.

UNIT-II

AIR POWER CYCLES Carnot, Otto, Diesel, Dual, Stirling and Ericsson cycle - Air standard efficiency – Mean effective pressure – Actual and theoretical PV diagram of two stroke and four stroke IC engines.

UNIT-III

VAPOUR POWER CYCLE Introduction – Rankine cycle – Means of increase of efficiency of the Rankin cycle – Ideal reheat and regenerative Rankine cycle – Second law analysis of vapour power cycles – Cogeneration.

UNIT-IV

REFRIGERATION AND AIR-CONDITIONING Principles of refrigeration and Psychometric - Vapour compression - Vapour absorption types - Co-efficient of performance, Properties of refrigerants – Basic Principle and types of Air conditioning.

UNIT-V

THERMODYNAMICS OF AIRCRAFT PROPULSION CYCLES Isentropic flow through passages – Brayton cycle – Brayton cycle with intercooling, reheat and regeneration – Ideal jet propulsion cycles. Basics of heat transfer.

Reference Books :-

1. Holman.J.P, Thermodynamics, McGraw-Hill (3rd edition), 2007.
2. Gordon J. Van Wylen and Richard E. Sonntag and Claus Borgnakke, Fundamentals of Classical
Thermodynamics – Vol 1, Wiley Eastern, 1994.
3. Arora C.P., Thermodynamics, Tata McGraw-Hill, New Delhi, 2003.
4. Merle C Potter and Craig W Somerton., Thermodynamics for Engineers, Schaum's.

List of Experiments :-

1. To find mechanical equivalent of heat using Joules apparatus.
2. To study working of impulse and reaction steam turbine by models.
3. To study working of Gas turbines by models and to identify various processes of Brayton Cycle.

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AEA-304 Thermodynamics

UNIT-I

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3. To study working of Gas turbines by models and to identify various processes of Brayton Cycle.

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4. To calculate COP of vapor compression refrigeration system and to plot on T-S, P-H diagrams.
5. To plot specific fuel consumption versus rpm diagrams for diesel and petrol engine.

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AEA- 305 Strength of Materials

UNIT-I

MOMENT OF INERTIA Moment of Inertia ,Mass Moment of Inertia , Area Moment Of Inertia, Parallel Axis theorem, Polar Moment of Inertia, Principal axes, Principal moment of inertia.

UNIT-II

STRESS AND STRAIN Definition, Stress- strain, uni-axial, bi-axial and tri-axial stresses, tensile & compressive stresses,shear stress-Elastic limit, Hooke's Law. Elastic Constants: Poisson's Ratio, Modulus of elasticity,Modulus of rigidity, Bulk modulus, Yield stress, Ultimate stress. Factor of safety, state of simple shear, relation between elastic constants, Volumetric Strain, Volumetric strain for tri-axial loading,Deformation of Tapering members, Deformation due to self-weight, bars of varying sections,composite sections, Thermal Stress.

UNIT-III

BEAMS Shear Force and Bending Moment in Beams: Axial force, shear force and bending moment diagrams for statically determinate beams including beams with internal hinges for different types of loading, relationship between rates of loading, shear force & bending moment. Deflection of Cantilever,simply supported and over hanging beams using. Double integration and Macaulay's Method for different type of loadings.

UNIT-IV

STRESSES IN BEAMS Theory of pure Bending, Assumptions, Flexural formula for straight beams, moment of resistance, bending stress distribution, Section moduli for different sections, beams for uniform strength, Flitched beams. Direct & Bending Stresses: Core of Section, Chimneys subjected to wind pressure Shear Stress in Beams: Distribution of shear stress, across plane sections used commonly for structural purposes, shear connectors.

UNIT-V

COLUMN & TORSION Buckling load, Types of end conditions for column, Euler's column theory and its limitations, Rankine- Gordon Formula, Torsion of circular shafts-solid and hollow, stresses in shafts when Transmitting power, shafts in series and parallel. Strain Energy: Resilience, proof Resilience, strain energy stored in the member due to gradually applies load, suddenly applied load, impact load. Strain energy stored due to Shear, Bending and Torsion.

Reference Books :-

1.Elements of Strength of Materials, Timoshenko and Young Affiliated East-West Press.
2. Mechanics of Materials, James M. Gere (5th Edition), Thomson Learning.

3. Strength of Materials, Subramanian, Oxford University Press, Edition 2005
4. Mechanics of Materials, B.C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi.

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List of Experiments :-

1. Standard tensile test on MS and CI test specimen.
2. Direct/ cross Shear test on MS and CI specimen.
3. Transverse bending test on wooden beams to obtain modulus of rupture.
4. Fatigue test.
5. Brinell Hardness tests.

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AEA- 306 Computer Programming

UNIT-I

BASICS C++ basics, loops and decisions, structures and functions, object and classes, object arrays, constructor and destructor functions.

UNIT-II

OPERATOR AND FUNCTION Operator and function overloading, pointers, pointers to base and derived classes inheritance, public and Private inheritance, multiple inheritance.

UNIT-III

POLYMORPHISM Polymorphism, virtual functions, abstract base classes and pure virtual function, friend function, early and late binding.

UNIT-IV

C++ I/O SYSTEM formatted I/O, creating insertors and extractors, file I/O basis, creating disk files and file manipulations using seekg(), seekp(), tellg() and tellp() functions, exception handling: try, catch and throw.

UNIT-V

UML CONCEPTS, object-oriented paradigm and visual modeling, UML diagrams, UML specifications, object model, object oriented design, identifying classes and object, object diagrams.

References Books :-

1. Hans Erit Eriksson "UML 2 toolkit" Wiley.
2. Balagurusawmy "Object Orienter Programming with C++".
3. B.G., Boach "Object Oriented Analysis & Design with Applications.

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AEA-307 Self Study /GD Seminar

Objective of GD and seminar is to improve the mass communication and convincing / understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves. Evaluation will be done by assigned faculty based on group discussion and power point presentation.

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Scheme of Examination

Bachelor of Engineering (Aeronautical Engineering)

IV Semester/ II Year **Academic Year 2019-20**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	BEA-401	Energy Ecology Environment & Society	60	30	10	-	-	100	3		-	3
2	AEA-402	Aircraft Systems and Instrumentation	60	30	10	30	20	150	2		2	3
3	AEA-403	Aerodynamics I	60	30	10	30	20	150	3		2	4
4	AEA-404	Aircraft Propulsion I	60	30	10	30	20	150	3		2	4
5	AEA-405	Aircraft Structure I	60	30	10	30	20	150	2	1	2	4
6	AEA-406	Java Programming	-	-	-	30	20	50	-	-	4	2
7	AEA-407	Industrial Training-I	To be completed during fourth semester semester break. Its evaluation/credit to be added in fifth semester									
	TOTAL		**300**	**150**	**50**	**150**	**100**	**750**	**13**	**1**	**12**	**20**

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BEA- 401 Energy Ecology Environments and Society

UNIT- I

SOURCES OF ENERGY Renewable & Non Renewable, Fossil fuel, Biomass Geothermal, Hydrogen, Solar, Wind, hydal, nuclear sources.

UNIT-II

SEGMENTS OF ENVIRONMENT Atmosphere, hydrosphere, Lithosphere, biosphere. Cycles in Ecosystem – Water, Carbon, Nitrogen. Biodiversity: Threats and conservation.

UNIT- III

AIR POLLUTION Air pollutants, classification, (Primary & secondary Pollutants) Adverse effects of pollutants. Causes of Air pollution chemical, photochemical, Greenhouse effect, ozone layer depletion, acid Rain. Sound Pollution: Causes, controlling measures, measurement of sound pollution (deciblage), Industrial and non – industrial.

UNIT- IV

WATER POLLUTION Water Pollution: Pollutants in water, adverse effects. Treatment of Domestic & Industrial water effluent. Soil Pollution – Soil Profile, Pollutants in soil, their adverse effects, controlling measures.

UNIT- V

SOCIETY, ETHICS & HUMAN VALUES Impact of waste on society. Solid waste management Nuclear, Thermal, Plastic, medical, Agriculture, domestic and e-waste). Ethics and moral values, ethical situations, objectives of ethics and its study. Preliminary studies regarding Environmental Protection Acts, introduction to value education, self-exploration, sanyam & swasthya.

References Books :-

1. Svakumar; Energy Environment & Ethics in society; TMH
2. AK De "Environmental Chemistry"; New Age Int. Publ.
3. BK Sharma, "Environmental Chemistry" ; Goel Publ. House.
4. Bala Krishnamoorthy; "Environmental management"; PHI

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AEA- 402 Aircraft System & Instrumentation

UNIT- I

AIRCRAFT SYSTEMS Hydraulic systems –Study of typical workable systems –components –Hydraulic systems controllers –Modes of operation –Pneumatic systems –Working principles– Typical Pneumatic Power system –Brake system –Components, Landing Gear Systems Classification –Shock absorbers –Retractive mechanism.

UNIT- II

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

UNIT- III

ENGINE SYSTEMS Fuel systems –Piston and Jet Engines –Components -Multi-engine fuel systems, lubricating systems -Piston and jet engines –Starting and Ignition systems –Piston and Jet engines.

UNIT- IV

AIRCONDITIONING & PRESSURIZING SYSTEM Basic Air Cycle systems –Vapour Cycle Systems, Boot-strap air cycle system –Evaporative vapour cycle systems –Evaporation air cycle systems –Oxygen systems –Fire protection systems, De-icing and anti-icing system.

UNIT- V

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

References Books :-

1. Teager, S. Gas Turbine technology, McGraw Hill 1997.
2. Mckinley, J.L. and Bent R.D. Aircraft Maintenance & Repair, McGraw Hill, 1993.

List Of Experiments:-

1. Study on Mock up system used for aircraft steering.
2. Typical workable hydraulic system used in aircraft.
3. Study of Push pulls rod system.
4. Study of Flight Instruments and Navigation Instruments5.Study of Vapor Cycle cooling Systems.

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AEA- 403 Aerodynamics-I

UNIT- I

REVIEW OF BASIC FLUID MECHANICS System and Control volume approach, substantial, local and convective derivative, Continuity, momentum and energy equations, inviscid flow, Euler equation, incompressible Bernoulli's Equation. Circulation and Vorticity, Green's Lemma and Stoke's Theorem, Barotropic Flow, Kelvin's theorem, Streamline, Stream Function, Irrotational flow, Potential Function, Equipotential Lines, Elementary Flows and their combinations.

UNIT- II

TWO DIMENSIONAL INVISCID IN COMPRESSIBLE FLOW Ideal Flow over a circular cylinder, D'Alembert"s Paradox, Magnus effect, Kutta Joukowski's Theorem, Starting Vortex, Kutta condition, Real flow over smooth and rough cylinder.

UNIT- III

AIRFOIL THEORY Cauchy- Riemann relations, Complex Potential, Methodology of Conformal Transformation, Kutta-Joukowski transformation and its applications, Karman Trefftz Profiles, Thin Airfoil theory and its applications.

UNIT- IV

SUBSONIC WING THEORY Vortex Filament, Biot and Savart Law, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Lifting Line Theory and its limitations.

UNIT- V

INTRODUCTION TO LAMINAR & TURBULENT FLOW Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, Energy thickness, Shape parameter, Boundary layer equations for a steady, two dimensional Incompressible flow, Boundary Layer growth over a Flat plate, Critical Reynolds Number, blasius solution, Basics of Turbulent flow, Prandtl's mixing length hypothesis, Free shear layers.

References Books :-

1. Milne Thomson, L.H., Theoretical Aerodynamics, Macmillan, 19852. John J Bertin., Aerodynamics for Engineers, Pearson Education Inc, 2002
2. Clancey, L J., Aerodynamics, Pitman, 1986.

List of Experiments :-

1. Calibration of subsonic wind tunnel.
2. Pressure distribution over smooth and rough cylinder.
3. Pressure distribution over symmetric airfoil.
4. Pressure distribution over cambered airfoil& thin airfoils
5. Force measurement using wind tunnel balance

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AEA- 404 Aircraft Propulsion –I

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 compressor–Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet–Performance characteristics.

UNIT- II

SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES 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–Starting problem on supersonic inlets –Shock swallowing by area variation – External declaration –Models of inlet operation.

UNIT- III

COMBUSTION CHAMBERS Classification of combustion chambers–Important factors affecting combustion chamber design –Combustion process–Combustion chamber performance– Effect of operating variables on performance–Flame tube cooling–Flame stabilization–Use of flame holders–Numerical problems.

UNIT- IV

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- V

COMPRESSORS Principle of operation of centrifugal compressor–Work done &pressure rise– Velocity diagrams –Diffuser vane design considerations–Concept of pre whirl–Rotation stall– Elementary theory of axial flow compressor–Velocity triangles–Degree of reaction–Three dimensional–Air angle distributions for free vortex and constant reaction designs–Compressor blade design–Centrifugal and Axial compressor performance characteristics.

References Books :-

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Longman, 1989.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
3. "Rolls Royce Jet Engine" –Third Edition –1983.
4. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 1999.

List of Experiments:-

1. Study of an aircraft piston engine - assembly of sub systems.
2. Study of an aircraft piston engine - various components, their functions and operating principles.
3. Study of an aircraft jet engine - assembly of sub systems.
4. Study of an aircraft jet engine - various components, their functions and operating principles.
5. Study of forced convective heat transfer

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AEA- 405 Aircraft Structure –I

UNIT- I

STATICALLY DETERMINATE STRUCTURES Statically determinate frames –plane truss analysis –method of joints –method of sections 3D trusses –the landing gear tripod –beams of two materials.

UNIT- II

STATICALLY INDETERMINATE STRUCTURES Propped cantilevers –fixed-fixed beams–Clapeyron's 3 moment equation moment Distribution method.

UNIT- III

ENERGY METHODS Strain energy evaluation in structural members –energy theorems – dummy load & unit load methods –Maxwell's reciprocal theorem –energy methods applied to statically determinate and indeterminate beams, frames, rings & trusses.

UNIT- IV

COLUMNS Euler's column curve –inelastic buckling –effect of initial curvature –the South well plot –columns with eccentricity –use of energy methods –theory of beam columns –beam columns different end conditions –stresses in beam columns.

UNIT- V

FAILURE THEORIES Ductile and brittle materials –maximum principal stress theory - maximum principal strain Theory -maximum shear stress theory -distortion energy theory –octa hedral shear stress theory.

References Books :-

1. Donaldson, B.K., „Analysis of Aircraft Structures -An Introduction", McGraw Hill, 1993.
2. Megson T M G, `Aircraft Structures for engineering students" Edward Arnold Publishers.
3. Peery, D.J., and Azar, J.J., Aircraft Structures, 2nd edition, McGraw –Hill,N.Y., 1999.

List of Experiments :-

1. Study the construction of fuselage and identify the primary load carrying members
2. Study the construction of wings.
3. Measurement of deflection of Truss members. 4. Study of Composite structure.5. Study the construction of landing gears

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AEA- 406 Java Programming

UNIT-I

Introduction To Java Basics of Java programming, Data types, Variables, Operators, Control structure including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

UNIT-II

Objects And Classes Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference.

UNIT-III

Inheritance And Polymorphism Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

UNIT-IV

Event And Gui Programming Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames. Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.

UNIT-V

Multithreading In Java Thread life cycle and methods, Runnable interface, Threadsynchronization, Exception handling with try-catch-finally, Collections in java, Introductionto JavaBeans and Network Programming.

Text Books:

1.Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.

References Books :-

1. Naughton & Schildt "The Complete Reference Java 2", Tata McGraw Hill.
2.The Complete Reference, Java
3. (Fourth Edition), Herbert Schild, TMH.
4.Java Programming, D. S. Malik, Cengage Learning.

List of Experiment :-

1. Installation of J2SDK
2. Write a program to show Scope of Variables
3. Write a program to show Concept of CLASS in JAVA
4. Write a program to show Type Casting in JAVA
5. Write a program to show How Exception Handling is in JAVA
6. Write a Program to show Inheritance
7. Write a program to show Polymorphism
8. Write a program to show Access Specifiers (Public, Private, Protected) in JAVA
9. Write a program to show use and Advantages of CONTRUCTOR
10. Write a program to show Interfacing between two classes
11. Write a program to Add a Class to a Package

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12. Write a program to show Life Cycle of a Thread
13. Write a program to demonstrate AWT.
14. Write a program to Hide a Class
15. Write a Program to show Data Base Connectivity Using JAVA
16. Write a Program to show "HELLO JAVA " in Explorer using Applet
17. Write a Program to show Connectivity using JDBC
18. Write a program to demonstrate multithreading using Java.
19. Write a program to demonstrate applet life cycle.
20. Write a program to demonstrate concept of servlet.

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AEA-407 Industrial Training –I

The following objective should be fulfilled in industrial training –I, and student must participate in any aerospace/aeronautical industry where they can learn to apply the Technical knowledge in real Industrial situations.

- Gain experience in writing Technical reports/projects.
- Expose students to the engineer's responsibilities and ethics.
- Expose the students to future employers.
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations

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Name of Faculty: School of Engineering

Name of Department: **Aeronautical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **04/06/2019**

The Board of Studies Committee Meeting was held in the room of Department of Aeronautical Engineering at 2:30 PM. on **04/06/2019**, Following members were present.

1. Mr. Prashant Singh, Asst. Prof.(Aeronautical Engineering) – Chairman
2. Ms. Sandhya Sahu, Asstt. Prof. (Aeronautical), Member
3. Mr. Anil Verma,Assist. Prof. (Mech.), Member
4. Mrs.Priyanka Jhavar,Asst Prof (Mech.)Member

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda Preparation of syllabus and Scheme for VI and V Sem.

Discussion Scheme

Scheme and syllabus was put up before the member as per recent AICTE Guidelines, It was Discussed in Detail by the Members and some modifications were Suggested.

Resolution of the Discussion:

It was resolved that the scheme and syllabus as proposed with some modification and may be acceptedThe Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

Mr. Prashant Singh, Asst. Prof.(Aeronautical Engineering) – Chairman

Ms. Sandhya Sahu, Asstt. Prof. (Aeronautical), Member

Mr. Anil Verma,Assist. Prof. (Mech.), Member

Mrs.Priyanka Jhavar,Asst Prof (Mech.)Member

Chairman

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V SEMESTER

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	AEA-501	Aircraft Structure -II	60	30	10	30	20	150	2	1	2	4
2	AEA-502	Aerodynamics -II	60	30	10	30	20	150	2	1	2	4
3	AEA-503	Aircraft Propulsion -II	60	30	10	30	20	150	2	1	2	4
4	AEA-504	Program Elective - I	60	30	10	-	-	100	3	1	0	4
5	AEA-505	Open Core Elective - I	60	30	10	-	-	100	3	1	0	4
6	AEA-506	Industrial Training-I				150	100	250			4	2
	TOTAL		**300**	**150**	**50**	**240**	**160**	**900**	**12**	**5**	**10**	**22**

Program Elective - I	
AEA-504	AEA-504 (A) Basics Aircraft Maintenance & Repair
	AEA-504 (B) Theory of Vibration
Open Core Elective-I	
AEA-505	AEA-505 (A) Nano Science & Technology
	AEA-505 (B) Heat and Mass Transfer

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VI SEMESTER

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	AEA-601	Aircraft Design	60	30	10	30	20	150	2	1	2	4
2	AEA-602	Aircraft Stability & Control	60	30	10	30	20	150	2	1	2	4
3	AEA-603	Program Elective - II	60	30	10	-	-	100	3	1	0	4
4	AEA-604	Program Elective - III	60	30	10	-	-	100	3	0	0	3
5	AEA-605	Open Core Elective-II	60	30	10	-	-	100	3	0	0	3
6	AEA-606	Minor Project	-	-	-	180	120	300	-	-	4	2
		TOTAL	**300**	**150**	**50**	**240**	**160**	**900**	**13**	**3**	**8**	**20**

Program Elective - II	
AEA-603	AEA-603 (A) Aircraft Rules & Regulation
	AEA-603 (B)Wind Tunnel Techniques
Program Elective - III	
AEA-604	AEA-604 (A) Fuel & Combustion
	AEA-604 (B) Maintenance of Radio & Communication Systems
Open Core Elective-II	
AEA-605	AEA-605 (A) Product Design & Development
	AEA-605 (B) Management and Entrepreneurship

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Semester -V

AEA-501 Aircraft Structure- II

AEA-501	**Aircraft Structure- II**	**2L:1T:0P**	**3 credits**	**3Hrs/Week**

Course Preambles:

To provide the behavior of loads experience of aircraft indigenous components.

- To provide the students adopt with various methods for analysis of aircraft wings and fuselage.
- To provide conception design of major aircraft structural components.
- To provide the better understate the low weight structures..

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Ability to understand loads acting an aircraft.
- Ability to identify& resolve the structural design& its limitations.
- Ability to improvise distribution their loads on aircraft member with safer limits.
- Ability to understand the design of low weight to high strength panel member.
- Ability to analyze the aircraft real structural components such as wings and fuselage.

Unit 1: Fundamentals of Structural Analysis (10 hours)

Basic Elasticity: stress, notation for forces and stresses , equation of equilibrium, plane stress, Boundary conditions, determination of stresses on inclined planes, principal stresses, strain, Compatibility equations, plane strain, determination of strains on inclined planes principal Strains, stress-strain relationship.

Unit 2: Bending of Thin Walled Beams (10 hours)

Bending of open and closed thin walled beams: Symmetrical bending, unsymmetrical bending, deflection due to bending, calculation of section properties, application of bending theory, temperature effects, and numerical problems.

Unit 3: Shear Flow (8 hours)

Torsion of beams: torsion of closed section beams, torsion of multi-cell section, shear center, properties of shear center, numerical problems.

Unit 4: Introduction to Controller Design (10 hours)

Bredt-Batho formula, Shear flow in open section, Shear flow in closed section, shear flow in boom section, combination of open and close section.

Unit 5: Airworthiness and Airframe Loads (10 hours)

Airworthiness, factor of safety-flight envelope, load factor determination, loads on an aircraft, safe life and fail safe structure, fatigue, creep and relaxation, materials used in an aircraft.

References:

- Megson T.H.G., Aircraft Structure for engineering students, Edward Arnold.
- Perry D.J. and Azar J.J., Aircraft Structures, McGraw hill.

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AEA-501 Aircraft Structure- II

AEA-501	**Aircraft Structure- II**	**0L:0T:1P**	**1 Credits**	**2 Hrs/week**

List of Experiments:

- Verification of Maxwell's Reciprocal theorem & principle of superposition.
- Shear center location for open sections.
- Deflection of beams with various end conditions for different load.
- Shear center location for closed sections.

Lab Outcome:

- Student able to understand Shear center location for open sections, close sections.
- Student can measure the loading condition of beams with various end conditions for different load.

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AEA-502 Aerodynamics-II

AEA-502	Aerodynamics-II	2L:1T:0P	3 Credits	3Hrs/Week

Course Preambles:

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

Course Outcomes:

- Calculate the compressible flow through a duct of varying cross section.
- Use quasi one-dimensional theory to analyze compressible flow problems.
- Estimate fluid properties in Rayleigh and Fanno type flows.
- Estimate the properties across normal and oblique shock waves.

Unit 1: Fundamental Aspects of Compressible Flow: (10 Hours)
Compressibility, Continuity, Momentum and energy equation, Calorically perfect gas, Mach number, speed of sound –Velocity relation, Mach cone, Mach angle, One dimensional Isentropic flow through variable area duct, Static and Stagnation properties, Critical conditions, Characteristic Mach number, Area-Mach number relation, Maximum discharge velocity.

Unit 2: Shock and Expansion Waves (10 Hours)
Normal shock relations, Prandtl's relation, Huguenot equation, Rayleigh Supersonic Pitot tube equation, Moving normal shock waves, Oblique shocks, Θ-β-M relation, Shock Polar, Reflection of oblique shocks, left running and right running waves, Interaction of oblique shock waves, slip line, Rayleigh flow, Fanno flow, Expansion waves, Prandtl-Meyer expansion, Maximum turning angle, Simple and nonsimple regions, operating characteristics of Nozzles.

Unit 3: Two Dimensional Compressible Flow (10 Hours)
Potential equation for 2-dimensional compressible flow, Linearization of potential equation, perturbation potential, Linearized Pressure Coefficient, Linearized subsonic flow, Prandtl-Glauert rule, Linearized supersonic flow, Method of characteristics.

Unit 4: High Speed Flow Over Airfoils, Wings and Airplane (40 Hours):
Supercritical Airfoil Sections, Transonic area rule, Swept wing, Airfoils for supersonic flows, Lift, drag, Pitching moment and Centre of pressure for supersonic profiles, Shock expansion theory, wave drag, supersonic wings, Design considerations for supersonic aircrafts.

Unit 5: Special Topics (6 Hours)
Shock-Boundary layer interaction, Wind tunnels for transonic, Supersonic and hypersonic flows, shock tube, Gun tunnels, Supersonic flow visualization, Introduction to Hypersonic Flows.

References:

1. Anderson, J. D, Modern Compressible Flow, McGraw-Hill & Co., 2002.
2. Rathakrishnan, E, Gas Dynamics, Prentice Hall of India, 2004.

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AEA-502	Aerodynamics-II	0L:0T:1P	1 Credits	2 Hrs/week

List of Experiments:

- The lift and drag over an NACA-0012 Aerofoil
- Study of shock tube
- Study of supersonic aircraft vehicle.
- Shock wave generation over the spacecraft.
- Study of subsonic compressible flow.

Lab Outcome:

- Student able to understand subsonic compressible flow, supersonic aircraft vehicle, Shock wave generation, shock tube and can make test the drag over an NACA-0012 Airfoil.

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AEA-503 Aircraft Propulsion –II

AEA-503	Aircraft Propulsion –II	2L:1T:0P	3 Credits	3Hrs/Week

Course Preambles:

To impart make students understand theory in non-air-breathing and hypersonic propulsion methods to students so that they are familiar with various propulsion technologies associated with space launch vehicles, missiles and space probes.

Course Outcomes:

- Understanding ramjet and hypersonic air breathing propulsion systems.
- To get familiarity in rocket propulsion systems.
- Knowing the applications and principles of liquid and solid-liquid propulsion systems.
- To gain knowledge about the advanced propulsion technique used for interplanetary mission.

Unit 1: Aircraft Gas Turbines: (10 Hours)

Impulse and Reaction Types of gas turbines – Velocity triangles and power output – Elementary theory Vortex theory – Choice of blade profile, pitch and chord – Estimation of stage performance– Limiting factors in gas turbine design- Overall turbine performance – Methods of blade cooling –Matching of turbine and compressor – Numerical problems.

Unit 2: Ramjet Propulsion: (10 Hours)

Operating principle – Sub critical, 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 3: Fundamentals of Rocket Propulsion: (10 Hours)

Operating principle – Specific impulse of rocket - Rocket nozzle classification – Rocket performance considerations – Numerical Problems.

Unit 4: Advanced Propulsion Techniques: (8Hours)

Solid propellant rockets – Selection criteria of solid propellants – Important hardware components of solid rockets – Propellant grain design considerations – Liquid propellant rockets– Selection of liquid propellants – Thrust control in liquid rockets – Cooling in liquid rockets –Limitations of hybrid rockets.

Unit 5: State Space Analysis: (10 Hours)

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

References:

- Anderson J.D. Introduction to flight, McGraw Hill Education (India) Pvt. Ltd.
- Ganesan V. Gas Turbines, McGraw Hill Education (India) Pvt. Ltd.
- Sutton, G.P., —Rocket Propulsion Elementsl, John Wiley & Sons Inc., New York, 5thEdn.

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AEA-503	Aircraft Propulsion –II	0L:0T:1P	1 Credits	2 Hrs/week

List of Experiments:

- Water Rocket
- Water jet study
- Calorific value estimation
- Ignition Delay Measurement
- Identification of burning rate

Lab Outcome:

- Student able to understand can measure Ignition Delay, Burning rate, Calorific value, and can develop the Water Rocket, Water jet study.

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Program Elective - I

AEA-504 (A) Basics Aircraft Maintenance & Repair

AEA-504 (A)	Basics Aircraft Maintenance & Repair	3L:1T:0P	4 Credits	4Hrs/Week

Course Preambles:

- To make the students to familiarize with the Aircraft maintenance procedure an practice.
- Must have knowledge of basics of Aeronautics and its components.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Apply maintenance procedure to Aircraft Structure
- Identify the Aircraft components and faults
- Apply nondestructive testing procedures to identify the defects
- Apply overhauling procedure to new aircraft.

Unit 1: Welding in Aircraft Structure (12 Hours)

Equipment used in welding shop and their maintenance – Ensuring quality welds –Welding jigs and fixtures – Soldering and brazing.

Sheet Metal Repair and Maintenance (12 Hours)

Inspection of damage – Classification – Repair or replacement – Sheet metal inspection – N.D.T. Testing – Riveted repair design, Damage investigation.

Unit 2: Plastics and Composites in Aircraft (12 Hours)

Review of types of plastics used in airplanes – Maintenance and repair of plastic components – Repair of cracks, holes etc., various repair schemes – Scopes. Inspection and Repair of composite components – Special precautions.

Unit 3: Aircraft Jacking and Rigging (12 Hours)

Airplane jacking and weighing and C.G. Location. Balancing of control surfaces –Inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

Unit 4: Synchronous Machines (12 Hours)

Trouble shooting and maintenance practices–Service and inspection–Inspection and maintenance of landing gear systems. – Inspection and maintenance of air-conditioning and pressurization system, water and waste system. Installation and maintenance of Instruments – handling– Testing– Inspection. Inspection and maintenance of auxiliary systems. Position and warning system.

Unit 5: Computer aided Design (CAD): (12 Hours)

Hazardous materials storage and handling, Aircraft furnishing practices – Equipment's. Trouble Shooting - Theory and practices.

References:

- Larry Reithmeir, —Aircraft Repair Manual‖, Palamar Books, Marquette, 1992.
- BRIMM D.J. BOGGES H.E., —Aircraft Maintenance‖, Pitman Publishing corp. New York. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

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AEA-504 (B) Theory of Vibration

AEA-504 (B)	Theory of Vibration	3L:1T:0P	4 Credits	4Hrs/Week

Course Preambles:

- To study the effect of time dependent forces on mechanical systems and to get the natural characteristics of system with more degree of freedom systems.
- To study the vibration and aero elastic effects of aircraft wing.

Course Outcomes

- Gaining understanding of single and multi-degree vibrating systems
- Ability to use numerical techniques for vibration problems
- Knowledge acquired in aero elasticity and fluttering.
- Differentiate types of vibrations according to dampness and particle motion.
- Solve Rayleigh and Holzer method to find natural frequency of an object

Unit 1: Introduction (12 hours)

Types of vibrations, S.H.M, principle of super position applied to Simple Harmonic Motions. Beats, Fourier theorem and simple problems.

Unit 2: Maxwell's Equations (12 hours)

Single degree of freedom systems. Undamped free vibration, natural frequency of free vibration, spring and Mass elements, effect of mass of spring, Compound Pendulum. Single degree of freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases under damping, critical and over damping, Logarithmic decrement.

Unit 3: Forced Vibration & Vibration Measuring Instruments (12 hours)

Single degree of freedom systems, steady state solution with viscous damping due to harmonic force. Solution by Complex algebra, reciprocating and rotating unbalance, vibration isolation, transmissibility ratio. Due to harmonic excitation and support motion. Vibration of elastic bodies– Vibration of strings – Longitudinal, lateral and torsional Vibration.

Unit 4: Systems with two Degrees of Freedom (12 hours)

Introduction, principle modes and Normal modes of vibration, co-ordinate coupling, Generalized and principal co-ordinates, free vibration in terms of initial conditions. Geared systems. Forced Oscillations-Harmonic excitation. Applications: a) Vehicle suspension. b) Dynamic vibration absorber. c) Dynamics of reciprocating Engines. Continuous Systems: Introduction, vibration of string, longitudinal vibration of rods, Torsional vibration of rods, Euler's equation for beams.

Unit 5: Waveguides (12 hours)

Introduction, Influence coefficients, Maxwell reciprocal theorem, Dunkerley's equation. Orthogonally of principal modes, Method of matrix iteration-Method of determination of all the natural frequencies using sweeping matrix and Orthogonally principle. Holzer's method, Stodola method.

Reference:

1. Theory of Vibrations W.T.Thomson.
2. Theory of Vibrations Grover & Nigam

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AEA-505 (A) Nano science & Technology

AEA-505 (A)	**Nano science & Technology**	**3L:1T:0P**	**4 Credits**	**4Hrs/Week**

Course Preambles

To foundational knowledge of the Nano science and related fields.2.To make the students acquire an understanding the Nano science and Applications 3. To help them understand in broad outline of Nano science and Nanotechnology.

Course Outcomes

After completing this course students will be able to:

- Learn about the background on Nano science
- Understand the synthesis of nanomaterial's and their application and the impact of nanomaterial's on environment
- Apply their learned knowledge to develop Nanomaterial's.

Unit 1: Bonding in Atoms (12 hours)

Giant molecular solids. Electronic conduction, system classification confined to one, two or three dimension and their effect on properties, top-down and bottom-up processes.

Unit II: Characterization (12 hours)

Characterization using scanning electron microscopy (SEM), electro probe microanalysis (EPMA), transmission electron microscopy (TEM) including energy dispersive X-ray (EDX) analysis, electron energy loss spectroscopy (EELS), Auger electron spectroscopy (AES), low energy electron diffraction (LEED), reflection high energy electron diffraction (RHEED).

Unit 3: Technique-1 (12 hours)

When photons are used as probes, generally electrons/photons are emitted and are analyzed as light microscopy including confocal and two photon microscopy, X-ray diffraction (XRD), X-ray fluorescence (XRF), X-ray absorption spectroscopy (XAS), infrared spectroscopy (IR), Raman spectroscopy (Raman), Luminescence, and X-ray photo electron spectroscopy (XPS). Proximal probe technique to monitor the interaction between a localized probe and a sample surface.

Unit 4: Technique-2 (12 hours)

Atomic force microscopy (AFM), scanning tunneling microscopy (STM) and scanning tunneling spectroscopy (STS). There is also position-sensitive atom probe (POSAP) spectroscopy. Inorganic nanostructures, optical properties, exactions, pn junctions, phonons, quantum confinement, quantum dots, colloidal quantum dots, characterization and application like biopolymer tagging and light emitting semiconductor quantum dots, Nano magnetism in technology and the challenges.

Unit 5: Chemistry (12 hours)

Chemistry of carbon, light emission from organic molecules, fluorescence and electroluminescence, synthetic metals, carbon nanotubes, Nano cuboids, grapheme, carbon quantum dots. Carbon Nano tube as Nano test tube for quantum dot synthesis, functionalized Nano particles for biological applications, bio mineralization. DNA as a nanotechnology building block, directed assembly using biomolecules., molecular motors, biological motors, artificial photosynthesis, solar energy transduction.

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Reference:

- Nano scale science and technology, John Wiley & Sons., 2005.
- Electron Microscopy and analysis, 2nd ed. Taylor and Francis, 2000.

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AEA-505(B) Heat and Mass Transfer

AEA-505 (B)	Heat and Mass Transfer	3L:1T:0P	4 Credits	4Hrs/Week

Course Preambles:

- To study the effect of time dependent forces on mechanical systems and to get the natural characteristics of system with more degree of freedom systems.
- To study the vibration and aero elastic effects of aircraft wing.

Course Outcomes:

- Gaining understanding of single and multi-degree vibrating systems
- Ability to use numerical techniques for vibration problems
- Knowledge acquired in aero elasticity and fluttering.
- Differentiate types of vibrations according to dampness and particle motion.
- Solve Rayleigh and Holzer method to find natural frequency of an object.

Unit 1: Fundamentals (12 Hours)

Modes of heat transfer: Conduction –Convection – Radiation

Unit 2: Heat Conduction (12 Hours)

Steady and unsteady state heat conduction in solids - Effect of variation of thermal conductivity on heat transfer in solids –conduction with heat generation –Heat transfer problems in infinite and semi-infinite solids–Critical radius of insulation-Extended surfaces-Application of numerical techniques.

Unit 3: Free and Forced Convection (12 Hours)

Convection fundamentals: Basic equations, Boundary layer concept, Dimensional analysis Free Convention: Laminar boundary layer equation- Free convection in atmosphere free Convection on a vertical flat plate –Integral method - Empirical relation in free convection – External flow. Forced convection: Forced convection - Laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations - numerical techniques in problem solving.

Unit 4: Radiative Heat Transfer and Heat Exchangers (12 Hours)

Concept of black body-Intensity of radiation-Laws of Black body Radiation-Radiation from non-black surfaces- real surfaces –Radiation between surfaces-Radiation shape factors-Radiation shields. HEAT EXCHANGERS: Types-overall heat transfer coefficient- LMTD-NTU method of heat exchanger Analysis.

Unit 5: Ac-dc bidirectional boost converter (6 Hours)

Heat transfer problems in gas turbine combustion chambers - Rocket thrust chambers Aerodynamic heating - Ablative heat transfer.

References:

- Sachdeva, S.C. Fundamentals of Engineering, Heat and Mass Transfer, Wiley Eastern Ltd., New Delhi, 1981.
- 2.Lienhard, J.H., —A Heat Transfer Text Book‖, Prentice Hall Inc., 1981.
- 3.Holman, J.P., —Heat Transfer‖, McGraw-Hill Book Co., Inc., New York, 6th Edn 1991.

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AEA 506 Industrial Training-I

AEA 506	**Industrial Training-I**	**0L:0T:4P**	**2 Credits**	**4Hrs/Week**

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Analyze the dynamic response and the calibration of few instruments
- Learn about various measurement devices, their characteristics, their operation and their limitations.
- Understand statistical data analysis
- Understand computerized data acquisition.
- Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on Minor project work.

Guidelines:

- The Minor-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
- The Minor project may be a complete hardware or a combination of hardware and software.
- The software part in Minor project should be less than 50% of the total work.
- Minor Project should cater to a small system required in laboratory or real life.
- It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
- After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and Preambles of Minor project.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
- The student is expected to exert on design, development and testing of the proposed work as per the schedule.
- Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

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Department of Aeronautical Engineering

AEA-601 Aircraft Design

AEA-601	Aircraft Design	2L:1T:0P	3 Credits	3Hrs/Week

Course Preambles:

- Familiarize students with the important issues and methodologies of aircraft design.
- Illustrate the process of aircraft synthesis as an outcome of the integration of the disciplines of aerodynamics, performance, stability and control, propulsion, structures and aero elasticity.
- Develop the ability to function as a member of a team in a design setting; including the ability to conduct a peer review of the other team members.

Course Outcomes:

- After completing this course students will be able to:
- Perform preliminary design of a complete aircraft based on the specifications provided.
- Performing a detailed preliminary design of a complete aircraft.

Unit-1: Preliminaries (10 Hours)

Aircraft Design Requirements, specifications, role of users. Aerodynamic and Structural Consideration, Importance of weight. Airworthiness requirements and standards. Classifications of airplanes. Special features of modern airplane. Air Loads in Flight: Symmetrical measuring loads in flight, Basic flight loading conditions, Load factor, Velocity - Load factor diagram, gust load and its estimation, Structural limits.

Unit-2: Airplane Weight Estimation (10 Hours)

Weight estimation based on type of airplane, trends in wing loading, weight-estimation based on mission requirements, iterative approach. Basic Wing Design: Selection of airfoil selection, influencing factors. Span wise load Distribution and plan form shapes of airplane wing. Stalling take-off and landing Considerations. Wing drags estimation. High lift devices. Structural Design: Cockpit and aircraft passenger cabin layout for different categories, types of associated structure, features of light airplanes using advanced composite materials. Structural aspects of design of airplane, Bending moment and shear force diagram. Design principles of all metal stressed skin wing for civil and military applications.

Unit-3: Landing Gears (10 Hours)

Different kinds of landing gears, and associated arrangement for civil and military airplanes. Preliminary calculations for locating main and nose landing gears.

Unit-4: Integration of Structure and Power Plant (10 Hours)

Estimation of Horizontal and Vertical tail volume ratios. Choice of power plant and various options of locations, considerations of appropriate air-intakes. Integration of wing, fuselage, empennage and power plant. Estimation of center of gravity.

Unit-5 Introduction of advanced concepts: (5 Hours)

Supercritical Wings, relaxed static Stability, controlled configured vehicles, V/STOL aircraft and rotary wing vehicles. Design and layout of flying controls and engine controls.

References:

- Daniel P Raymer, Aircraft Design: A conceptual approach, AIAA Series, 1992.
- John D Anderson (Jr.), Airplane Performance and Design, mcgraw Hill.

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Department of Aeronautical Engineering

AEA-601	Aircraft Design	0L:0T:1P	1 Credits	2Hrs/Week

List of Experiment:

- Comparative configuration study of different types of airplanes.
- Comparative study on specification and performance details of aircraft.
- Preparation of comparative data sheets.
- Work sheet layout procedures.
- Comparative graphs preparation and selection of main parameters for the design.
- Preliminary weight estimations, selection of main parameters.
- Power plant selection, Airfoil selection, Wing tail and control surfaces.
- Preparation of layouts of balance diagram and three view drawings.
- Estimation of various Drags.
- Detailed performance calculations and stability estimates.

Lab Outcome:

- Student able to understand can develop the basic concept of any aircraft design.
- All students will learn the design of an Airplane for given preliminary specifications.

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AEA-602 Aircraft Stability & Control

AEA-602	Aircraft Stability & Control	2L:1T:0P	3 Credits	3Hrs/Week

Course Preambles:

- To introduce the concept of Stability and control of Aircraft.
- To impart knowledge about various Aircraft motions and related stability.
- To introduce the concept of dynamic stability of Aircraft.

Course Outcomes:

After completing the course the student will be able to

- Understand the degree of freedom of aircraft system.
- Analyse the static stability Behaviour of the aircraft.
- Understand the dynamic longitudinal stability of aircraft.
- Perform the dynamic analysis to determine stability of aircraft.
- Estimate the requirement of control force and power plant.
- Assess the motion of unstable aircraft and related modes of instability.

Unit 1: Historical perspective (10 Hours)

Aerodynamic Nomenclature, Equilibrium conditions, Definition of static stability, Definition of longitudinal static stability, stability criteria, Contribution of airframe components: Wing contribution, Tail contribution, Fuselage contribution, Power effects Propeller airplane and Jet airplane Introduction, Trim condition. Static margin. Stick fixed neutral points. Longitudinal control, Elevator power, Elevator angle versus equilibrium lift coefficient, Elevator required for landing, Restriction on forward C.G. range.

Unit 2: Static Longitudinal Stability& Static Directional Stability (10 Hours)

Control-Stick free Introduction, Hinge moment parameters, Control surface floating characteristics and aerodynamic balance, Estimation of hinge moment parameters, The trim tabs, Stick-free Neutral point, Stick force gradient in unaccelerated flight, Restriction on aft C.G. Introduction, Definition of directional stability, Static directional stability rudder fixed, Contribution of airframe components, Directional control. Rudder power, Stick-free directional stability, Requirements for directional control, Rudder lock, Dorsal fin. One engine inoperative condition. Weather cocking effect.

Unit 3: Lateral Stability (10 Hours)

Introduction, definition of Roll stability. Estimation of dihedral effect, Effect of wing sweep, flaps, and power, Lateral control, Estimation of lateral control power, Aileron control forces, balancing the aileron. Coupling between rolling and yawing moments. Adverse yaw effects. Aileron reversal. Definition of Dynamic longitudinal stability. Types of modes of motion: long or phugoid motion, short period motion. Airplane Equations of longitudinal motion.

Unit 4: Yawning and Rolling Stability (10 Hours)

Derivation of rigid body equations of motion, Orientation and position of the airplane, gravitational and thrust forces, Small disturbance theory. Aerodynamic force and moment representation, Derivatives due to change in forward speed, Derivatives due to the pitching

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velocity, Derivatives due to the time rate of change of angle of attack, Derivatives due to rolling rate, Derivatives due to yawing rate.

Unit 5: Control (5 Hours)

Routh"s criteria. Factors affecting period and damping of oscillations. Effect of wind shear. Flying qualities in pitch. Cooper-Harper Scale. Response to aileron step-function, side-slip excursion. Dutch roll and Spiral instability. Auto- rotation and spin. Stability derivatives for lateral and directional dynamics.

Reference:

- Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley Son Inc, New York, 1988.
- Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2007.

Department of Aeronautical Engineering

AEA-602	Aircraft Stability & Control	0L:0T:1P	1 Credits	2Hrs/Week

List of Experiment:

- Introduction to flight testing (V-n diagram).
- Evaluation of glider drag polar.
- Evaluation of cruise and climb performance of a small airplane.
- Observations of airplane dynamic modes and stall characteristics.
- Introduction to GPS based navigation.
- Introduction to auto-pilot.

Lab Outcome:

- Student can able to use the V-n diagram, drag polar chart.
- Student can able to understand the functioning of autopilot, GPS based navigation and able to evaluate the cruise and climb performance of a small airplane.

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Program Elective - II

AEA-603(A) Aircraft Rules and Regulation

AEA-603(A)	**Aircraft Rules and Regulation**	**3L:1T:0P**	**4 Credits**	**4Hrs/Week**

Course Preambles:

- Familiarize students with the important terms and rules related with DGCA, ICAO.
- To impart the knowledge on the scope and purpose of Air rules and regulation

Course Outcomes:

- After completing this course students will be able to:
- Identify the flight operations between different altitudes
- Differentiate the runway restrictions and limitations.

Unit-1: C.A.R. Series 'A and B' C.A.R. Series A (12Hours)

Procedure for Civil Air Worthiness Requirements and Responsibility Operators Vis- À-Vis Air Worthiness Directorate Responsibilities of operators / owners-Procedure of CAR issue, amendments etc., Objectives and targets of airworthiness directorate; Airworthiness regulations & safety oversight of engineering activities of operators.

Unit-2: C.A.R. Series 'C' and 'D' C.A.R. Series 'C' (12Hours)

Defect Recording, Monitoring, Investigation and Reporting Defect recording, reporting, investigation, rectification and analysis; Flight report; Reporting and rectification of defects observed on aircraft; Analytical study of in-flight readings & recordings; Maintenance control by reliability Method.

C.A.R.SERIES_D' – and Aircraft Maintenance Programmes

Reliability Programmes (Engines); Aircraft maintenance programme & their approval; on condition maintenance of reciprocating engines; TBO–Revision programme; Maintenance of fuel and oil uplift and consumption records –Light aircraft engines.

Unit-3: C.A.R. SERIES E AND'F' (12Hours)

C.A.R. SERIES E–Approval of Organization

Approval of organizations in categories A, B, C, D, E, F, & G - Requirements of infrastructure at stations other than parent base.

C.A.R.SERIES_F'–Airworthiness and Continued Air Worthiness

Procedure relating to registration of aircraft; Procedure for issue/revalidation of Type Certificate of aircraft & its engines/propeller; Issue/revalidation of Certificate of Airworthiness.

Unit-4: C.A.R. SERIES 'L'&'M" (12Hours)

Issue of AME License, its classification and experience requirements, Mandatory Modifications/Inspections.

Unit-5: C.A.R. SERIES 'T'&'X' (12Hours)

Flight testing of (Series) aircraft for issue of C of A; Flight testing of aircraft for which C of A had been previously issued. Registration Markings of aircraft; Weight and balance control

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of an aircraft; Provision of first aid kits & Physician"s kit in an aircraft; Concessions; Aircraft log books; Document to be carried on board on Indian registered aircraft; Procedure for issue of tax permit.

Reference:

- Aeronautical Information Circulars (relating to Airworthiness) from DGCA 2000.
- Aircraft Manual (India) Volumel–Latest Edition, the English Book Store, 17-1, Connaught Circus, New Delhi

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AEA-603(B) Wind Tunnel Techniques

AEA-603(B)	Wind Tunnel Techniques	3L:1T:0P	4 Credits	4Hrs/Week

Course Preambles:

- To provide knowledge of various types of wind tunnels and test techniques.
- To introduce the basic concepts of measurement of pressure, velocity, forces and moments on models.
- To provide knowledge of various flow visualization techniques

Course Outcomes:

After completing this course students will be able to:

- Choose proper high speed wind tunnel for required test.
- Choose correct model for wind tunnel testing
- Estimate the forces and moments for given model
- Arrive the pressure, velocity and temperature using measurement techniques
- Choose the proper flow visualization techniques

Unit 1: Principles of Model Testing (12Hours)

Buckingham Theorem – Non-Dimensional Numbers – Scale Effect Types of Similarity.

Unit 2: Wind Tunnels (12Hours)

Classification – Special problems of Testing in Subsonic, Transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.

Unit 3: Calibration of Wind Tunnels (12Hours)

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

Unit 4:Wind Tunnel Measurements (12Hours)

Pressure and velocity measurements – Force measurements – Three component and six component balances – Internal balances.

Unit 5: Flow Visualization Techniques (12Hours)

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

References:

- Rae, W.H. and Pope, A. "Low Speed Wind Tunnel Testing", John Wile Publication, 1914.
- Pope, A., and Goin, L., "High Speed wind Tunnel Testing", John Wiley, 1915.

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Program Elective - III

AEA-604 (A) Fuel & Combustion

AEA-604 (A)	Fuel & Combustion	3L:0T:0P	3 Credits	3Hrs/Week

Course Preambles:

- To build up knowledge of the concepts and theories of a of classical fuel combustion.
- To develop understanding of the basic principles and concepts of advanced fuel combustion and control process.

Course Outcomes:

- After completing this course students will be able to:
- Students with the required skills for analyzing thermal cycles.
- Students will get understand fundamental physical and chemical principles regarding formation and control of air pollutants in industrial and technological processes.

Unit 1: Characterization (12Hours)

Fuels –Types and Characteristics of Fuels –Determination of Properties of Fuels –Fuels Analysis – Proximate and Ultimate Analysis –Moisture Determination –Calorific Value –Gross& Net Calorific Values –Calorimetry-DuLong"s Formula for CV Estimation –Flue gas Analysis –Orsat Apparatus – Fuel, Ash Storage & Handling -Spontaneous Ignition Temperatures.

Unit 2: Solid Fuels & Liquid Fuels (12Hours)

(a) Solid Fuels Types –Coal Family –Properties –Calorific Value –ROM, DMMF, DAF and Bone Dry Basis–Ranking –Bulk & Apparent Density –Storage –Washability –Coking & Caking Coals – Renewable Solid Fuels –Biomass –Wood Waste –Agro Fuels –Manufactured Solid Fuels.

(b) Liquid Fuels Types –Sources –Petroleum Fractions –Classification –Refining –Properties of Liquid Fuels: Calorific Value, Specific Gravity, Flash & Fire Point, Octane Number, Cetane Number -Alcohols –Tar Sand Oil –Liquefaction of Solid Fuels.

Unit 3: Gaseous Fuels (12Hours)

Classification –Composition & Properties –Estimation of Calorific Value –Gas Calorimeter –Rich & Lean Gas –Wobbe Index –Natural Gas –Dry & Wet Natural Gas –Stripped NG –FoulandSweet NG – LPG –LNG –CNG –Methane –Producer Gas –Gasifiers –Water Gas –TownGas –Coal Gasification – Gasification Efficiency –Non-Thermal Route –Biogas –Digesters –Reactions –Viability –Economics.

Unit 4: Combustion: Stoichiometry & Kinetics (12Hours)

Stoichiometry –Mass Basis and Volume Basis –Excess Air Calculation –Fuel & Flue Gas Compositions –Calculations –Rapid Methods –Combustion Processes –Stationary Flame –Surface or Flameless Combustion –Submerged Combustion –Pulsating & Slow Combustion Explosive Combustion-Mechanism of Combustion –Ignition & Ignition Energy –Spontaneous Combustion – Flame Propagation –Solid, Liquid and Gaseous Fuels Combustion –Flame Temperature –Theoretical, Adiabatic & Actual –Ignition Limits –Limits of Inflammability.

Unit 5: Combustion Equipment's (12Hours)

Coal Burning Equipment's –Types –Pulverized Coal Firing –Fluidized Bed Firing –Fixed Bed and Recycled Bed –Cyclone Firing –Spreader Stokers –Vibrating Grate Stokers –Sprinkler Stokers – Traveling Grate Stokers –Oil Burners –Vaporizing Burners –Atomizing Burners –Design o burners – Gas Burners –Atmospheric Gas Burners –Air Aspiration Gas Burners –Burners. Classification according to Flame Structures –Factors Affecting Burners & Combustion.

References:

- Samir Sarkar, "Fuels & Combustion", Second Edition, Orient Longman, 1990.
- Bhatt, "Vora Stoichiometry", Second Edition, Tata Mcgraw Hill, 1984.
- Blokh AG, "Heat Transfer in Steam Boiler Furnace", Hemisphere Publishing Corp., 1988.

- Civil Davies, "Calculations in Furnace Technology", Pergamon Press, Oxford, 1966.
- Sharma SP, Mohan Chander, "Fuels & Combustion", Tata Mcgraw Hill, 1989.

AEA-604(B) Maintenance of Radio & Communication Systems

AEA-604(B)	Maintenance of Radio & Communication Systems	3L:0T:0P	3 Credits	3Hrs/Week

Course Preambles:

- To study the electrical cable and resistors.
- To know the various types of antennas and battery
- To understand the basic radio systems.

Course Outcomes:

- This course provides the students deep knowledge Satellite Communications and its application to aircraft.
- At the end of course, students will should able to work on ac and dc measuring instruments.
- The course will focus on various types of antennas.

Unit 1: Electrical Cable and Resistors (12Hours)

Basics of the application and identification of electrical cables used in Aircraft radio installation, crimping and soldering techniques, bonding continuity and insulation tests. Composition, performance (stability and tolerance) and limitations of the fixed resistors and varistors (carbon composition, carbon film, wire wound and metallic film).

Unit 2: AC and DC Measuring Instruments (12Hours)

Electrical power distribution systems, the operation and construction of static inverters, rotary inverters and transformer rectifier units. Basics of interference caused by electrical and ignition system to radio apparatus, methods of minimizing or suppressing such interference, bonding and screening.

Unit 3: Construction and Identification of Various Types of Antennas (12Hours)

The voltage and current distribution along antenna of various length; characteristics of ground planes. Very high frequency (VHF) and high frequency (HF) airborne communications; frequency bands allocation; the methods of propagation and the ranges expected, both day and night; calculation of approximate range of communication (line of sight) with given data. The performance levels expected and specifications of typical airborne HF and VHF communication systems; the principle of operation, installation practices and procedures, functioning of the operating controls and indications and maintenance of typical HF and VHF communication transceivers. Theory of operation, performance level and specifications of an Audio Integration System.

Unit 4: Battery (12Hours)

Working principles and testing of Lead Acid and Nickel Cadmium and Silver Zinc batteries Principles, Characteristics and operation of the under mentioned systems: Automatic Direction Finder (ADF) Systems, Very High Frequency (VHF) Omni, Directional Range System.

Unit 5: Basic Radio Systems (12Hours)

Instrument Landing Systems, Weather Radar Systems, Microwave Devices, Air Traffic Control (ATC) Transponder System, Omega Navigation System, Radio Altimeter Systems, Cockpit Voice Recorder. Distance Measuring Equipment, Doppler Navigation System, Microwave Landing System, GPWS, And Emergency Locator Transmitters. Computers, Simulators. Flight Control Systems. Basics of state-of-the-art communication and navigation systems. Principles of Satellite Communications and its application to aircraft.

Reference:

1. RF Hansforde, Heywood and Company London: Radio Aids to Civil Aviation.

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2. George Kannedy: Electronic Communication System, McGraw Hill
3. Brian Kendal: Manual of Avionics, Blackwell.

Open Core Elective-II

AEA-605 (A) Product Design & Development

AEA-605 (A)	Product Design & Development	3L:0T:0P	3 Credits	3Hrs/Week

Course Preambles:

- Familiarize students with the Product design, development and management process over whole product life cycle.
- To understand Methodology for product design, development and management
- To know Lean new product introduction
- To build the relationship of tangible product and brand
- To know the Marketing and product specification.

Course Outcomes:

- After completing this course students will be able to:
- Identify and analyse the product design and development processes in manufacturing industry.
- Define the components and their functions of product design and development processes and their relationships from concept to customer over whole product lifecycle.
- Analyse, evaluate and apply the methodologies for product design, development and management.

Unit 1: Introduction to Product Design (12Hours)

Applications, Relevance, Product Definition, Scope, Design definitions, the role and nature of design, Old and new design methods, Design by evolution vs design by innovation. Examples such evolution of bicycle, safety razor etc. Need based development, Technology based developments. Physical reliability& Economic feasibility of design concepts

Unit 2: Morphology of Design (12Hours)

Divergent, Transformation and Convergent phases of product design, Identification of need, Analysis of need, Design criteria, Functional aspects, Aesthetics, ergonomics, form (structure). Shape, size, color, Creativity, Mental blocks in creativity, Removal of blocks, Ideation Techniques.

Unit 3: Transformations stage of design (12Hours)

Brainstorming &Synaptic, Morphological techniques, Utility concept, Utility value, Utility index, Economic aspects of design, Fixed and variable costs, Break-even analysis, Product Appraisal Information and literature search, patents, standards and codes, Environment and other safety considerations in product design.

Unit4: Reliability (12Hours)

Reliability considerations in product design, Bath tub curve, Reliability of systems in series and parallel. Failure rates, MTTF and MTBF, Optimum spares from reliability consideration.

Unit5: Design of displays and controls (12Hours)

Man-Machine interface, Compatibility of displays and controls, Ergonomic aspects of design, Anthropometric data and its importance in design.

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- Product Design & Manufacturing - A.K.Chitale & R.C.Gupta, Prentice Hall. Engg . Product Design -C .D. Cain, Bussiness Books.
- Industrial design for Engineers –W .H. Mayall, Itiffe.
- Product Design & Decision Theory - M.K. Starr - Prentice Hall

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AEA-605 (B) Management and Entrepreneurship

AEA-605 (B)	Management and Entrepreneurship	3L:T:0P	3 Credits	3Hrs/Week

Course Preambles:

- Understanding basic concepts in the area of entrepreneurship,
- Understanding the role and importance of entrepreneurship for economic development,
- Developing personal creativity and entrepreneurial initiative,
- Adopting of the key steps in the elaboration of business idea,
- Understanding the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

Course Outcomes:

- Identify the elements of success of entrepreneurial ventures,
- Consider the legal and financial conditions for starting a business venture,
- Evaluate the effectiveness of different entrepreneurial strategies, specify the basic performance indicators of entrepreneurial activity,

Unit 1: Management & Planning (12Hours)

Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management &Administration, Management as a Science, Art & Profession Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.

Unit 2: Organizing and Staffing (12Hours)

Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees –meaning, Types of Committees, Centralization Vs Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment.

Unit 3: Entrepreneurship (12Hours)

Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Entrepreneur – An Emerging Class, Comparison between Entrepreneur and Entrepreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship.

Unit4: Modern Small Business Enterprises (12Hours)

Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry.

Unit 5: Project Management (12Hours)

Meaning of Project, Project Objectives & Characteristics, Project Identification- Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents

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Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation.

References:

- Principles of Management–P. C. Tripathi, P. N. Reddy–Tata McGraw Hill,
- Dynamics of Entrepreneurial Development & Management Vasant Desai Himalaya Publishing House.
- Management Fundamentals- Concepts, Application, Skill Development-Robers Lusier Thomson.

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AEA-606 Minor Project

AEA-606	Minor Project	0L:0T:4P	2 Credits	4Hrs/Week

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Analyze the dynamic response and the calibration of few instruments
- Learn about various measurement devices, their characteristics, their operation and their limitations
- understand statistical data analysis
- Understand computerized data acquisition.
- Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on Minor project work.

Guidelines:

- Minor Project should cater to a small system required in laboratory or real life.
- After interactions with course coordinator and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and Preambles of Minor project.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
- The student is expected to exert on design, development and testing of the proposed work as per the schedule.
- Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

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Name of Faculty: School of Engineering

Name of Department: **Aeronautical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **01/05/2020**

The Board of Studies Committee Meeting was held in the room of Department of Aeronautical Engineering at 2:30 PM. on **01/05/2020**, Following members were present.

1. Mr. Prashant Singh, Asst. Prof.(Aeronautical Engineering) – Chairman
2. Ms. Sonu Mittal, Asstt. Prof. (Aeronautical), Member
3. Mr. Anil Verma,Assist. Prof. (Mech.), Member
4. Mrs.Priyanka Jhavar,Asst Prof (Mech.)Member

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda Preparation of syllabus and Scheme for VII & VIII Semester

Discussion Scheme

Scheme and syllabus was put up before the member as per recent AICTE Guidelines, It was discussed in Detail by the Members and some modifications were suggested.

Resolution of the Discussion:

It was resolved that the scheme and syllabus as proposed with some modification and may be accepted

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

1. Mr. Prashant Singh, Asst. Prof.(Aeronautical Engineering) – Chairman
2. Ms. Sonu Mittal, Asstt. Prof. (Aeronautical), Member
3. Mr. Anil Verma,Assist. Prof. (Mech.), Member
4. Mrs.Priyanka Jhavar,Asst Prof (Mech.)Member

Chairman

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Scheme of Examination - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

VII SEMESTER

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ Hour/ Week			Credits
			End Sem. Exam.	Mid Tests	Assignments/ Quiz	End Sem. Practical & Viva	Practical Record /Assignment / Quiz / Presentation		L	T	P	
1	AEA-701	Computational Fluid Dynamics	60	30	10	30	20	150	3	0	2	4
2	AEA-702	Rockets and Missiles	60	30	10	30	20	150	3	0	2	4
3	AEA-703	Program Elective-IV	60	30	10	-	-	100	3	0	0	3
4	AEA-704	Open Core Elective-III	60	30	10	-	-	100	3	0	0	3
6	AEA-705	Project Stage-I	-	-	-	120	80	200	-	-	10	5
7	AEA-706	Self-Study/GD/Seminar					200	200			2	1
	TOTAL		240	120	40	180	320	900	12	0	16	20

Program Elective-IV	
AEA-703	AEA-703 (A) Air Traffic Control and Planning
	AEA-703 (B) Flight Instrumentation
Open Core Elective-III	
AEA-704	AEA-704 (A) UAV System
	AEA-704 (B) Fatigue and Fracture system

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Scheme of Examination - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

VIII SEMESTER

S.No.	Subject Code	Subject Name	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment / Quiz / Presentation		L	T	P	
1	AEA-801	Finite Elements Methods	60	30	10	30	20	150	3	0	2	4
3	AEA-802	Program Elective-V	60	30	10	-	-	100	3	0	0	3
4	AEA-803	Open Elective-IV	60	30	10	-	-	100	3	0	0	3
6	AEA-804	Project Stage-II	-	-	-	240	160	400	-	-	16	8
	TOTAL		**180**	**90**	**30**	**270**	**180**	**750**	**9**	**0**	**18**	**18**

Program Elective - V	
AEA-802	AEA-802 (A) Avionics
	AEA-802 (B) Industrial Aerodynamics
Open Elective-IV	
AEA-803	AEA-803(A) Economic Policies in India
	AEA-803(B) Internet of Things

* Additional open electives can be provided as per the availability of faculty in the University and student should produce prior permission from Dean with a batch of at least 5 students.

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

7th Semester Syllabus - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

AEA-701 Computational Fluid Dynamics

AEA-701	Computational Fluid Dynamics	3L:0T:0P	3 Credits	3Hrs/Week

Course Preamble:

- To introduce Governing Equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

Couse Outcomes:

- Upon completion of this course, the students can able
- To create numerical modeling and its role in the field of fluid flow and heat transfer
- To use the various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

Unit1: Governing Equations and Boundary Conditions (10 Hours)

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

Unit 2: Finite Difference and Finite Volume Methods for Diffusion (10 Hours)

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

Unit 3: Finite Volume Method for Convection Diffusion (10 Hours)

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

Unit4: Flow Field Analysis (10 Hours)

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

Unit 5: Turbulence Models and Mesh Generation (10 Hours)

Turbulence models, mixing length model, Two equation (k-Є) models–High and low Reynolds number models–Structured Grid generation–Unstructured Grid generation–Mesh refinement– Adaptive mesh–Software tools.

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- Versteeg, H.K., and Malalasekera, W.,"An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd. Second Edition–2007.
- Ghoshdastidar, P.S.,"Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.

AEA-701	Computational Fluid Dynamics	0L:0T:1P	1 Credits	2Hrs/Week

List of Experiment:

- Introduction to Modeling and Simulation Software to Aerodynamic problems.
- Solution for the one dimensional wave equations using explicit method of Lax Using Finite Difference Method (code development)
- Solution for the one dimensional Heat Conduction Equation using Explicit Method using Finite Difference Method (Code Development)
- Generation of the Algebraic Grid (Code Development)
- Generation of the Elliptic Grids (Code Development)
- Numerical Simulation of flow over an airfoil using commercial software Packages.
- Numerical Simulation of supersonic flow over a Wedge using commercial Software packages.
- Numerical Simulation of flat Plate Boundary Layer using commercial Software packages.
- Numerical Simulation of laminar flow through pipe using commercial Software packages.
- Numerical Simulation of flow past cylinder using Commercial Software packages.

Lab Outcome:
Student can able to do the coding for Boundary Layer, laminar flow through pipe, Heat Conduction, supersonic flow over a Wedge, flow over an airfoil and make simulation for various structures.

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7th Semester Syllabus - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

AEA-702 Rockets and Missile

AEA-702	Rockets and Missile	3L:0T:0P	3 Credits	3Hrs/Week

Course Preamble:

To give exposure on important topics like rocket motion, rocket aerodynamics and staging & control of rockets to students to enrich their knowledge in the area of missile flight

Couse Outcomes:

- Knowledge in types of rockets and missiles with respect to Indian & international scenario
- Gaining information's on aerodynamics of rocket and missiles
- Knowledge on stages and remote control of rockets missiles.

Unit 1: Classification of Rockets and Missiles (10 Hours)

Various methods of classification of missiles and rockets–Basic aerodynamic characteristics of surface to surface, surface to air, air to surface and air to air missiles–Examples of various Indian space launch vehicles and missiles–Current status of Indian rocket programme with respect to international scenario.

Unit 2: Aerodynamics of Rockets and Missile (10 Hours)

Airframe components of rockets and missiles–forces acting on a missile while passing through atmosphere–classification of missiles–slender body aerodynamics–method of describing forces and moments–lift force and lateral moment–lateral aerodynamic damping moment–longitudinal moment–drag estimation–up wash and downwash in missile bodies–rocket dispersion.

Unit 3: Rocket Motion in Free Space and Gravitational Field (10 Hours)

One dimensional and two-dimensional rocket motions in free space and homogeneous gravitational fields–description of vertical, inclined and gravity turn trajectories–determination of range and altitude–simple approximations to determine burn out velocity and altitude–estimation of culmination time and altitude.

Unit 4: Staging of Rockets and Missiles (10 Hours)

Design philosophy behind multi staging of launch vehicles and ballistic missiles–optimization of multistage vehicles–stage separation techniques in atmosphere and in space–stage separation dynamics and lateral separation characteristics.

Unit 5: Control of Rockets and Missiles (10 Hours)

Introduction to aerodynamic and jet control methods–various types of aerodynamic control methods for tactical and short range missiles-aerodynamic characteristics-various types of thrust vector control methods including secondary injection thrust vector control for launch vehicles and ballistic missiles.

References:

- Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5thEdition, 1993.
- Parker, E.R., "Materials for Missiles and Spacecraft", McGraw Hill Book Co. Inc., 1982.

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Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

AEA-702	Rockets and Missile	0L:0T:1P	1 Credits	2Hrs/Week

List of Experiment:

- Determination of heat of combustion of Liquid fuels
- To determine flash point and fire point of diesel, Pensky-Martins Apparatus.
- To determine the effect of temperature on Kinematic Viscosity of glycerin by Redwood Viscometer.
- Proximate Analysis of wax and coke.
- To determine the calorific value of solid fuel using Bomb Calorimeter.

Lab Outcome:

Student can able to identify heat of combustion of Liquid fuels, Proximate Analysis of wax and coke, and able to calculate the value of flash point, calorific value and viscosity of fuel.

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7th Semester Syllabus - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

Program Elective-IV

AEA-703 (A) Air Traffic Control and Planning

AEA-703 (A)	Air Traffic Control and Planning	3L:0T:1P	3 credits	3Hrs/Week

Course Preamble:

To study the procedure of the formation of aerodrome and its design and air traffic control.

Couse Outcomes:

- Understanding the requirement of air traffic control systems and types of air traffic control system.
- Knowledge in flight information systems and rules of air traffic systems.
- Knowledge indirection indicator systems for air navigation.

Unit 1: Basic Concepts (10 Hours)

Objectives of air traffic control systems - Parts of ATC services – Scope and Provision of ATCs – VFR & IFR operations – Classification of ATS air spaces – Various kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS – Division of responsibility of control.

Unit 2: Air Traffic Systems (10 Hours)

Area control service, assignment of cruising levels - minimum flight altitude - ATS routes and significant points – RNAV and RNP – Vertical, lateral and longitudinal separations based on time distance –ATC clearances – Flight plans – position report

Unit3: Flight Information Systems (10 Hours)

Radar service, Basic radar terminology – Identification procedures using primary / secondary radar – performance checks – use of radar in area and approach control services – assurance control and co-ordination between radar / non radar control – emergencies – Flight information and advisory service – Alerting service – Co-ordination and emergency procedures – Rules of the air.

Unit 4: Aerodrome Data (10 Hours)

Aerodrome data - Basic terminology – Aerodrome reference code – Aerodrome reference point –Aerodrome elevation – Aerodrome reference temperature – Instrument runway, physical Characteristics; length of primary / secondary runway – Width of runways – Minimum distance between parallel runways etc. – obstacles restriction.

Unit 5: Navigation and Other Services (10 Hours)

Visual aids for navigation Wind direction indicator – Landing direction indicator – Location and characteristics of signal area – Markings, general requirements – Various markings – Lights, general requirements – Aerodrome beacon, identification beacon – Simple approach lighting system and various lighting systems – VASI & PAPI - Visual aids for denoting obstacles; object to be marked and lighter – Emergency and other services.

References:

- Aircraft Manual (India) Volume I", latest Edition – The English Book Store, 17-1, Connaught Place, New Delhi.
- PANS – RAC – ICAO DOC 4444", Latest Edition, The English Book Store, 17-1, Connaught Place, New Delhi.

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Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

AEA-703 (B) Flight Instrumentation

AEA-703 (B)	Flight Instrumentation	3L:0T:1P	3 credits	3Hrs/Week

Course Preamble:

- To familiarize the available basic concepts of Flight instruments to the engineers.
- To Understand the necessary knowledge that are needed in significance and operations of Flight instruments

Couse Outcomes:

- The students will also have an exposure to various topics such as measurement concepts, air data sensors and measurements, Flight Management Systems, and other instruments pertaining to gyroscopic measurements and Engine data measurements.
- Student will be able to deploy these skills effectively in understanding and analyzing the instrumentation methods in avionics engineering.

Unit 1: Measurement Science and Displays (10 Hours)
Instrumentation brief review-Concept of measurement-Errors and error estimation- Functional elements of an instrument system –Transducers - classification - Static and dynamic characteristics- calibration - classification of aircraft instruments - Instrument displays panels and cockpit layout.

Unit 2: Air Data Instruments and Synchro Transmission Systems (10 Hours)
Air data instruments-airspeed, altitude, Vertical speed indicators. Static Air temperature, Angle of attack measurement, Synchronous data transmission system

Unit3: Gyroscopic Instruments (10 Hours)
Gyroscope and its properties, gyro system, Gyro horizon, Direction gyro-direction indicator, Rate gyro-rate of turn and slip indicator, Turn coordinator, acceleration and turning errors.

Unit4: Aircraft Compass Systems &Flight Management System (10 Hours)
Direct reading compass, magnetic heading reference system-detector element, monitored gyroscope system, DGU, RMI, deviation compensator. FMS- Flight planning-flight path optimization-operational modes-4D flight management

Unit5: Power Plant Instruments (10 Hours)
Pressure measurement, temperature measurement, fuel quantity measurement, engine power and control instruments-measurement of RPM, manifold pressure, torque, exhaust gas temperature, EPR, fuel flow, engine vibration, monitoring.

References:

- Doeblin.E.O, "Measurement Systems Application and Design", McGraw-Hill, New York, 1999.
- HarryL.Stilz, "Aerospace Telemetry", Vol I to IV, Prentice-Hall Space Technology Series.
- Murthy, D.V.S., "Transducers and Measurements", McGraw-Hill, 1995
- Pallet, E.H.J. "Aircraft Instruments & Integrated systems", Longman Scientific and Technical, McGraw-Hill, 1992.

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7th Semester Syllabus - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

Open Core Elective-III

AEA-704 (A) UAV System

AEA-704 (A)	**UAV System**	**3L:0T:0P**	**3 Credits**	**3Hrs/Week**

Course Preamble:

- To make the students to understand the basic concepts of UAV systems design.

Couse Outcomes:

- Ability to design UAV system
- Ability to identify different hardware for UAV.

Unit 1: Introduction to UAV (10 Hours)

History of UAV–classification–Introduction to Unmanned Aircraft Systems--models and prototypes–System Composition-applications

Unit 2: The Design of UAV Systems (10 Hours)

Introduction to Design and Selection of the System-Aerodynamics and Airframe Configurations Characteristics of Aircraft Types Design Standards and Regulatory Aspects UK,USA and Europe-Design for Stealth--control surfaces-specifications.

Unit 3: Avionics Hardware (10 Hours)

Autopilot–AGL-pressure sensors-servos-accelerometer–gyros-actuators-power supply processor, integration, installation, configuration, and testing

Unit 4: Communication Payloads and Controls (10 Hours)

Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range –modems-memory system-simulation-ground test-analysis-trouble shooting

Unit 5: The Development of UAV Systems (10 Hours)

Waypoints navigation-ground control software-System Ground Testing System In-flight Testing Future Prospects and Challenges-Case Studies–Mini and Micro UAVs.

References:

- Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley,2010.
- Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.

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7th Semester Syllabus - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

AEA-704 (B) Fatigue and Fracture

AEA-704 (B)	Fatigue and Fracture	3L:0T:0P	3 credits	3Hrs/Week

Course Preamble:

- To understand the basic concepts involved in fatigue analysis and to study the importance of fracture mechanics in aerospace applications.

Couse Outcomes:

- Ability to apply mathematical knowledge to define fatigue behaviors
- Ability to perform fatigue design
- Ability to analyses the fracture due to fatigue

Unit 1: Fatigue of Structures (10 Hours)

S.N. curves-Endurance limits-Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams-Notches and stress concentrations- Neubers stress concentration factors-Plastic stress concentration factors-Notched S.N. curves–Fatigue of composite materials.

Unit 2: Statistical Aspects of Fatigue Behaviour (10 Hours)

Low cycle and high cycle fatigue-Coffin-Mansons relation-Transition life-cyclic strain hardening and softening-Analysis of load histories-Cycle counting techniques-Cumulative damage-Miners theory-Other theories.

Unit 3: Physical Aspects of Fatigue (10 Hours)

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

Unit 4: Fracture Mechanics (10 Hours)

Strength of cracked bodies-Potential energy and surface energy-Griffith□s theory-Irwin-Orwinextension of Griffith□s theory to ductile materials-stress analysis of "cracked bodies-Effect of thickness on fracture toughness"-stress intensity factors for typical 'geometries.

Unit 5: Fatigue Design and Testing (10 Hours)

Safe life and Fail-safe design philosophies-Importance of Fracture Mechanics in aerospace structures-Application to composite materials and structures.

References:

- Prasanth Kumar, "Elements of fracture mechanics",Wheeter publication, 1999.
- Barrois W, Ripely, E.L., "Fatigue of aircraft structure,"Pergamon press. Oxford, 1983.

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7th Semester Syllabus - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

AEA-705 Projects Stage-I

AEA 705	Project Stage-I	0L:0T:10P	5 credits	10Hrs/Week

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Design and validate electrical algorithms for optimum solution
- Analyze the dynamic response and the calibration of few instruments
- Build projects as per industry and society demands.

Guidelines:

- Minor Project should cater to a small system required in laboratory or real life.
- After interactions with course coordinator and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and Preambles of Minor project.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
- The student is expected to exert on design, development and testing of the proposed work as per the schedule.

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7th Semester Syllabus - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

AEA-706 Self Study/GD/Seminar

AEA-706	Self-Study/GD/Seminar	0L:0T:1P	1 Credits	2Hrs/Week

Course Preamble:

The main Preamble is to improve the mass communication and convincing/understanding skills of students and to give the students an opportunity to exercise their rights to express themselves. The evaluation will be done based on their presentation work and group discussion.

Couse Outcomes:

In terms of **content**, students will be able to do the following:

Presentation Skills

They will be able to make use of visual, audio and audio-visual material to support their presentation, and will be able to speak cogently with or without notes. Students will present either in groups or as individuals.

Discussion Skills

Students will be able to judge when to speak and how much to say, speak clearly and audibly in a manner appropriate to the subject, ask appropriate questions, use evidence to support claims, respond to a range of questions, take part in meaningful discussion

Listening Skills

Students will demonstrate that they have paid close attention to what others say and can respond constructively. Through listening attentively, they will be able to build on discussion fruitfully, supporting and connecting with other discussants. They will be able to follow academic discussions, infer meanings that are not overt, and take notes from a discussion or presentation.

Argumentative Skills and Critical Thinking

Students will develop persuasive speech, present information in a compelling, well-structured, and logical sequence, respond respectfully to opposing ideas, show depth of knowledge of complex subjects, and develop their ability to synthesize, evaluate and reflect on information.

Questioning

Through asking appropriate questions, students will demonstrate their understanding of discussions and spark further discussion.

Interdisciplinary Inquiry

Students will be able to reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem.

Engaging with Big Questions

Students will engage with important questions that stimulate discussion and debate.

Studying Major Works

Students will engage with works that are widely held to be significant in the field of study, while recognizing cultural diversity and the ever-changing nature of what is regarded as important.

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

8th Semester Syllabus - AICTE Pattern

Undergraduate Degree Courses in Engineering & Technology

Bachelor of Engineering (Aeronautical Engineering)

AEA-801 Finite Element Methods

AEA-801	Finite Element Methods	3L:0T:0P	3 Credits	3Hrs/Week

Course Preamble:

- To give exposure various methods of solution and in particular the finite element method.
- Gives exposure to the formulation and the procedure of the finite element method and its application to varieties of problems.

Couse Outcomes:

- Write flow chart of finite element steps and understand the convergence of the problem
- Solve stiffness matrix for bar, beam and frame problems using suitable boundary condition.
- Plane stress and plane strain condition are used to understand 2d structures.
- Apply the concepts of finite element methods to solve fluid flow and heat transfer problems.

Unit 1: Introduction (10 Hours)

Review of various approximate methods – variational approach and weighted residual approach application to structural mechanics problems. finite difference methods- governing equation and convergence criteria of finite element method.

Unit 2: Discrete Elements (10 Hours)

Bar elements, uniform section, mechanical and thermal loading, varying section, 2D and 3D truss element. Beam element - problems for various loadings and boundary conditions – 2D and 3D Frame elements - longitudinal and lateral vibration. Use of local and natural coordinates.

Unit 3: Continuum Elements (10 Hours)

Plane stress, plane strain and axisymmetric problems. Derivation of element matrices for constant and linear strain triangular elements and axisymmetric element.

Unit 4: Isoperimetric Elements (10 Hours)

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, stiffness matrix and consistent load vector, evaluation of element matrices using numerical integration.

Unit 5 : Field Problem and Methods of Solutions (10 Hours)

Heat transfer problems, steady state fin problems, derivation of element matrices for two dimensional problems, torsion problems. bandwidth- elimination method and method of factorization for solving simultaneous algebraic equations – Features of software packages, sources of error.

Reference:

- An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw-Hill, New Delhi.
- Concepts & Applications of Finite Element Analysis, Cook, Malkus, Plesha and Witt, Willey India, New Delhi.
- Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall.

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AEA-801	Finite Element Methods	0L:0T:1P	1 Credits	2Hrs/Week

List of Experiments:

- Write flow chart of finite element steps.
- Study and understand the convergence of the problem.
- Solve stiffness matrix for bar, beam and frame problems using suitable boundary condition.
- Plane stress and plane strain condition are used to understand 2d structures.
- Analysis of beams and frames (bending problems)
- Analysis of beams and frames (torsion problems)
- Nodal analysis problem.
- Heat transfer problems.
- Problems leading to analysis of three dimensional solids.
- Problems leading to analysis of axisymmetric solids.

Lab Outcome:
Student can able to do the coding for heat transfer analysis, structural analysis and make simulation for various structures.

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Program Elective-V

AEA-802 (A) Avionics

AEA-802 (A)	Avionics	3L:0T:1P	3 credits	3Hrs/Week

Course Preamble:

- To introduce the basic of avionics and its need for civil and military aircrafts
- To impart knowledge about the avionic architecture and various avionics data buses
- To gain more knowledge on various avionics subsystems

Couse Outcomes:

- Ability to build Digital avionics architecture
- Ability to Design Navigation system
- Ability to design and perform analysis on air system.
- Integrate avionics systems using data buses.
- Analyze the performance of various cockpit display technologies.
- Design autopilot for small aircrafts using MATLAB

Unit1: Introduction to Avionics (10 Hours)

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

Unit 2: Digital Avionics Architecture (10 Hours)

Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

Unit 3: Flight Decks and Cockpits (10 Hours)

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

Unit 4: Introduction to Navigation Systems (10 Hours)

Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellite navigation systems – GPS.

Unit 5: Air Data Systems and Auto Pilot (10 Hours)

Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

References:

- Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indian edition 2011.
- Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J.,U.S.A. 1993. Spitzer, C.R. "The Avionics Hand Book", CRC Press, 2000

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AEA-802 (B) Industrial Aerodynamics

AEA-802 (B)	**Industrial Aerodynamics**	**3L:0T:1P**	**3 credits**	**3Hrs/Week**

Course Preamble:

- To familiarize the learner with non-aeronautical uses of aerodynamics such as road vehicle, building aerodynamics and problems of flow induced vibrations

Couse Outcomes:

- Use of aerodynamics for non- aerodynamics such as vehicle, building.
- Solve the problems and able to analyses vibrations during flow
- Identify the Atmospheric boundary layer and applications of wind energy collectors.
- Analyze the aerodynamics of road vehicles, buildings and problems of flow induced vibrations.

Unit 1: Atmosphere (10 Hours)

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

Unit 2 :Wind Energy Collectors (10 Hours)

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

Unit 3: Vehicle Aerodynamics (10 Hours)

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

Unit 4: Building Aerodynamics (10 Hours)

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.

Unit 5: Flow Induced Vibrations (10 Hours)

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

References:

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

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Open Core Elective-IV

AEA 803(A) Economic Policies in India

AEA 803(A)	Economic Policies in India	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

- The students get clear perspectives about social sciences and the subject matter of Economics.
- The students gather fundamental knowledge and information about theoretical foundations social sciences especially Economics.

Course Outcomes

On successful completion of the course, the student will:

- To enable the students to understand the theories and strategies of growth and development.
- The student becomes able to analyze individual rationality in situations of scarcity and choice

Unit –I Basic features and problems of Indian Economy: - (10 Hrs)

Nature of Indian Economy, demographic features and Human Resource Development (HDI), Problems of Poverty, Unemployment, Inflation, income inequality, Black money in India.

Unit-II Sectorial composition of Indian Economy (10 Hrs)

- Issues in Agriculture sector in India ,land reforms Green Revolution and agriculture policies of India , Industrial development , small scale and cottage industries, industrial Policy, Public sector in India, service sector in India.

Unit-III Economic Policies :- (10 Hrs)

Economic Planning in India , Planning commission v/s NITI Aayog, monetary policy in India, Fiscal Policy in India,

Unit IV Centre state Finance Relations, (10Hrs)

Finance commission in India. LPG policy in India.

Unit-V External sector in India: -(10Hrs)

India's foreign trade value composition and direction, India Balance of payment since 1991, FDI in India, Impact of Globalization on Indian Economy, WTO and India.

References:

- Dutt Rudder and K.P.M Sunderam (2001): Indian Economy, S Chand & Co. Ltd. New Delhi.
- Mishra S.K & V.K Puri (2001) "Indian Economy and –Its development experience", Himalaya Publishing House.
- KapilaUma: Indian Economy: Policies and Performances, Academic Foundation

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AEA 803(B) Internet of Things

AEA 803(B)	Internet of Things	3L:0T:0P	3 Credits	3Hrs/Week

Course Preambles:

- To assess the vision and introduction of IoT.
- To Understand IoT Market perspective.
- To Implement Data and Knowledge Management and use of Devices in IoT Technology.
- To Understand State of the Art - IoT Architecture.
- To classify Real World IoT Design Constraints, Industrial Automation in IoT.

Course Outcomes:

On successful completion of the course, the student will:

- Understand the concepts of Internet of Things
- Analyze basic protocols in wireless sensor network
- Design IoT applications in different domain and be able to analyze their performance
- Implement basic IoT applications on embedded platform

Unit 1: Introduction to IoT - (10 Hrs)

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

Unit 2: IoT & M2M - (10 Hrs)

Machine to Machine, Difference between IoT and M2M, Software define Network

Unit 3 :Network & Communication (10 Hrs)

Network & Communication aspects Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination Challenges in IoT Design challenges, Development challenges, Security challenges, Other challenges

Unit 4 :Domain specific applications (6 Hrs)

Domain specific applications of IoT Home automation, Industry applications, Surveillance applications,

Unit 5: Other IoT applications (6 Hrs)

Developing IoTs Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python.

Reference:

- Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
- Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

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AEA 804 Projects Stage –II

AEA 804	**Projects Stage –II**	**0L:0T:16P**	**8 credits**	**16Hrs/Week**

Preambles:

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under project stage-I, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department. The assignment to normally include:

- In depth study of the topic assigned in the light of the Report prepared;
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department.
- Final Seminar Presentation before a Departmental Committee.

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