HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE

SCHOOL OF AERONAUTICAL SCIENCES

CURRICULUM

(Applicable for Students admitted from Academic Year 2015-16)

CHOICE BASED CREDIT SYSTEM

B. Tech.

AEROSPACE ENGINEERING

VISION

- To enable the graduates to be successful in their career as Aeronautical/Aerospace Engineers.

MISSION

- To provide good quality of education and to show the way to achieve advancement in his/her career goals.
- To impart skills to acquire knowledge in all spheres of Aeronautical/Aerospace engineering and technology.
- To provide a creative environment in which education and research flourish both amongst the students and the faculty.
- To impart the importance of teamwork, independent innovative thinking and leadership qualities.

The Program outcome should enable the students to:

1. Acquire an in-depth knowledge required to apply and analyze real life problems.
2. Execute critical thinking, including the ability to develop innovative ideas and come up with practical solutions.
3. Communicate effectively, including the ability to listen, write and interpret.
4. Work collectively and participate effectively in teams.
5. Prepare to engage in lifelong learning and demonstrate proficiency in use of current technologies.
6. Practice personal and professional ethics in all aspects.
7. Demonstrate social, cultural & global competence.

The Programme Educational Objectives (PEOs)

The main Objectives are to enable students to:

1. Adapt to new technologies in Aeronautical Engineering and cater the needs of the society.
2. Gain knowledge from modern design tools and apply to current technical issues.
3. Encourage an attitude of independent learning and communication skills.
4. Execute multi-disciplinary engineering projects in team.
5. Inculcate lifelong learning to be able to cope with changing technologies.
6. Have high degree of professional ethics and standards.
7. Develop ability to critically analyze and carry out innovative and independent research.

STRUCTURE OF THE B.TECH PROGRAMME

The programme will consist of the following categories of courses:

- General Core foundation (CF) courses
- Compulsory Courses (CC)
- Engineering Electives(EE)
- Open Electives(OE)
- Non-CGPA courses

General Core foundation (CF) courses comprising of:

- English;
- Basic Sciences (BS)including Physics, Chemistry, Mathematics;
- Engineering Sciences (ES), including Basic Engineering courses such as Material Science, Basic Workshop, Engineering Drawing, Engineering Graphics Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation; etc

Compulsory Courses (CC) consisting of:

- Professional Core (**PC**), courses introducing the students to the foundation of engineering topics related to the chosen programme of study comprising of theory and Practical/ field work/ Mini project/ Project ;
- Professional Electives (**PE**)-are elective programmes enabling the students to take up a group of courses for specialisation/ interest to him/her in his/her programme of study.

Engineering Electives (EE) - Engineering electives are offered by other engineering departments (across disciplines);

Open Electives (OE) - Courses offered by non-Engineering departments (Science & Humanities Management School) other than communication skills and personality development credit courses etc.);

Non-CGPA courses shall be offered in certain semesters which are compulsory, but not calculated for GPA and CGPA. However, the credits will be mentioned in the grade card.

CURRICULUM STRUCTURE FOR B. TECH. DEGREE PROGRAMMES

Sl. No.	Course Classification	Range of Total Credit (%)	Suggested (out of 180)	
			% of Total Credit	Credit
1	**Core Foundation (CF)**	**20-30**	**25**	**45**
2	**Core Courses (CC)**	**55-65**	**60**	**108**
	i) Professional Core (PC)#, Theory Lab/project work	40-60 (*30-40)* (10-20)	50 (35) (15)	90 (63) (27)
	ii) Professional Electives (PE)	8-12	10	18
3	**Engineering Electives (EE)**	**5-10**	**8**	**15**
4	**Open Electives (OE)**	**5-10**	**7**	**12**
	Total		100	**180**

SEMESTER WISE CREDIT FOR AEROSPACE ENGINEERING

Course Category		I	II	III	IV	V	VI	VII	VIII	Total	Grand Total
CF	English	4	3	1	1	1	1	-	-	**11**	**51**
	BS	8	8	4	4	-		-	-	**24**	
	ES	8	5	-	-	3	-	-	-	**16**	
CC	PC (Theory)	-	7	14	15	15	8	9	-	**68**	**112**
	PC (Practical)	-		3	3	5	5	4	6[#]	**26**	
	PE	-	-	-	-	3	6	9	-	**18**	
EE		-	-	3	3	3	3	3	-	**15**	**15**
OE		-	-	-	3	3	3	3	-	**12**	**12**
Total		**20**	**23**	**25**	**29**	**33**	**26**	**28**	**6**	**190**	**190**

COURSE PLAN FOR AEROSPACE ENGINEERING

Semester I

Sl. No.	Course Code	Course classification	Course Title	L	T	P	C	TCH
Theory								
1	ELA101	CF	Technical English	3	0	0	3	3
2	MAA101	CF(BS)	Engineering Mathematics– I	3	1	0	4	4
3	PHA101/ CYA101	CF(BS)	Engineering Physics / Engineering Chemistry	3	0	0	3	3
4	CSA101	CF(ES)	Computer Programming	3	0	0	3	4
Practical								
6	MEA101	CC(ES)	Computer Aided Engineering Drawing	1	1	3	3	5
7	PHA131/ CYA131	CF(BS)	Physics LAB/Chemistry LAB*	0	0	3	1	3
8	CSA131	CF(ES)	Computer Programming LAB	0	0	3	1	3
9	ELA131	CF(BS)	Communication Skills LAB-I	0	0	3	1	3
10	GEA131	CF(ES)	Engineering Practices LAB-I	0	0	3	1	3
Total							**20**	**29**

CF: 20 (BS: 8, English: 4, ES: 8); CC: 0; EE: 0; OE: 0; Total: 20

Semester II

Sl. No.	Course Code	Course classification	Course Title	L	T	P	C	TCH
Theory								
1	MAA102	CF(BS)	Engineering Mathematics – II	2	1	1	4	4
2	PHA101/ CYA101	CF(BS)	Engineering Chemistry / Engineering Physics*	3	0	0	3	3
3	EEB122	CF(ES)	Basic Electrical &Electronics Engineering	3	1	0	4	4
4	MEA102	CC(PC)	Engineering Mechanics	3	1	0	4	4
5	ASB101	CC(PC)	Introduction to Aerospace	3	0	0	3	3
6	ELA102	CF(BS)	Personality Development and soft skills	3	0	0	3	3
Practical								
7	PHA131/ CYA131	CF(BS)	Physics lab/Chemistry Lab	0	0	3	1	3
8	GEA132	CF(ES)	Engineering Practices Lab-II	0	0	3	1	3
Total							**23**	**33**

CF: 16 (BS: 8, English: 3, ES: 5); CC: 8 (PC: 8, PE: 0); EE: 0; OE: 0; Total: 23

Semester III

Sl. No.	Course Code	Course classification	Course Title	L	T	P	C	TCH
Theory								
1	MAA201	CF(BS)	ENGG. Mathematics – III	3	1	0	4	4
2	ASB202	CC(PC)	Aero engineering thermodynamics	3	1	0	4	4
3	ASB203	CC(PC)	Solid mechanics	3	1	0	4	4
4	ASB204	CC(PC)	Fluid mechanics	3	0	0	3	3
5	ASB205	CC(PC)	Aircraft Materials	3	0	0	3	**3**
6		EE	Engineering Elective I	3	0	0	3	3
7	SSA231		Aptitude- I	1	0	1	1	2
Practical								
8	ASB210	CC(PC)	Strength of materials lab	0	0	3	1	3
9	ASB211	CC(PC)	Fluid Mechanics & Machinery Lab	0	0	3	1	3
10	ASB212	CC(PC)	Thermodynamics lab	0	0	3	1	3
Total							**25**	**32**

CF: 4 (BS: 4, ES: 0); CC: 17 (PC: 17, PE: 0); EE: 3; OE: 0; Total: 25

Engineering Elective Courses (Semester III)

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ASD220	Elements of Avionics	3	0	0	3	**3**
2	ASD221	Aircraft Design	3	0	0	3	**3**

Semester IV

Sl. No.	Course Code	Course classification	Course Title	L	T	P	C	TCH
Theory								
1	MAA202	CF(BS)	Numerical Methods	3	1	0	4	4
2	ASB230	CC(PC)	Aerodynamics – I	3	1	0	4	4
3	ASB231	CC(PC)	Aerospace Structures – I	3	1	0	4	4
4	ASB232	CC(PC)	Propulsion – I	3	1	0	4	4
5	ASB233	CC(PC)	Mechanics of Machine	3	0	0	3	3
6		EE	Engineering Elective-II	3	0	0	3	3
7		OE	Open Elective-I	3	0	0	3	3
8	SSA232		Aptitude-II	1	0	1	1	2
Practical								
8	ASB240	CC(PC)	Aerospace Structures Lab -I	0	0	3	1	3
9	ASB241	CC(PC)	CAD Lab	0	0	3	1	3
10	ASB242	CC(PC)	Aerodynamics Lab-I	0	0	3	1	3
Total							**29**	**36**

CF: 4 (BS: 4, ES: 0); CC: 18 (PC: 18); EE: 3; OE: 3; Total: 29

Engineering Elective Courses (Semester IV)

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ASD251	Aircraft Maintenance Practices	3	0	0	3	**3**
2	ASD252	Introduction to NDT	3	0	0	3	**3**

Semester V

Sl. No.	Course Code	Course classification	Course Title	L	T	P	C	TCH
Theory								
1	ASB301	CC(PC)	Aerodynamics-II	3	1	0	4	4
2	ASB302	CC(PC)	Propulsion – II	3	1	0	4	4
3	ASB303	CC(PC)	Aerospace Structures II	3	1	0	4	4
4	ASB304	CC (PE)	Professional Elective-I	3	0	0	3	3
5	ASB305	CC(PC)	Control Engineering	3	0	0	3	3
6		EE	Engineering Elective III	3	0	0	3	3
7		OE	Open Elective II	3	0	0	3	3
8	SSA331		Placement Preparatory Program	1	0	1	1	2
9	CYA302	CF	Environmental Science and Engineering	3	0	0	3	3
Practical								
10	ASB311	CC (PC)	Propulsion Lab - I	0	0	3	1	3
11	ASB312	CC (PC)	Aerodynamics Lab - II	0	0	3	1	3
12	ASB314	CC(PC)	Design Project-I	0	0	8	3	-
Total							**33**	**38**

CF: 4, CC: 23 (PC: 20, PE: 3), EE: 3, OE: 3 TOTAL: 33

Engineering Elective Courses (Semester V)

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ASD321	Experimental Stress Analysis	3	0	0	3	**3**
3	ASD322	Computer Integrated Manufacturing	3	0	0	3	**3**

Professional Elective Courses- PE (Semester V)

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	AEC331	Aero Engine Maintenance and Repair	3	0	0	3	**3**
2	AEC332	Elements of Vibration	3	0	0	3	**3**
3	AEC333	Airframe Maintenance & Repair	3	0	0	3	**3**

Semester VI

Sl. No.	Course Code	Course classification	Course Title	L	T	P	C	TCH
Theory								
1	ASB341	CC(PC)	Propulsion – III	3	1	0	4	4
2	ASB342	CC(PC)	Flight Mechanics I	3	1	0	4	4
3		CC(PE)	Professional Elective-II	3	0	0	3	3
4		CC(PE)	Professional Elective-III	3	0	0	3	3
5		EE	Engineering Elective-IV	3	0	0	3	3
6		OE	Open Elective-III	3	0	0	3	3
7	ELA331		Communication Skills & Personality Development	0	0	2	1	2
Practical								
7	ASB351	CC(PC)	Propulsion Lab- II	0	0	3	1	3
8	ASB352	CC(PC)	Aerodynamics Design Lab	0	0	3	1	3
10	ASB353	CC(PC)	Design Project-II*	0	0	8	3	-
Total							**26**	**28**

Note: * The Design Project by students which does not require contact hours.

CF: 1, CC: 19 (PC: 13, PE: 6), EE: 3, OE: 3 TOTAL: 26

Engineering Elective Courses (Semester VI)

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ASD361	Fundamentals of space vehicle design	3	0	0	3	**3**
2	ASD362	Wind Tunnel Techniques	3	0	0	3	**3**
3	ASD363	Theory of Elasticity	3	0	0	3	**3**

Professional Elective Courses- PE (Semester VI)

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ASC371	FEM in Aerospace	3	0	0	3	**3**
2	ASC372	Heat Transfer	3	0	0	3	**3**
3	ASC373	High Temperature Materials	3	0	0	3	**3**
4	ASC374	Aircraft General Engineering & Maintenance	3	0	0	3	**3**

Semester – VII

Sl. No.	Course Code	Course classification	Course Title	L	T	P	C	TCH
Theory								
1	ASB401	CC(PC)	Flight Mechanics II	3	0	0	3	3
2	ASB402	CC(PC)	Rockets & Missiles	3	0	0	3	**3**
3	ASB403	CC(PC)	Composite Materials and Structures	3	0	0	3	3
4		CC(PE)	Professional Elective-IV	3	0	0	3	3
5		CC(PE)	Professional Elective-V	3	0	0	3	3
6		CC(PE)	Professional Elective-VI	3	0	0	3	3
7		EE	Engineering Elective-V	3	0	0	3	3
8		OE	Open Elective-IV	3	0	0	3	3
Practical								
9	ASB411	CC(PC)	Structural Design Lab	0	0	3	1	3
10	ASB412	CC(PC)	Space Propulsion Laboratory	0	0	3	1	3
11	ASB413	CC (PC)	Viva-voce	-	-	-	2	-
Total							**28**	**30**

CF: 0; CC: 22(PC: 13, PE: 9); EE: 3; OE: 3; Total: 28

Engineering Elective Courses (Semester VII)

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ASD421	Vibration and Aero Elasticity	3	0	0	3	**3**
2	ASD422	Fatigue and Fracture Mechanics	3	0	0	3	**3**

Professional Elective Courses- PE (Semester VII)

Sl. No	Course Code	Course Title	L	T	P	C	TCH
1	ASC431	Computational Fluid Dynamics	3	0	0	3	**3**
2	ASC432	Satellites and Space System Design	3	0	0	3	**3**
3	ASC433	Flight Mechanics III	3	1	0	3	**3**
4	ASC434	THEORY OF COMBUSTION	3	0	0	3	**3**
5	ASC435	Helicopter Maintenance	3	0	0	3	**3**

Semester - VIII

Sl. No.	Course Code	Course classification	Course Title	L	T	P	C	TCH
Practical								
1	ASB441	CC (PC)	Project & Viva-voce	0	0	24	6	24
Total							**6**	**24**

CF: 0; CC: 6 (PC: 6, PE: 0); EE: 0; OE: 0; Total: 6

SEMESTER - I

ELA101 TECHNICAL ENGLISH

L	T	P	C
3	0	0	3

GOAL

The goal of the programme is to provide a theoretical input towards nurturing accomplished learners who can function effectively in the English language skills; to cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning; to help them become responsible members or leaders of the society in and around their workplace or living space; to communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

OBJECTIVES

The course should enable the students to:

1. Widen the capacity of the learners to listen to English language at the basic level and understand its meaning.
2. Enable learners to communicate in an intelligible English accent and pronunciation.
3. Assist the learners in reading and grasping a passage in English.
4. Learn the art of writing simple English with correct spelling, grammar and punctuation.
5. Cultivate the ability of the learners to think and indulge in divergent and lateral thoughts.

OUTCOME

The students should be able to:

1. Have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
2. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
3. Read, comprehend and answer questions based on literary, scientific and technological texts.
4. Write instructions, recommendations, checklists, process-description, letter-writing and report writing.
5. Have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.

`UNIT I LISTENING SKILL 9

Listening to the sounds, silent letters & stress in English words & sentences - Listening to conversation & telephonic conversation -- Listening for general meaning & specific information -- Listening for positive & negative comments - Listening to technical topics - Listening to prose & poetry reading - Listening exercises.
Embedded language learning: Sentence definition -- Spelling & punctuation -- Imperative form Sequencing of sentences -- Gerunds -- Infinitives -- 'Wh-'questions.

UNIT II SPEAKING SKILL 9

Self-introduction - Expressing personal opinion - Dialogue - Conversation - Simple oral interaction -Speaking on a topic -- Expressing views for & against -- Speaking on personal topics like hobbies, topics of interest, present & past experiences, future plans - Participating in group discussions, role plays, debates, presentations, power-point presentations & job-interviews.

Embedded language learning: Adverbs -Adjectives - Comparative and Numerical adjectives -- Nouns & compound nouns -- Prefixes and suffixes.

UNIT III READING SKILL 9

Reading anecdotes, short stories, poems, parts of a novel, notices, message, time tables, advertisements, leaflets, itinerary, content page - Reading pie chart & bar chart -- Skimming and scanning -- Reading for contextual meaning - Scanning for specific information -- Reading newspaper & magazine articles - Critical reading -- Reading-comprehension exercises.

Embedded language learning: Tenses - Active and passive voice -- Impersonal passive -- - Words and their function -- Different grammatical forms of the same word.

UNIT IV WRITING SKILL 9

Writing emails, notes, messages, memos, notices, agendas, advertisements, leaflets, brochures, instructions, recommendations & checklists -- Writing paragraphs -- Comparisons & contrasts Process description of Flow charts - Interpretation of Bar charts & Pie charts - Writing the minutes of a meeting -- Report writing -- Industrial accident reports -- Letter-writing -- Letter to the editors - Letter inviting & accepting or declining the invitation - Placing orders - Complaints -- Letter requesting permission for industrial visits or implant training, enclosing an introduction to the educational institution -- Letters of application for a job, enclosing a CV or Resume - Covering letter.

Embedded language learning: Correction of errors - Subject-verb Concord -- Articles - Prepositions - Direct and indirect speech.

UNIT V THINKING SKILL 9

Eliciting & imparting the knowledge of English using thinking blocks - Developing thinking skills along with critical interpretation side by side with the acquisition of English -- Decoding diagrams & pictorial representations into English words, expressions, idioms and proverbs.

Embedded language learning: General vocabulary -- Using expressions of cause and effect -Comparison & contrast -- If-conditionals -- Expressions of purpose and means.

REFERENCES

1. Norman Whitby. Business Benchmark: Pre-Intermediate to Intermediate - BEC Preliminary. New Delhi: Cambridge University Press, 2008 (Latest South Asian edition).
2. Devaki Reddy & Shreesh Chaudhary. Technical English. New Delhi: Macmillan, 2009.
3. Rutherford, Andrea J. Basic Communication Skills for Technology. 2nd edition. New Delhi:
   Pearson Education, 2006.

MAA101 ENGINEERING MATHEMATICS- I

L	T	P	C
3	1	0	4

GOAL

To create the awareness and comprehensive knowledge in engineering mathematics.

OBJECTIVES

The course should enable the students to:

1. Find the inverse of the matrix by using Cayley Hamilton Theorem and Diagonalisation of matrix using transformation.
2. Understand the Evolutes and Envelope of the curve.
3. Learn the solutions of second order linear differential equations of standard types and Legendre's linear differential equation.
4. Learn partial differentiations involving two and three variables and expansions of functions using Taylor series.
5. Learn the expansions of trigonometric, hyperbolic functions and their relations.

OUTCOME

The students should be able to:

1. Identify Eigen value problems from practical areas and obtain its solutions and using transformation diagonalising the matrix which would render Eigen values.
2. Find out effectively the geometrical aspects of curvature and appreciates mathematical skills in constructing evolutes and envelopes in mechanics and engineering drawing.

3. Recognize and to model mathematically and solving, the differential equations arising in science and engineering.
4. Understand and model the practical problems and solve it using maxima and minima as elegant applications of partial differentiation.
5. Acquire skills in using trigonometric and hyperbolic and inverse hyperbolic functions.

UNIT I: - MATRICES **12**

Review: Basic concepts of matrices-addition, subtraction, multiplication of matrices - adjoint -inverse - solving cubic equations. Characteristic equation - Properties of Eigen values - Eigen values and Eigen vectors - Cayley Hamilton theorem (without proof) - Verification and inverse using Cayley Hamilton theorem. Diagonalization of matrices - Orthogonal matrices - Quadratic form - Reduction of symmetric matrices to a Canonical form using orthogonal transformation - Nature of quadratic form

UNIT II:-DIFFERENTIAL CALCULUS **12**

Review: Basic concepts of differentiation - function of function, product and quotient rules. Methods of differentiation of functions - Cartesian form - Parametric form - Curvature - Radius of curvature - Centre of curvature - Circle of curvature. Evolutes of parabola, circle, ellipse, hyperbola and cycloid - Envelope.

UNIT III: - ORDINARY DIFFERENTIAL EQUATIONS **12**

Review: Definition, formation and solutions of differential equations. Second order differential equations with constant coefficients - Particular integrals - , e^{ax}Cosbx, e^{ax}Sinbx. Euler's homogeneous linear differential equations - Legendre's linear differential equation Variation of parameters.

UNIT IV: - PARTIAL DIFFERENTIATION **12**

Partial differentiation - differentiation involving two and three variables - Total differentiation -Simple problems. Jacobian - verification of properties of Jacobians - Simple problems. Taylor's series Maxima and minima of functions of two and three variables.

UNIT V: - TRIGONOMETRY **12**

Review: Basic results in trigonometry and complex numbers - De Moivre's theorem.
Expansions of sinn, cosn , tann where n is a positive integer. Expansions of in terms of sines and cosines of multiples of where m and n are positive integers. Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers - Separation of complex functions into real and imaginary parts - Simple problems.
Note: Questions need not be asked from review part.

TOTAL: 60

TEXT BOOKS

1. Erwin Kreyzig, A Text book of Engineering Mathematics, John Wiley, 1999.
2. Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.
3. Chandrasekaran A, A Text book of Engineering Mathematics I, Dhanam Publications, Chennai, 2010.

REFERENCES

1. Venkataraman M.K, Engineering Mathematics, Volume I, The National Publishing Company, Chennai, 1985.
2. Kandaswamy P, Thilagavathy K and Gunavath K, Engineering Mathematics, Volume I & II,S.Chand and Company, New Delhi, 2005.
3. Bali N.P, Narayana Iyengar. N.Ch., Engineering Mathematics, Laxmi Publications Pvt. Ltd, New Delhi, 2003
4. Veerarajan T, Engineering Mathematics (for first year), Fourth Edition, Tata McGraw - Hill Publishing Company Limited, New Delhi, 2005.

PHA101 ENGINEERING PHYSICS **L T P C**

3 0 0 3

To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES

The course should enable the students to:

1. Develop strong fundamentals of properties and behavior of the materials
2. Enhance theoretical and modern technological aspects in acoustics and ultrasonic.
3. Enable the students to correlate the theoretical principles with application oriented study of optics.
4. Provide a strong foundation in the understanding of solids and materials testing.
5. Enrich the knowledge of students in modern engineering materials.

OUTCOME

The students should be able to:

1. Understand the properties and behavior of materials.
2. Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonic and be able to employ it as an engineering tool.
3. Understand the concept, working and application of lasers and fiber optics.
4. Know the fundamentals of crystal physics and non-destructive testing methods.
5. Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I: - PROPERTIES OF MATTER 9

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

UNIT II:-ACOUSTICS AND ULTRASONICS 9

Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonic - production - Magnetostriction and Piezoelectric methods - properties - applications of ultrasonic with particular reference to detection of flaws in metal (Non - Destructive testing NDT) - SONAR.

UNIT III:- LASER AND FIBER OPTICS 9

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO2 laser Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

UNIT IV:- CRYSTAL PHYSICS AND NON- DESTRUCTIVE TESTING 9

Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V:-MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS 9

Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis -Properties and applications.

Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II Superconductors - High Tc superconductors (qualitative) - uses of superconductors.

L=45 TOTAL = 45

TEXT BOOKS

1. Gaur R.K. and Gupta S.L., "Engineering Physics ", 8th edition, Dhanpat rai publications (P) Ltd., New Delhi 2010.
2. P.Mani, "Engineering Physics", Vol-I, Dhanam Publications, Chennai 2011.
3. Rajendran V. an Marikani A., "Applied Physics for engineers" , 3rd edition, Tata Mc Graw -Hill publishing company Ltd., New Delhi,2003.

REFERENCES

1. Uma Mukherji, Engineering Physics, Narosa publishing house, New Delhi, 2003.
2. Arumugam M., Engineering Physics, Anuradha agencies, 2007.
3. Palanisamy P.K., Engineering Physics, SciTech Publications, Chennai 2007.
4. Arthur Beiser, Concepts of Modern Physics, Tata Mc Graw -Hill Publications, 2007.
5. P.Charles, Poople and Frank J. Owens, Introduction to Nanotechnology, Wiley India,

CYA101 ENGINEERING CHEMISTRY L T P C

3 0 0 3

GOAL

To impart basic principles of chemistry for engineers.

OBJECTIVES

The course should enable the students to

1. Make the students conversant with the basics of
   (a) Water technology and (b) Polymer science
2. Provide knowledge on the requirements and properties of a few important engineering materials.
3. Educate the students on the fundamentals of corrosion and its control.
4. Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
5. Create an awareness among the present generation about the various conventional energy sources.

OUTCOME

The students should be able to

1. Gain basic knowledge in water analysis and suitable water treatment method.
2. Get an idea on the type of polymers to be used in engineering applications.
3. Get awareness about new materials
4. Get knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.
5. Get exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.
6. Get a good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I: - WATER TECHNOLOGY AND POLYMER CHEMISTRY 9

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys Definition, Examples

UNIT II:- ENGINEERING MATERIALS 9

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications. Lubricants - Classification, properties and applications - Mechanism of

Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

UNIT III:-ELECTROCHEMISTRY AND CORROSION 9

Conductometric Titration - HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electrodeless plating (Cu and Ni) Constituents of Paints and varnish.

UNIT IV:- CHEMICAL THERMODYNAMICS 9

Thermodynamic terminology- First Law of Thermodynamics-Internal energy- enthalpy - heat capacity work done in isothermal expansion of an ideal gas -problems - second law of thermodynamics entropy change - phase transformations and entropy change - problems - Work Function & Free Energy Function- Maxwell's Relations-Gibbs Helmholtz equation- van't Hoff Isotherm- van't Hoff Isochore - Problems.

UNIT V: - FUELS AND ENERGY SOURCES 9

Fuels - classification - Calorific Value - Dulong's Formula - Problems - Determination of Calorific Value by Bomb Calorimeter - Coal - Proximate Analysis - problems - Octane Number - Cetane Number - Diesel Index (Definitions only) - Bio Gas - Producer Gas -Water Gas - Preparation, Properties and Uses - Batteries - Primary Cells - Leclanche Cell -Secondary Cell - Nickel Cadmium Battery Fuel Cells - Hydrogen - Oxygen Fuel Cell - Solar Battery - Lead Acid Storage Cell - Nuclear Energy Light water nuclear power plant.

L=45 TOTAL = 45

TEXT BOOKS

1. S. S. Dara, Text Book of Engineering Chemistry, S. Chand & Company Ltd., New Delhi, 2003
2. Murthy, Agarwal & Naidu, Text Book of Engineering Chemistry, BSP, 2003.
3. S. Sumathi, Engineering Chemistry, Dhanam Publications, 2008.
4. S. Sumathi and P.S. Raghavan, Engineering Chemistry II, Dhanam Publications, 2008.

REFERENCES

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
2. A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004

3. A. Gowarikar, Text Book of Polymer Science, 2002
4. Kuriacose & Rajaram, Vols. 1 & 2, Chemistry in Engineering and Technology, 2004
5. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.

CSA101 COMPUTER PROGRAMMING L T P C
3 0 0 3

GOAL

To introduce computers and programming and to produce an awareness of the power of computational techniques that are currently used by engineers and scientists and to develop programming skills to a level such that problems of reasonable complexity can be tackled successfully.

OBJECTIVES

The course should enable the students to:

1. Learn the major components of a Computer system.
2. Learn the problem solving techniques.
3. Develop skills in programming using C language.

OUTCOMES

The student should be able to:

1. Understand the interaction between different components of Computer system and number system.
2. Devise computational strategies for developing applications.
3. Develop applications (Simple to Complex) using C programming language.

UNIT I: - COMPUTER FUNDAMENTALS 9

Introduction - Evolution of Computers - Generations of Computer - Classification of Computers Application of Computers - Components of a Computer System - Hardware - Software - Starting a Computer (Booting) - Number Systems.

UNIT II :- COMPUTER PROGRMMING AND LANGUAGES 9

Introduction - Problem-Solving Techniques: Algorithms, Flowchart, Pseudocode - Program Control Structures - Programming Paradigms - Programming languages - Generations of Programming Languages - Language Translators - Features of a Good Programming Languages.

UNIT III:- PROGRAMMING WITH C 9

Introduction to C - The C Declaration - Operators and Expressions - Input and Output in C - Decision Statements - Loop Control Statements.

UNIT IV:- FUNCTIONS, ARRAYS AND STRINGS 9

Functions - Storage Class - Arrays - Working with strings and standard functions.

UNIT V:-POINTERS, STRUCTURES AND UNION 9

Pointers - Dynamic Memory allocation - Structure and Union - Files.

TOTAL 45

TEXT BOOK

1. ITL Education Solution Limited, Ashok Kamthane, "Computer Programming", Pearson Education Inc 2007 (Unit: I to V).

REFERENCES

1. Byron S. Gottfried, "Programming with C", Second Edition, Tata McGraw Hill 2006.
2. Yashvant Kanetkar, "Let us C", Eighth edition, BPP publication 2007.
3. Stephen G.Kochan, "Programming in C - A Complete introduction to the C programming language", Pearson Education, 2008.
4. T. JeyaPoovan, "Computer Programming Theory and Practice", Vikas Pub, New Delhi

MEA101 COMPUTER AIDED ENGINEERING DRAWING L T P C

3 0 0 3

GOAL

To develop graphical skills for communicating concepts, ideas and designs of engineering products and to give exposure to national standards relating to technical drawings using Computer Aided Design and Drafting practice.

OBJECTIVES

The course should enable the students to

1. Introduce drawing standards and use of drawing instruments.
2. Introduce first angle projection.
3. Practice of engineering hand sketching and introduce to computer aided drafting
4. Familiarize the students with different type of pictorial projections.
5. Introduction to Solid modeling
6. Introduce the process of design from sketching to parametric 3D CAD and 2D orthographic drawings to BIS

OUTCOME

The students should be able to

1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Get a Detailed study of an engineering artifact

Note: Only first angle projection is to be followed

UNIT I: BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES 12

Importance of graphics Use of drawing instruments - BIS conventions and specifications - drawing sheet sizes, layout and folding - lettering - Dimensioning- Geometrical constructions - Scales. Introduction to plane curves like ellipse, parabola, cycloids and involutes

Drafting methods - introduction to Computer Aided Drafting – Computer Hardware – Workstation – Printer and Plotter – Introduction to software for Computer Aided Design and Drafting – Exposure to Solid Modeling software – Geometrical Construction- Coordinate Systems/Basic Entities

UNIT II: VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING 15

Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects. Drafting of simple Geometric Objects/Editing

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

UNIT III: PROJECTIONS OF POINTS, LINES, SURFACES AND SOLIDS 18

Introduction to Projections of points – Projections of straight lines located in first quadrant using rotating line method only – Projections of plane surfaces when the surface of the lamina is inclined to one reference plane only – Projections of simple solids when the axis of the solid is inclined to one reference plane only – Sectioning of above solids in simple positions – Section Views. Practice includes drafting the projection of lines and solids using appropriate software. 2D drawing commands: Zoom, Picture editing commands, Dimensioning and 2D drafting.

UNIT IV: GEOMETRICAL MODELING AND ISOMETRIC VIEWS 15

Solid Modeling – Types of modeling - Wire frame model, Surface Model and Solid Model – Introduction to graphic software for solid modeling. Principles of isometric projection and solid modeling. Isometric drawing - IsoPlanes and 3D Modeling commands. Projections of Principal Views from 3-D Models

UNIT V: COMPUTER AIDED DESIGN AND DRAFTING 15

Preparation of solids of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modeling software.

Introduction to computer aided drafting and dimensioning using appropriate software. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting of drawing.

TOTAL = 75

TEXT BOOKS

1. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt Ltd., New Delhi, 2010.
2. Warren J. Luzadder and Jon. M.Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2003.

REFERENCES:

1. Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes Elsevier, 2011
2. Engineering Drawing and Graphic Technology-International Edition, Thomas E. French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 1993
3. Engineering Drawing and Design-Sixth Edition, C. Jensen, J.D. Helsel, D.R. Short, McGraw-Hill, 2002
4. Technical Drawing-Fourteenth Edition, F. E. Giesecke, A. Mitchell, H. C. Spencer, I.L. Hill, J.T. Dygdon, J.E., Novak, Prentice-Hall, 2012,
5. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2007.
6. Mechanical Engineering Drawing-Self Taught, Jashua Rose, http://www.gutenberg.org/files/23319/23319-h/23319-h.htm

Bureau of Indian Standards (BIS) for Engineering Drawing:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.

PHA131 PHYSICS LABORATORY
(COMMON TO ALL BRANCHES)

L	T	P	C
0	0	3	1

S. No.	List of Experiments
1	Torsional Pendulum - Determination of rigidity modulus of the material of a wire.
2	Non Uniform Bending - Determination of Young's Modulus.
3	Viscosity -Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.
4	Lee's Disc - Determination of thermal conductivity of a bad conductor.
5	Air Wedge - Determination of thickness of a thin wire.
6	Spectrometer - Refractive index of a prism.
7	Semiconductor laser - Determination of wavelength of Laser using Grating.

LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS

1	Torsional Pendulum	(500 gm, wt, 60 cm wire Al-Ni Alloy)	5 nos.
2	Travelling Microscope	(X10)	15 nos.
3	Capillary tube	(length 10cm, dia 0.05mm)	5 nos.
4	Magnifying lens	(X 10)	15 nos.
5	Lee's disc apparatus	(std form)	5 nos.
6	Stop watch	(+/- 1 s)	5 nos.
7	Meter scale	1m length	5 nos.
8	Spectrometer	(main scale 360 deg, ver 30")	5 nos.
9	Grating	(2500 LPI)	5 nos.
10	Laser	(632.8 nm)	5 nos.
11	Semi-transparent glass plate	Al coating, 65 nm thickness, 50% visibility	5 nos.
12	Equilateral prism	(n = 1.54)	5 nos.
13	Thermometer	+/- 1 deg	8 nos.
14	Screw gauge	(+/- 0.001cm)	12 nos.
15	Vernier caliper	(+/- 0.01 cm)	8 nos.
16	Steam Boiler	1 L	5 nos.
17	Scale	50 cms	5 nos.

18	Cylindrical mass	100 gms	10 sets
19	Slotted wt	300 gms	5 sets
20	Heater	1.5 KW	5 nos.
21	Transformer sodium vapour lamp	1 KW	10 nos.
22	Sodium vapour lamp	700 W	5 nos
23	Burette	50 mL	5 nos
24	Beaker	250 mL	5 nos
25	Spirit level		10 nos

REFERENCE:

P. Mani, Engineering Physics Practicals, Dhanam Publications, Chennai, 2005.

CYA131 CHEMISTRY LABORATORY L T P C
0 0 3 1

S. No.	List of Experiments
1	Estimation of Commercial soda by acid-base titration
2	Determination of Percentage of nickel in an alloy
3	Determination of Temporary, permanent and total hardness of water by EDTA method
4	Determination of Chloride content in a water sample
5	Potentiometric Estimation of iron
6	Conductometric Titration of a strong acid with a strong base
7	Conductometric Titration of mixture of acids.
8	Determination of Degree of polymerization of a polymer by Viscometry

List of Glassware and Equipment's required for a batch of 30 students

1	Burette	(50 mL)	30 nos
2	Pipette	(20 mL)	30 nos.
3	Conical Flask	(250 mL)	30 nos
4	Distilled water bottle	(1 L)	30 nos
5	Standard flask	(100 mL)	30 nos

6	Funnel	(small)	30 nos
7	Glass rod	20 cm length	30 nos
8	Reagent Bottle	(250 mL)	30 nos.
9	Reagent Bottle	(60 mL)	30 nos
10	Beaker	(100 mL)	30 nos
11.	Oswald Viscometer	Glass	30 nos
12.	Measuring Cylinder	(25 mL)	30 nos
13.	Digital Conductivity Meter	PICO make	8 nos
14.	Conductivity cell	(K=1)	12 nos
15.	Digital Potentiometer	PICO make	8 os
16.	Calomel Electrode	Glass	12 nos
17.	Platinum Electrode	Polypropylene	12 nos
18.	Burette Stands	Wooden	30 nos
19.	Pipette stands	Wooden	30 nos
20.	Retard stands	Metal	30 nos
21.	Porcelain Tiles	White	30 os
22.	Clamps with Boss heads	Metal	30 nos

REFERENCES

1. J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantative Chemical Analysis, 6th Edition, Pearson Education, 2004.
2. C. W. Garland, J. W. Nibler, D. P. Shoemaker, Experiments in Physical Chemistry, 8th ed., McGraw-Hill, New York, 2009.
3. S. Sumathi, Engineering Chemistry Practicals, Dhanam Publications, 2011.

CSA131 COMPUTER PROGRAMMING LABORATORY L T P C
0 0 3 1

(Common to all branches)

GOAL

To provide an awareness to develop the programming skills using computer languages.

OBJECTIVES

The course should enable the students to:

1. To gain knowledge about Microsoft office, Spread Sheet.
2. To learn a programming concept in C.

OUTCOME

The students should be able to

1. Use MS Word to create document, table, text formatting and Mail merge options.
2. Use Excel for small calculations using formula editor, creating different types of charts and including pictures etc.
3. Write and execute the C programs for small applications.

LIST OF EXPERIMENTS

a) Word Processing **12**

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing- flow Chart

b) Spread Sheet **9**

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document

c) Programming in C **24**

8. To write a C program to prepare the electricity bill.
9. **Functions**
   (a) Call by value (b) Call by reference.
10. To write a C program to print the Fibonacci series for the given number.
11. To write a C program to find the factorial of number using recursion.
12. To write a C program to implement the basic arithmetic operations using Switch Case statement.
13. To write a C program to check whether the given number is an Armstrong number.
14. To write a C program to check whether the given string is a Palindrome.
15. To write a C program to create students details using Structures.

16. To write a C program to demonstrate the Command Line Arguments.
17. To write a C program to implement the Random Access in Files.
18. To write C programs to solve some of the Engineering applications

TOTAL: 45

HARDWARE/SOFTWARE REQUIRED FOR BATCH OF 30 STUDENTS

HARDWARE

LAN system with 33 nodes (OR) Standalone PCs - 33 Nos
Printers - 3 Nos

SOFTWARE

OS - Windows / UNIX
Application package - MS office
Software - C language

ELA131 COMMUNICATION SKILLS LABORATORY- 1 **L T P C**
0 0 3 1

GOAL

The goal of the programme is to provide a practical input towards nurturing accomplished learners who can function effectively in the English language skills.

OBJECTIVES

The course should enable the students to

1. Extend the ability of the learners to be able to listen to English and comprehend its message.
2. Enable the learners to have a functional knowledge of spoken English.
3. Assist the learners to read and grasp the meaning of technical and non-technical passages in English.
4. Help the learners develop the art of writing without mistakes.
5. Expand the thinking capability of the learners so that they would learn how to view things from a different angle.

OUTCOME

The students should be able to

1. Listen to and evaluate English without difficulty and comprehend its message.

2. Develop a functional knowledge of spoken English so as to use it in the institution and at job interviews.
3. Read and comprehend the meaning of technical and non-technical passages in English.
4. Develop the art of writing so as to put down their thoughts and feelings in words.
5. Think independently and contribute creative ideas.

UNIT I LISTENING SKILL

Listening to conversations and interviews of famous personalities in various fields -- Listening practice related to the TV-- Talk shows - News - Educative programmes -- Watching films for critical comments - Listening for specific information - Listening for summarizing information - Listening to monologues for taking notes - Listening to answer multiple-choice questions.

UNIT II SPEAKING SKILL

Self-introduction -- Group discussion - Persuading and negotiating strategies - Practice in dialogues - Presentations based on short stories / poems -- Speaking on personal thoughts and feelings -academic topics - News reading - Acting as a compere -- Speaking about case studies on problems and solutions - Extempore speeches.

UNIT III READING SKILL

Reading anecdotes to predict the content - Reading for interpretation -- Suggested reading -- Short stories and poems -- Critical reading - Reading for information transfer - Reading newspaper and magazine articles for critical commentary - Reading brochures, advertisements, pamphlets for improved presentation.

UNIT IV WRITING SKILL

At the beginning of the semester, the students will be informed of a mini dissertation of 1000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

UNIT V THINKING SKILL

Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms and proverbs - Inculcating interest in English using thinking blocks. Making pictures and improvising diagrams to form English words, phrases and proverbs -- Picture reading

REFERENCES

1. Raman, Meenakshi, and Sangeetha Sharma. Technical Communication: English Skills for Engineers. 2nd edition. New Delhi: Oxford University Press, 2010.
2. Riordian, Daniel. Technical Communication. New Delhi. Cengage Learning, 2009

Websites for learning English

1. British: Learn English - British Council (Listen & Watch) - <http://learnenglish. british council.
   org/>
2. American: Randall's ESL Cyber Listening Lab - <http://www.esl-lab.com/>
3. Intercultural: English Listening Lesson Library Online http://www.elllo.org/

SEMESTER - II

ENGINEERING MATHEMATICS – II

(Common to All Branches)

MAA102 ENGINEERING MATHEMATICS-II **L T P C**

2 1 1 4

GOAL

The course is aimed at developing the basic Mathematical skills of engineering students that are imperative for effective understanding of engineering subject using MATLAB.

OBJECTIVES

- To understand effectively the evaluation of double and triple integrals and their applications
- To know the basics of vector calculus comprising of gradient, divergence, curl, line surface and volume integrals along with the classical theorems involving them
- To have a sound knowledge of Laplace transform and its properties. Solutions of Laplace transform using MATLAB.
- To understand and expand periodic functions as Fourier series using MATLAB

OUTCOME

- To understand effectively the evaluation of double and triple integrals and their applications
- To know the basics of vector calculus comprising of gradient, divergence, curl, line surface and volume integrals along with the classical theorems involving them
- To have a sound knowledge of Laplace transform and its properties. Solutions of Laplace transform using MATLAB.
- To understand and expand periodic functions as Fourier series using MATLAB

UNIT I MULTIPLE INTEGRALS **12(8+4)**

Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a double integral – Triple integration in Cartesian co ordinates – Volume as a triple integral - Change of variables between Cartesian and polar coordinates.

Lab: Area and Volume of double integration and triple integration.

UNIT II VECTOR CALCULUS **12(8+4)**

Gradient, Divergence and Curl – Unit normal vector, Directional derivative – angle between surfaces-Irrotational and solenoidal vector fields.

Green's theorem - Gauss divergence theorem and Stoke's theorem (without proof) – Verification and evaluation of the above the theorems - Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelopipeds.

Lab: Green's theorem - Gauss divergence theorem and Stoke's theorem

UNIT III LAPLACE TRANSFORM 12(8+4)

Laplace transform – Conditions of existence – Transform of elementary functions – properties - Derivatives and integrals of transforms – Transforms of derivatives and integrals – Initial and final value theorems – Transform of periodic functions. Inverse Laplace transforms using partial fraction and convolution theorem. Solution of linear ODE of second order with constant coefficients.

Lab: Solutions of differential equations using Laplace transform

UNIT IV FOURIER SERIES 12(8+4)

Dirichlet's Conditions – General Fourier Series – Odd and even functions – Half range sine and cosine series –Harmonic Analysis.

Lab: Solutions of Fourier series and Harmonic Analysis.

UNIT V COMPLEX VARIABLES 12(8+4)

Functions of a complex variable – Analytic function - Cauchy - Riemann equations (Statement only) – Properties of analytic function (Statement only) – Construction of Analytic functions by Milne – Thomson method.

Lab: Cauchy - Riemann equations, Milne – Thomson method

TOTAL: 60

TEXT BOOK:

1.Venkatraman M.K, Mathematics, Volume – II & Volume -III, National Publishing Company, Chennai, 1985.
2.A.P.Santhakumaran, P.Titus, Engineering Mathematics - II, NiMeric Publications, Nagercoil, 2012

REFERENCE:

1. Kandasamy P, Engineering Mathematics Volume II, S. Chand & Co., New Delhi, 1987.
2. Grewal B.S, "Engineering Maths – II", Sultan Chand, New Delhi, 1993.
3. Bali N.P, Manish Goyal, Text book of Engineering Mathematics, 3rd Edition,Lakshmi Publications, 2003.
4.Chandrasekaran A, Engineering Mathematics, Volume – II, Dhanam Publication, 2008.

PHA101 ENGINEERING PHYSICS L T P C
3 0 0 3

To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES

The course should enable the students to:

(i) Develop strong fundamentals of properties and behavior of the materials
(ii) Enhance theoretical and modern technological aspects in acoustics and ultrasonic.
(iii) Enable the students to correlate the theoretical principles with application oriented study of optics.
(iv) Provide a strong foundation in the understanding of solids and materials testing.
(v) Enrich the knowledge of students in modern engineering materials.

OUTCOME

The students should be able to:

(i) Understand the properties and behavior of materials.
(ii) Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonic and be able to employ it as an engineering tool.
(iii) Understand the concept, working and application of lasers and fiber optics.
(iv) Know the fundamentals of crystal physics and nondestructive testing methods.
(v) Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I: - PROPERTIES OF MATTER 9

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

UNIT II: - ACOUSTICS AND ULTRASONICS 9

Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriction and Piezoelectric methods - properties - applications of ultrasonic with particular reference to detection of flaws in metal (Non - Destructive testing NDT) - SONAR.

UNIT III :- LASER AND FIBRE OPTICS 9

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO2 laser Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

UNIT IV:- CRYSTAL PHYSICS AND NON- DESTRUCTIVE TESTING 9

Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V: - MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS 9

Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis -Properties and applications.

Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - uses of superconductors.

TOTAL = 45

TEXT BOOKS

1. Gaur R.K. and Gupta S.L., "Engineering Physics ", 8th edition, Dhanpatrai publications (P) Ltd., New Delhi 2010.
2. P.Mani, "Engineering Physics", Vol-I, Dhanam Publications, Chennai 2011.
3. Rajendran V. an Marikani A., "Applied Physics for engineers", 3rd edition, Tata McGraw -Hill publishing company Ltd., New Delhi, 2003.

REFERENCES

1. Uma Mukherji, Engineering Physics, Narosa publishing house, New Delhi, 2003.
2. Arumugam M., Engineering Physics, Anuradha agencies, 2007.
3. Palanisamy P.K., Engineering Physics, SciTech Publications, Chennai 2007.
4. Arthur Beiser, Concepts of Modern Physics, Tata McGraw -Hill Publications, 2007.
5. P. Charles, Poople and Frank J. Owens, Introduction to Nanotechnology, Wiley India,

CYA101 ENGINEERING CHEMISTRY L T P C
3 0 0 3

To impart basic principles of chemistry for engineers.

OBJECTIVES

The course should enable the students to

(i) Make the students conversant with the basics of
(ii) (a) Water technology And (b) Polymer science
(iii) Provide knowledge on the requirements and properties of a few important engineering materials.
(iv) Educate the students on the fundamentals of corrosion and its control.
(v) Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
(vi) Create awareness among the present generation about the various conventional energy sources.

OUTCOME

The students should be able to

(i) Gain basic knowledge in water analysis and suitable water treatment method.
(ii) Get an idea on the type of polymers to be used in engineering applications.
(iii) Get awareness about new materials
(iv) Get knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.
(v) Get exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.
(vi) Get a good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I:- WATER TECHNOLOGY AND POLYMER CHEMISTRY 9

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys Definition, Examples

UNIT II: - ENGINEERING MATERIALS 9

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications. Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties – Epoxy

resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

UNIT III: - ELECTROCHEMISTRY AND CORROSION 9

Conduct metric Titration – HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design - Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) Constituents of Paints and varnish.

UNIT IV: - CHEMICAL THERMODYNAMICS 9

Thermodynamic terminology- First Law of Thermodynamics-Internal energy- enthalpy - heat capacity work done in isothermal expansion of an ideal gas -problems - second law of thermodynamics entropy change - phase transformations and entropy change - problems - Work Function & Free Energy Function- Maxwell's Relations-Gibbs Helmholtz equation- van't Hoff Isotherm- van't Hoff Isochore - Problems.

UNIT V: - FUELS AND ENERGY SOURCES 9

Fuels - classification - Calorific Value - Dulong's Formula - Problems - Determination of Calorific Value by Bomb Calorimeter - Coal - Proximate Analysis - problems - Octane Number - Cetane Number - Diesel Index (Definitions only) - Bio Gas - Producer Gas -Water Gas - Preparation, Properties and Uses - Batteries - Primary Cells - Leclanche Cell -Secondary Cell - Nickel Cadmium Battery Fuel Cells - Hydrogen - Oxygen Fuel Cell - Solar Battery - Lead Acid Storage Cell - Nuclear Energy Light water nuclear power plant.

L=45 TOTAL = 45

TEXT BOOKS

1. S. S. Dara, Text Book of Engineering Chemistry, S. Chand & Company Ltd., New Delhi, 2003
2. Murthy, Agarwal & Naidu, Text Book of Engineering Chemistry, BSP, 2003.
3. S. Sumathi, Engineering Chemistry, Dhanam Publications, 2008.
4. S. Sumathi and P.S. Raghavan, Engineering Chemistry II, Dhanam Publications, 2008.

REFERENCES

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
2. A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004
3. A. Gowarikar, Text Book of Polymer Science, 2002

4. Kuriacose & Rajaram, Vols. 1 & 2, Chemistry in Engineering and Technology, 2004
5. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.

EEB122 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 1 0 4

GOAL

To impart basic principles of electrical circuits and its applications. To understand about digital electronics, its devices and application in aerospace industry.

OBJECTIVES

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS 12

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS 12

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 12

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL HOURS: 60

TEXT BOOKS:

1. V.N. Mittle “Basic Electrical Engineering”,Tata McGraw Hill Edition, New Delhi, 1990.

2. R.S. Sedha, “Applied Electronics” S. Chand & Co., 2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”,Tata McGraw Hill, Second Edition, (2006).

2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press (2005).

3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, (1994).

4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, (2002).

5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publications

MEA102 ENGINEERING MECHANICS L T P C
3 1 0 4

OBJECTIVES

The course should enable the student to:

- Understand the Basics and Statics of particles
- Study the equilibrium of rigid bodies and resolution of forces
- Understand the basics of properties of surfaces and solids
- Study the dynamics of particles
- Study the friction and elements of rigid body dynamics

OUTCOME

The student should be able to understand:

- Vectorial representation of forces and moment and principle of transmissility.
- Types of supports and reactions and equilibrium of rigid bodies in two and three dimension
- First moment of area and centroid of various shapes & sections
- The relative motion of particles and impact of elastic bodies
- The frictional forces & types of friction and translation and rotation of rigid bodies

UNIT I BASICS & STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and

perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force – Laws of Coulomb friction – simple contact friction – Rolling resistance – Belt friction. Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60

TEXT BOOK

- Beer, F.P and Johnson Jr. E.R. *"Vector Mechanics for Engineers",* Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES

- Rajasekaran, S, Sankarasubramanian, G., *"Fundamentals of Engineering Mechanics"*, Vikas Publishing House Pvt. Ltd., (2000).
- Hibbeller, R.C., *"Engineering Mechanics*", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).

  Palanichamy, M.S., Nagam, S., *"Engineering Mechanics* – Statics & Dynamics", Tata McGraw-Hill, (2001).

ASB101 INTRODUCTION TO AEROSPACE ENGINEERING L T P C
3 0 0 3

OBJECTIVES

The course should enable the student to:

1) Understand the Historical evaluation of Airplanes
2) Study the different component systems and functions
3) Understand the basic principles behind propulsion of flight
4) Study the different structures & construction
5) Study the various types of instruments and navigation systems

OUTCOME

The students should be able to:

1. Understand the history of aircraft & developments over the years
2. Understand the types & classifications of components and configurations.
3. Understand the basic concepts of propulsion and power plants
4. Understand the types of fuselage, constructions and materials
5. Understand the different types of navigation and instruments for flight

UNIT I HISTORICAL EVALUATION 9

History of aviation, early development of airplanes, biplanes and monoplanes, history of spaceflight, development of space vehicle, classification of duct jet propulsion, rocket propulsion, advance propulsion and applications.

UNIT II CONFIGURATIONS 9

Anatomy of flight vehicles, components of an airplanes and their function, configuration of space vehicle, earth's atmosphere and gravitational field, bluff bodies v/s streamlined body, airfoil. Lift generation, significance of L/D ratio, aerodynamic forces.

UNIT III PROPULSION 9

Classification and essential features of propulsion, jet propulsion, general characteristics of rocket engines, theory of propulsion, elementary gas dynamics, spacecraft's and aircraft performance

UNIT IV AEROSPACE STRUCTURES AND MATERIALS 9

General types of construction and structural layout, flight envelope and V-n diagrams, monocoque, semimonocoque, corrugated, sandwich structure, reinforced and honeycomb structures, geodesic construction, aerospace materials, metallic and non metallic materials, use of aluminum alloy, titanium, stainless steel, composite and ceramic materials

UNIT V INSTRUMENTS AND NAVIGATION 9

Basic instrumentation electronics (dc electronics, ac electronics, semiconductors, electro-optics and digital electronics), sensing devices, bridge circuits, optical devices and introduction to computer based data acquisition, measurements in aerodynamics, flight structures, and flight control, principles of navigation, celestial, radio, and inertial navigation schemes, navigational and guidance requirements for orbital, planetary, and atmospheric entry missions

Total 45

TEXT BOOKS

- Shevel, "Fundamentals of Flight", Prentice Hall, 1989.
- Merrill, G., "Principle of Guided Missile Design", D. Van Nostrand Co., INC., 1977

REFERENCES

- Anderson, J. D., "Introduction to Flight", McGraw-Hill, 2000.
- Kermode, A. C., "Flight without Formulae", Pitman, 1970

ELA102 PERSONALITY DEVELOPMENT AND SOFT SKILLS L T P C
3 0 0 3

GOAL

- To enhance holistic development of students and improve their employability skills.
- To nurture the language skills and cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning
- To help them become responsible members or leaders of the society in and around their workplace or living space
- to communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

OBJECTIVES

The course should enable the students to

1. Develop inter personal skills and be an effective goal oriented team player.
2. Develop professionals with idealistic, practical and moral values.
3. Develop communication and problem solving skills.
4. To face the challenges in the world and enable the students excel in the world of work and life.

OUTCOME

The students should be able to:

1. Develop self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
2. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.

3. Read, comprehend and answer questions based on literary, scientific and technological texts.
4. Think creatively and participate in mind-mapping, audiovisual activities, brain storming, and creative thinking and also answer tests in the job-selection processes.
5. Make right decisions, communicate effectively, and develop self-management talents, to lead a healthy and productive life.
6. Imbibe the requisite employability skills , learned skills, intuitive skills and people skills
7.

UNIT I SPEAKING SKILLS **9 hours**

Art of Speaking- Body Language and speaking- Non Verbal communication- -Vocal Communication Techniques- Intercultural communication- The difference in Approach in five countries- Vocabulary Enrichment- Pronunciation of words-Mark the stress on appropriate syllable-split the word into syllables- Speaking as an Art-Simple Oral Interaction-Body Language and Speaking- Five characteristics of an ideal GD- group discussions - role plays- short speeches-Extempore – JAM –Debate-Talk shows-Power point presentation and speaking

UNIT II LANGUAGE SKILLS **13 hours**

Functional Grammar: Synonyms and Antonyms – Active and Passive Voice- Direct and Indirect Speech- Conditional Clauses- collocations- rearrange the jumbled sentences and make meaningful sentences- Language functions: apologizing, greeting, clarifying, inviting, advising, agreeing, disagreeing, refusing, thanking, interrupting, expressing obligation, expressing preferences, CV / application letters- Job interviews-FAQ's – e-mail etiquette

UNIT III PEOPLE SKILLS/SOFT SKILLS **8 hours**

SWOT analysis- JOHARI window- Goal setting- speaking on Goals - goals to be achieved- modes of behavior to achieve the goals- decision making- time management - stress management- power of positive attitude

UNIT IV COMPREHENSION SKILLS **7 hours**

Art of Listening- listening to English news- listening to debates on current issues - Listening to dialogues for general meaning and specific information- listening to toast master speeches- -cloze exercises-open comprehension questions-Art of Listening- Reading passages –interpreting in own words- reading articles in magazines/journals/newspapers- writing articles for newspaper-reporting events-completing the middle/end of a story

UNIT V PERSONALITY DEVELOPMENT **9 hours**

Define Personality- Types of Personality-Personality test- Leadership Skills - Interpersonal Skills- Team Work - Mind Mapping- concept maps- Study skills and techniques - Edward De Bono's lateral thinking-exercises-questionnaires-project

TEXT BOOK:

English for Life and the workplace through LSRW&T skills by Dr. Dolly John, Pearson Publications

REFERENCES

1. Education and Personality Development, Dr. P.K. Manoharan, APH Publishing Corporation.

2. Effective technical Communication, M. Ashraf Rizvi, Tata McGraw Hill Companies

3. Professional Speaking Skills, Aruna Koneru, Oxford University Press

4. Essential Grammar in Use, Fourth Edition by Raymond Murphy, Cambridge University Press

5. Covey Sean, Seven Habit of Highly Effective Teens, New York, Fireside Publishers, 1998.

6. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.

Web links for reference for Flipped classroom sessions

1. https://owl.english.purdue.edu/exercises/28/12/33
2. http://englishplaza.vn/flexpaper/pdf/english-collocations-in-use_1405952201.pdf
3. http://www.htsb.org/wp-content/uploads/2014/07/Academic-Language-Functions-toolkit.pdf
4. http://www.intelligencetest.com/puzzles/lateral.htm
5. http://www.teachingenglish.org.uk/sites/teacheng/files/mind_map.pdf
6. http://www.teachingenglish.org.uk/article/using-mind-maps-develop-writing.
7. http://www.teachingenglish.org.uk/article/jigsaw-readingArrange
8. http://www.teachthought.com/critical-thinking/10-team-building-games-that-promote-critical-thinking
9. http://www.myenglishpages.com/site_php_files/grammar-exercise-conditionals.php
10. http://flax.nzdl.org/greenstone3/flax?a=fp&sa=collActivity&c=copyrightlaw
11. http://www.humanmetrics.com/personality/type

PHA131 PHYSICS LABORATORY

(COMMON TO ALL BRANCHES)

L	T	P	C
0	0	3	1

S. No.	List of Experiments
1	Torsional Pendulum - Determination of rigidity modulus of the material of a wire.
2	Non Uniform Bending - Determination of Young's Modulus.
3	Viscosity -Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.
4	Lee's Disc - Determination of thermal conductivity of a bad conductor.
5	Air Wedge - Determination of thickness of a thin wire.
6	Spectrometer - Refractive index of a prism.
7	Semiconductor laser - Determination of wavelength of Laser using Grating.

LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS

1	Torsional Pendulum	(500 gm, wt, 60 cm wire Al-Ni Alloy)	5 nos.
2	Travelling Microscope	(X10)	15 nos.
3	Capillary tube	(length 10cm, dia 0.05mm)	5 nos.
4	Magnifying lens	(X 10)	15 nos.
5	Lee's disc apparatus	(std form)	5 nos.
6	Stop watch	(+/- 1 s)	5 nos.
7	Meter scale	1m length	5 nos.
8	Spectrometer	(main scale 360 deg, ver 30")	5 nos.
9	Grating	(2500 LPI)	5 nos.
10	Laser	(632.8 nm)	5 nos.
11	Semi-transparent glass plate	Al coating, 65 nm thickness, 50% visibility	5 nos.
12	Equilateral prism	(n = 1.54)	5 nos.
13	Thermometer	+/- 1 deg	8 nos.
14	Screw gauge	(+/- 0.001cm)	12 nos.
15	Vernier calliper	(+/- 0.01 cm)	8 nos.
16	Steam Boiler	1 L	5 nos.
17	Scale	50 cms	5 nos.
18	Cylindrical mass	100 gms	10 sets

19	Slotted wt	300 gms	5 sets
20	Heater	1.5 KW	5 nos.
21	Transformer sodium vapour lamp	1 KW	10 nos.
22	Sodium vapour lamp	700 W	5 nos
23	Burette	50 mL	5 nos
24	Beaker	250 mL	5 nos
25	Spirit level		10 nos

REFERENCE:

P. Mani, Engineering Physics Practicals, Dhanam Publications, Chennai, 2005.

CYA131 CHEMISTRY LABORATORY L T P C
0 0 3 1

S. No.	List of Experiments
1	Estimation of Commercial soda by acid-base titration
2	Determination of Percentage of nickel in an alloy
3	Determination of Temporary, permanent and total hardness of water by EDTA method
4	Determination of Chloride content in a water sample
5	Potentiometric Estimation of iron
6	Conductometric Titration of a strong acid with a strong base
7	Conductometric Titration of mixture of acids.
8	Determination of Degree of polymerization of a polymer by Viscometry

List of Glassware and Equipment's required for a batch of 30 students

1	Burette	(50 mL)	30 nos
2	Pipette	(20 mL)	30 nos.
3	Conical Flask	(250 mL)	30 nos
4	Distilled water bottle	(1 L)	30 nos

5	Standard flask	(100 mL)	30 nos
6	Funnel	(small)	30 nos
7	Glass rod	20 cm length	30 nos
8	Reagent Bottle	(250 mL)	30 nos.
9	Reagent Bottle	(60 mL)	30 nos
10	Beaker	(100 mL)	30 nos
11.	Oswald Viscometer	Glass	30 nos
12.	Measuring Cylinder	(25 mL)	30 nos
13.	Digital Conductivity Meter	PICO make	8 nos
14.	Conductivity cell	(K=1)	12 nos
15.	Digital Potentiometer	PICO make	8 os
16.	Calomel Electrode	Glass	12 nos
17.	Platinum Electrode	Polypropylene	12 nos
18.	Burette Stands	Wooden	30 nos
19.	Pipette stands	Wooden	30 nos
20.	Retard stands	Metal	30 nos
21.	Porcelain Tiles	White	30 os
22.	Clamps with Boss heads	Metal	30 nos

REFERENCES

4. J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantative Chemical Analysis, 6th Edition, Pearson Education, 2004.
5. C. W. Garland, J. W. Nibler, D. P. Shoemaker, Experiments in Physical Chemistry, 8th ed., McGraw-Hill, New York, 2009.
6. S. Sumathi, Engineering Chemistry Practicals, Dhanam Publications, 2011.

Manual", 3rd Edition 2006, Vikas publishing house (P) Ltd., New Delhi.

GEA3132 - ENGINEERING PRACTICES LABORATORY II

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

1. Electrical Engineering

1. Wiring for a tube light.
2. Wiring for a lamp and fan.
3. Staircase wiring.
4. Study of (i) Iron box and (ii) Fan with Regulator.

2. Electronics Engineering

1. Study of Electronic components and Equipments.
2. Characteristics of PN junction diode & measurement of ripple factor or half wave and full wave rectifier.
3. Applications of OP-AMP – Inverter, Adder and Sub tractor.
4. Study and verification of Logic Gates.

Total = 30

Text Book:

T. Jeyapoovan, M.Saravanapandian and S. Pranitha, "*Engineering Practices Lab Manual", 3rd Edition 2006, Vikas Publishing house (P) Ltd.,* New Delhi.

SEMESTER III

MAA201	ENGINEERING MATHEMATICS III	L	T	P	C
		3	1	0	4

GOAL

OBJECTIVES

The course should enable the students to:

1. Learn techniques of solving the standard types of first and second partial differential equations.
2. Grasp the Fourier series expansions for the given periodic function in the specific intervals and their different forms.
3. Learn solving one dimensional wave equation, One and two dimensional heat equation using Fourier series.
4. Understand the problems using Fourier transform and learns their properties.
5. Understand the problems using Z – transform and learns their properties

OUTCOME

The students should be able to:

1. Formulate mathematically certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
2. Use the knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
3. Formulate and identify certain boundary and initial value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve the vibration and heat flow problems and then interpret the results.
4. Apply Fourier transform pair, their properties, with the possible special cases with attention to their applications
5. Apply the basics of Z – transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z – transform technique bringing out the elegance of the procedure involved.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order non linear partial differential equations- simple problems – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 12

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates

UNIT IV FOURIER TRANSFORM 12

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – simple problems.

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL: 60

Text Books

- Grewal, B.S., "*Higher Engineering Mathematics*", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
- Kandasamy, P., Thilagavathy, K., and Gunavathy, K., *"Engineering Mathematics Volume III",* S. Chand & Company ltd., New Delhi, 1996.

References

- Andrews, L.A., and Shivamoggi B.K., "*Integral Transforms for Engineers and Applied Mathematicians,"* MacMillan, New York, 1988.
- Narayanan, S., Manikavasagom Pillai, T.K. and Ramaniah, G., *"Advanced Mathematics for Engineering Students", Volumes II and III*, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.

ASB203	SOLID MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES

The course should enable the student:

1. Stress and Strain – Hooke's Law – Elastic constants and their relationship– Statically determinate cases - bar with uniform and varying section statically indeterminate cases –composite bar. Thermal Stresses – stresses due to freely falling weight.
2. Shear force and bending moment diagrams for simply supported and cantilever beams – Bending stresses in straight beams – Shear Stresses in bending of beams with various cross sections – beams of uniform strength
3. Beam Deflections though various methods
4. Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts – closely coiled helical springs.
5. Stresses in thin circular cylinder and spherical shell under intl pressure, volumetric Strain. Combined loading, Principal and maximum Shear Stresses - Analytical and Graphical methods.

OUTCOMES

The students should be able to:

1. Proportional Limit, Elastic Limit, Elastic Constants and relations. Determinacy and indeterminacy. Elongation of bars with uniform varying section. Elongation of compound bars and thermal stresses
2. Calculation of reaction forces. Differentiate between cantilever and simple support beams. Draw the shear force and bending moment diagrams for various load cases. Establish the relation between Moment, Moment of Inertia, Radius of curvature, Young's modulus. Understand shear stresses and obtain shear stress for various cross sections.
3. Double integration method – McCauley's method - Area moment method – Conjugate beam method.
4. Distinguish difference between bending moment & twisting moment and effects of twisting moment. Find out shear stresses for solid & hollow shafts and study of helical springs
5. Understand Hoops stress, Meridonal stress for thin cylinders and obtain pressure for spherical shell. Calculate principal planes and find principal stresses. Represent as Mohr's circles in graphical form

UNIT I - BASICS AND AXIAL LOADING **12**

- Stress and Strain – Hooke's Law – Elastic constants and their relationship– Statically determinate cases - bar with uniform and varying section statically indeterminate cases – composite bar. Thermal Stresses – stresses due to freely falling weight.

UNIT II - STRESSES IN BEAMS **12**

- Shear force and bending moment diagrams for simply supported and cantilever beams – Bending stresses in straight beams – Shear Stresses in bending of beams with various cross sections – beams of uniform strength

UNIT III - DEFLECTION OF BEAMS **12**

- Double integration method – McCauley's method - Area moment method – Conjugate beam method.

UNIT IV – TORSION **12**

- Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts – closely coiled helical springs.

UNIT V - BI AXIAL STRESSES **12**

- Stresses in thin circular cylinder and spherical shell under internal pressure, volumetric Strain. Combined loading, Principal Stresses and maximum Shear Stresses - Analytical and Graphical methods.

Total **60**

TEXT BOOKS

Nash William – *"Strength of Materials",* TMH, 1991

Timoshenko.S. and Young D.H. – *"Elements of strength materials* Vol. I and Vol. II". T. Van Nostrand Co-Inc Princeton-N.J. 1990.

REFERENCES

1. Dym C.L. and Shames I.H. – *"Solid Mechanics*", 1990.

ASB202 AERO ENGINEERING THERMODYNAMICS **L T P C**

3 1 0 4

OBJECTIVES

1. The subject should enable the students to have a basic idea about Thermodynamic Systems, and processes.

2. The student should understand the air cycles like (**Otto**, Diesel, and Dual combustion and Brayton combustion cycles), they should understand PV diagrams of four stroke and two stroke IC Engines.
3. To understand the thermodynamics of One Dimensional fluid flow and the application of Continuity and energy equations Properties of steam .To understand the Simple jet propulsion system and Thrust rocket motor
4. To understand about the refrigeration and Principles of Air conditioning and understand the Coefficient of performance and Properties of refrigerants.

OUTCOME

1. The student should be able to understand the basic thermodynamic systems.

2. Understanding about the air cycles, and understanding about the plot of the PV diagrams of four stroke and two stroke IC Engines

3. Understand about the One Dimensional fluid flow and the applications of the Continuity equation and understand about the simple jet propulsion systems.

4. Understand about the Principles of refrigeration and Air conditioning and understand the Coefficient of performance and Properties of refrigerants.

UNIT I BASIC THERMODYNAMICS 12

Systems, Zeroth Law, First Law - Heat and work transfer in flow and non-flow processes, Second law, Kelvin- Planck statement - Clausius statement - concept of entropy - Clausius inequality - entropy change in non-flow processes.

UNIT II AIR CYCLES 12

Otto, Diesel, Dual combustion and Brayton combustion cycles – Air standard efficiency - Mean effective pressure – Actual and theoretical PV diagrams of four stroke and two stroke IC Engines.

UNIT III THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW12

Application of Continuity and energy equations- Properties of steam - Rankine cycle - Isentropic flow of ideal gases through nozzles - Simple jet propulsion system - Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR CONDITIONING 12

Principles of refrigeration, Air conditioning - Heat pumps - Vapour compression - Vapour absorption types - Coefficient of performance, Properties of refrigerants.

UNIT V AIR COMPRESSORS 12

Classification and working principle, work of compression with and without clearance, Isothermal and Isentropic efficiency of reciprocating air compressors, multistage

compression and intercooling. Various types of compressors (Descriptive treatment only.

Total 60

TEXT BOOKS

1. Rathakrishnan, E, "*Fundamentals of Engineering Thermodynamics",* Prentice – Hall, India, 2000
2. Nag. P.K., "Engineering Thermodynamics", Tata McGraw-Hills Co., Ltd., Seventh Edn. 1993
3. Yunus A.Cengal. *"Thermodynamics an Engineering Approach"*, Tata McGraw-Hill Co. Ltd., 3rd Edition, 2002.

REFERENCES

1. Mayhew, A. and Rogers, B., *"Engineering Thermodynamics"*, Longman Green & Co. Ltd., London, E.L.B.S. Edition, 1990.
2. Van Wylen, G.J. and Sonntag, R.E., *"Fundamentals of Classical Thermodynamics* (S.I.Version)", Second Edition, 1986.
3. Bacon, D.H., *"Engineering Thermodynamics*", Butterworth & Co., London, 1989.
4. Saad, M.A., *"Thermodynamics for Engineers*", Prentice-Hall of India Pvt. Ltd., 1989.
5. Reynolds*, "Thermodynamics*", Int. Student Edn. McGraw-Hill Book Co., Ltd., 1990

ASB204 FLUID MECHANICS AND MACHINERY L T P C
3 1 0 4

OBJECTIVES

The course should enable the student to:

1. Understand the principles of Basic concepts and properties of Fluid
2. Understand the Fluid Kinematics and its Dynamics
3. Study the basic concepts of Incompressible Flows
4. Study the basic concepts of Fluid Machines and Hydraulic turbines
5. To study the Hydraulic pumps & its applications

OUTCOME

The student should be able to understand:

1. The basic terms like Pressure , Density, Surface Tension & Fluid Statics
2. The types of flows , stream functions, Velocity Potential & familiarize in equations of Fluid Motion

3. The Laminar Flows , Flow through Pipes , Boundary Layers
4. The working Principles of Various Turbines like Keplon , Pelton , Francis
5. The working Principles of Pumps like Centrifugal & Reciprocating Pumps

UNIT I BASIC CONCEPTS AND PROPERTIES 6

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

UNIT II FLIUD KINEMATICS AND FLUID DYNAMICS 12

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 - flow net. 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 INCOMPRESSIBLE FLUID FLOW 12

Viscous flow - Navier-Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy -weisback's equation - pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

UNIT IV HYDRAULIC TURBINES 8

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagram's - head and specific work - components of energy transfer - degree of reaction.

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies -performance curve for turbines.

UNIT V HYDRAULIC PUMPS 7

Pumps: definition and classifications - Centrifugal pump: Classifications, working principles, velocity triangles, specific speed, efficiency and performance curves. Reciprocating pump: classification, working principles, indicator diagram, and work

saved by air vessels and performance curves - cavitations in pumps - rotary pumps, working principles of gear and vane pumps

TOTAL: 45

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

ASB205 AIRCRAFT MATERIALS L T P C
3 0 0 3

OBJECTIVES

1. To know about various types of materials and Knowledge of various types of hardness testing machines and various types of hardness numbers Linear and non-linear elastic properties- Stress and Strain Curves.
2. To know about the materials used in aircraft construction- Aluminium, Magnesium and Titanium
3. To know about the materials used in aircraft construction- Steel, Copper alloys and Super alloys.
4. To know about the adhesives and sealants used in aircraft industries.
5. To know about the non metals used in aircraft construction

OUTCOME

1. Understand the different materials used and know the various types of hardness testing machine. Knowledge of Stress-strain curves for different type of materials.
2. Knowledge about the properties of the material, the process of machining them and heat treating them.
3. Knowledge about the specification of materials, their structural applications and properties.
4. Finding out the different types of adhesives and sealant used, their advantages and the knowledge of the sandwich and honeycomb structure.
5. Knowledge about the non metals like wood, fabrics, glass, plastics and the use of composite materials.

UNIT I MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS 9

Various types of hardness testing machines and various types of hardness numbers, Linear and non-linear elastic properties - Stress and Strain Curves – Yielding and strain Hardening ,Toughness – Modulus of resilience -– Bauchinger's effect – Effect of notches – Non-destructive testing.

UNIT II MATERIALS IN AIRCRAFT CONSTRUCTION – I 9

Aluminium and its alloys: Types. Properties – Heat treatment processes – Surface treatments. Application

Magnesium and its alloys: Cast and Wrought alloys – Aircraft application, features specification, fabrication problems, Special treatments.

Titanium and its alloys: Applications, machining, forming, welding and heat treatment.

UNIT III MATERIALS IN AIRCRAFT CONSTRUCTION - II 9

Steels: Plain and low carbon steels, aircraft steel specifications, corrosion and heat resistant steels, structural applications

Maraging Steels: Properties and Applications

Copper Alloys – Monel, K Monel

Super Alloys - Introduction & Its Use

UNIT IV ADHESIVE AND SEALANTS FOR AIRCRAFT 9

Advantages of Bonded structure in airframes – Crack arresting – Weight saving – Technology of adhesive Bonding Structural adhesive materials – Test for bonding structure. Non destructive tests for bonded joint.

Sandwich structures – Honeycomb structures – Methods of construction of honeycombs

UNIT V NON METALS IN AIRCRAFT CONSTRUCTION 9

Wood and fabric in aircraft construction. Glues. Use of glass, plastics and rubber in aircraft, Introduction to composites.

Total: 45

Text Books

- Lalith Gupta, "*Aircraft General Engineering*" Himalaya Book House, Delhi 2003
- HajiraChowdhry, "*Workshop Technology* " – Vol 1 & 2 ,Nedia Promoters, Mumbai

REFERENCE

- *"Aircraft Material & Process"* , Titterton 2004
- *"Advanced Composite Materials* " ,Lalith Gupta 2006, Himalaya Book House, Delhi

SSA231 APTITUDE – I L T P C
1 0 1 1

PURPOSE:

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.

INSTRUCTIONAL OBJECTIVES

1. To guide thought process
2. Appear for placement aptitude tests confidently
3. To develop Communication skill
4. To build confidence
5. Acquire aptitude skills for employment

METHODOLOGY:

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group Activities + Individual activities
2. Collaborative learning
3. Interactive sessions
4. Ensure participation
5. Empirical learning

LOGICAL REASONING:

Number, Letter series, Analogies- Coding, Decoding – Blood relations, direct sense,

Operator based questions – Clock & Calendars

Distribution, Binary Logic and Puzzles – Arrangements, Selections.

Routes & Networks, Comparison – Cubes & Venn Diagrams.

VERBAL ABILITY:

Critical Reasoning – Antonym, Synonym
Odd man – fill in the blank
Sentence Construction / Completion – Idiomatic expression
Detection of errors.
Jumbled sentences, Vocabulary, Alphabetical sequence, cloze passage.

EVALUATION:

1. University Theory Question paper
2. Activities assessed by both group and individual participation

3. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION:

Marks allocated for regular participation in all oral activities in class.

SCHEME OF EXAMINATION:

Complete internal evaluation on regular basis.

ASB210	**STRENGTH OF MATERIALS LABORATORY**	**L T P C** **0 0 3 2**
S.No	OBJECTIVE	OUTCOME
1	To test a specimen using Brinell hardness testing machine.	The hardness of the material is found out and verified.
2	To test a specimen using Rockwell hardness testing machine.	The hardness of the material is found out and verified.
3	To perform tension test on mild steel a rod using universal testing machine.	The yield load, ultimate load of the mild steel rod is found out.
4	To perform torsion test on a mild steel rod using universal testing machine.	The ultimate torque of the mild steel rod is found out.
5	To perform impact test using Izod impact testing machine.	The impact load of the material is found out.
6	To perform impact test using Charpy impact testing machine.	The impact load of the material is found out.
7	To perform fatigue test in rotating beam using fatigue tester	The fatigue load of the rotating beam is found out.
8	To perform tension and compression test on open and closed helical spring setup.	The ultimate compressive load and tensile loads are found out.
9	To perform tension and compression test on wood using UTM .	The ultimate compressive load is found out
10.	To verify Maxwell reciprocal theorem	Maxwell reciprocal thermo is verified.

LIST OF EXPERIMENTS

- Hardness test - a)Vickers b) Brinell c) Rockwell 9
- Tension test 6
- Torsion test 6
- Impact test - a) Izod b) Charpy c) Drop Test. 6
- Fatigue test - a) Reverse plate bending 6
  b) Rotating Beam
- Testing of springs 6
- Block Compression Test 6

Total 45

LIST OF EQUIPMENTS

S.No	Details of Equipments	Qty Required	For Experiments
1	Brinell Hardness Testing Machine	1	1
2	Rockwell Hardness Testing Machine	1	1
3.	Universal Testing Machine	1	2,3,7
4.	Izod Impact Testing Machine	1	4
5.	Charpy Impact Testing Machine	1	4
6.	Fatigue tester- Rotating Beam	1	5
7.	Fatigue tester –Reverse plate bending	1	5

ASB211 FLUID MECHANICS AND MACHINERY LAB

L T P C

0 0 3 2

OBJECTIVES

The subject should enable the student to:

1. Understand the properties of the fluid and also to learn about the pressure and velocity of the flowing fluid using venturimeter, orifice meter.
2. Understand the discharge of fluid by using pump like centrifugal, reciprocating and gear pump and also to find the rate of flow using rota meter.

3. Understand the efficiency of turbine like Kaplan and francis.
4. Understand the change in pressure (friction factor) of given set of pipes.
5. Understand the efficiency of Pelton wheel.

OUTCOME

The students should be able to:

1. Determine the coefficient of discharge of orifice meter and venturimeter.
2. Conduct experiments and draw the characteristic curves of centrifugal pump, submergible pump, reciprocating pump, Gear pump and also can find the discharge of the pump.
3. Conduct experiments and draw the characteristics curves of Francis turbine and Kaplan turbine and also can find the efficiency of the turbine.
4. Conduct experiments and draw the characteristics curves of Pelton wheel.
5. Determine the friction factor of given set of pipes when there is change in pressure& Calculate the rate of flow using Rotameter

LIST OF EXPERIMENTS

• Calibration of venturimeter	3
• Pressure measurement with Pitot static tube	3
• Determination of pipe flow losses.	3
• Verification of Bernoulli's theorem	3
• Flow visualization by Heleshaw apparatus	3
• Performance test on centrifugal pumps	6
• Performance test on reciprocating pumps	6
• Performance test on Pelton wheel turbine	6
• Performance test on Francis turbine	6
• Determination of Viscosity of a Fluid	6
	Total 45

LIST OF EQUIPMENTS

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	Venturimeter setup	1	1,3
2.	Pipe friction set up	1	3
3.	Pitot tube set up	1	2,4
4.	Jet pump	1	6
5.	Submersible pump	1	6
6.	Centrifugal pump	1	6
7.	Reciprocating pump	1	7
8.	Pelton wheel turbine and Francis turbine	1	8,9
9.	Viscosity Meter	1	10
10.	Hele-shaw apparatus	1	5

ASB212 THEROMODYNAMICS LAB **L T P C**
0 0 3 2

OBJECTIVES

1. To carry out performance test on a 4 stroke region
2. To carry out valve timing of a 4 stroke engine and Port timing of a 2 stroke engine
3. To carry out test on effectiveness of a parallel flow heat exchanger
4. To carry out test on effectiveness of a counter flow heat exchanger
5. To carry out test for determination of viscosity of a given liquid
6. To carry COP test on a vapour compression refrigeration test rig.
7. To carry COP test on a vapour compression A/C test rig
8. To study about the characteristics of a Gas turbine Engine
9. To carry out experiment on evaluation of conductive Heat transfer coefficient
10. To carry out experiment on evaluation of thermal resistance of composite wall

OUTCOME

1. Understand the 4 stroke engine cycle and performance

2. Clearly understand the port timing mechanism and valve timing mechanism of stroke engine
3. To get a clear idea about effectiveness of a parallel flow heat exchanger
4. To get a clear idea about effectiveness of a counter flow heat exchanger
5. Understand the viscosity effects in a given fluid flow
6. To carry COP test on a vapour compression refrigeration test rig
7. To carry COP test on a vapour compression A/C test rig
8. Can clearly understand the performance of a Gas Turbine Engine
9. To understand importance of thermal resistance of composite wall
10. To understand importance of thermal resistance of composite wall

LIST OF EXPERIMENTS

- Performance test on a 4-stroke engine 6
- Valve timing of a 4 - stroke engine and port timing of a 2 stroke engine 6
- Determination of effectiveness of a parallel flow heat exchanger 6
- Determination of effectiveness of a counter flow heat exchanger 6
- Determination of the viscosity coefficient of a given liquid 3
- COP test on a vapour compression refrigeration test rig 3
- COP test on a vapour compression air-conditioning test rig 3
- Study of a Gas Turbine Engine. 3
- Determination of Conductive Heat Transfer Coefficient. 3
- Determination of Thermal Resistance of a Composite wall. 6

Total 45

LIST OF EQUIPMENTS

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	4 stroke twin cylinder diesel engine	1	1
2.	Cut section model of 4 stroke kirloskar diesel engine and cut section model of 2 stroke petrol engine	1	2
3.	Parallel and counter flow heat exchanger test rig	1	3,4
4.	Red wood viscometer	1	5
5.	Vapour compression refrigeration test rig	1	6

SYLLABUS FOR 4th SEMESTER

MAA202 NUMERICAL METHODS L T P C

3 1 0 4

OBJECTIVES

The course should enable the students to:

1) Learn the techniques of solving the algebraic and transcendental equations.
2) Learn to interpolate using Newton's forward and backward difference formulae for equal and unequal intervals
3) Understand the use of numerical differentiation and understands to find the approximate area using numerical integration.
4) Understand solving numerically the initial value problems for ordinary differential equations using single step and multi step method.
5) Learn the methods of solving second order partial differential equations numerically and use it to solve initial and boundary value problems for partial differential equations.

OUTCOME

The students should be able to:

1) Find out the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations by direct and indirect methods.
2) Solve problems where huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
3) Use the numerical differentiation and integration when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
4) Solve engineering problems which are characterized in the form of nonlinear ordinary differential equations, since many physical laws are couched in terms of rate of change of one independent variable
5) Solve the initial and boundary value problems related heat flow, both one and two dimensional and vibration problems. Understands the numerical techniques of solving the partial differential equation in engineering applications

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 12

Linear interpolation methods (method of false position) – Newton's method – Statement of Fixed Point Theorem - Fixed point iteration: x=g(x) method. Solution of linear algebraic system of equations – Direct methods - Gauss-Jordon method and Crout's method - Iterative method: Gauss-Seidel method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation – equal intervals – Newton's forward and backward difference formulae – problems. Interpolation-unequal intervals – Newton's divided difference formula – Lagrange's and inverse interpolation-problems.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Numerical differentiation – Newton's forward and backward difference - Divided differences and finite differences – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules. Two and Three point Gaussian quadrature formulae – Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods: Taylor series method – first order-second order and simultaneous – Euler and Modified Euler methods. Fourth order Runge – Kutta method for solving first and second order equations – Multi-step methods: Milne's and Adam's predictor and corrector methods.

UNIT V INITIAL AND BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference solution of second order ordinary differential equation – classification of partial differential equations - Finite difference solution of two dimensional heat flow equations Laplace and Poisson equations. One dimensional heat equation by explicit and implicit methods – One dimensional wave equation

TOTAL: 60

TEXT BOOKS

1. Kandasamy P, Thilagavathy K, Gunavathy K, "*Numerical Methods*", S.Chand Co. Ltd., New Delhi, 2003.
2. Chandrasekaran A. and Beena James, "*Numerical Methods*", Dhanam publications, Chennai, 2011.

REFERENCES

1. Burden R.L, and Faires T.D, "*Numerical Analysis*", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Gerald C.F, Wheatley P.O, "*Applied Numerical Analysis*", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
3. Balagurusamy E, "*Numerical Methods*", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

ASB232 PROPULSION 1 L T P C
3 1 0 4

OBJECTIVES

The course should enable the students to:

1) Know the fundamentals of gas turbines and its components
2) Know the steady one dimensional flow of perfect gas.
3) Know the different types of gas turbine engines and engine performances.
4) Study the fundamentals of rocket propulsion.
5) Study the performance of aerospace vehicles

OUTCOME

The students should be able to:

1) Understand the working principle of gas turbine engines, thermodynamic cycles and performance characteristics of gas turbine engines.
2) Understand the internal flow and external characteristics near the inlets. Starting problems and different modes of operation in supersonic inlets.
3) Understand the types and working of gas turbine engines
4) Understand the types of rocket, missiles and its basic configuration
5) Know the performance characteristics of solid, liquid and hybrid rocket

UNIT I INTRODUCTION TO AIRCRAFT PROPULSION 11

Introduction to propulsion, Basic thermodynamics, Fundamental equations, Types of aircraft engines Performance parameters, thrust equation, factors affecting thrust and efficiencies.

UNIT II STEADY ONE DIMENSIONAL FLOW 11

One dimensional flow of a perfect gas, isentropic flow, non-isentropic flow, frictionless constant area flow, constant area flow with friction, without friction, normal shock and oblique shocks

UNIT III FUNDAMENTALS OF GAS TURBINE ENGINES 13

Working principle of gas turbine engine, gas turbine cycle, and turboprop, turbofan and turbojet engines -Thrust and efficiency - Methods of thrust augmentation -- Engine Performance characteristics.

UNIT IV FUNDAMENTALS OF ROCKET PROPULSION 12

History of rocket propulsion, types of rocket, Basic configurations and application -

Types of missiles and their structure, Heat transfer and cooling system in rocket , classification of Chemical rocket propulsion system.

UNIT V PERFORMANCE OF AEROSPACE VEHICLES 13

Static performance, vehicle acceleration, performance characteristics, nozzle, solid, liquid and hybrid rocket and their propellants.

TOTAL: 60

TEXT BOOKS

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.
2. G.P Sutton & O. Biblarz, "Rocket Propulsion Elements", John Wiley & Son Inc., 2001.

REFERENCES

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.

ASB233 MECHANICS OF MACHINES L T P C
3 1 0 4

OBJECTIVE

The subject should enable the student to:

1. The Kinematic analysis of simple mechanisms and its velocity and accelerations.
2. To know the various belt and rope drives and friction in screw and nut.
3. To know the Gear and cam profile and geometry.
4. To study the Static and dynamic balancing of the various masses
5. To study the vibrations of single degree of freedom systems and Vibration isolation and absorption

OUTCOME

The students should be able to:

1. Understand the various mechanisms and its degree of freedom
2. Learn to find out the effect of centrifugal and initial tension in both drives and Condition for maximum power transmission.
3. Learn to determine the speed and torque of the various types of gear geometry and also the follower motions of cam profile.
4. Understand the concept of balancing in rotating mass and Balancing of radial V engine (reciprocating mass).
5. Understand the Free, forced and damped vibrations and its force transmitted to supports

UNIT I MECHANISMS 12

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

UNIT II FRICTION 12

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

UNIT III GEARING AND CAMS 12

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

UNIT IV BALANCING 12

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

UNIT V VIBRATION 12

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

TOTAL 60

TEXT BOOKS

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

REFERENCES

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

ASB231 AEROSPACE STRUCTURES – I L T P C
3 1 0 4

GOAL

Analysis and design simple a/c structural components

OBJECTIVES

The course should enable the student:

1. Understand various structural elements
2. Understand statically determinate and indeterminate structural analysis.
3. Understand various energy method
4. able to understand columns with various end condition.
5. To understand various failure theories

OUTCOME

The students should be able to:

1. Analysis structural elements in aircraft.
2. Solve three moment equation and moment distribution.
3. To make simplified analysis of a/c structures & apply energy methods.
4. Understand and solve the column problems
5. Apply failure theories for various loading conditions

UNIT I STATICALLY DETERMINATE STRUCTURES 12

Analysis of plane truss - Method of joints –method of sections- 3 D Truss - Plane frames

UNIT II STATICALLY INDETERMINATE STRUCTURES 12

Shear force and bending moment of fixed-fixed beam, propped cantilever beam – continuous beam - Clapeyron's Three Moment Equation - Moment Distribution Method.

UNIT III ENERGY METHODS 12

Strain Energy due to axial, bending and Torsional loads – Castigliano's theorem - Maxwell's

Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.

UNIT IV COLUMNS 12

Columns with various end conditions - Euler's Column curve –inelastic buckling - Rankine's formula - Column with initial curvature - Eccentric loading - South well plot - Beam column

UNIT V FAILURE THEORY 12

Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.

TOTAL 60

TEXT BOOK: 1. Donaldson, B.K., "*Analysis of Aircraft Structures – An Introduction*", McGraw-Hill, 1993.

REFERENCE: Timoshenko, S., "*Strength of Materials",* Vol. I and II, Princeton D. Von Nostrand Co, 1990.

ASB230 AERODYNAMICS – I L T P C

3 1 0 4

GOAL

To study aerodynamic concepts and understanding motion of air around an object enables the calculation of forces and moments acting on the object.

OBJECTIVES

The course should enable the student:

1) To understand the fluid mechanics concepts for advanced applications

2) To study two dimensional flows in aerodynamics
3) To integrate the mathematics with aerodynamics
4) To study ideal flows over wings
5) To study real time viscous flows

OUTCOME

Student should able to:

1) Should be able to apply fluid mechanics concepts
2) Should be able to model flow over wing
3) Should be able to differentiate between ideal and real flows
4) Develops mathematical modelling ability.
5) Understand the real time viscous flow and Boundary Layer behavior

UNIT I REVIEW OF BASIC FLUID MECHANICS 6

Continuity, momentum and energy equations.

UNIT II TWO DIMENSIONAL FLOWS 14

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

UNIT III CONFORMAL TRANSFORMATION 12

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

UNIT IV AIRFOIL AND WING THEORY 14

Joukowski, Karman - Trefftz, Profiles - Thin aerofoil theory and its applications. Vortex line,Horse shoe vortex, Biot and Savart law, Lifting line theory and its limitations

UNIT V VISCOUS FLOW 14

Newton's law of viscosity, Boundary Layer, Navier-Stokes equation, displacement, Momentumthickness, Flow over a flat plate, Blasins solution.

TOTAL : 60

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

SSA232 APTITUDE – IV L T P C
1 0 1 1

PURPOSE:

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.

INSTRUCTIONAL OBJECTIVES

1. To guide thought process
2. Appear for placement aptitude tests confidently
3. To develop Communication skill
4. To build confidence
5. Acquire aptitude skills for employment

METHODOLOGY:

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group Activities + Individual activities
2. Collaborative learning
3. Interactive sessions
4. Ensure participation
5. Empirical learning

QUANTITATIVE APTITUDE:

Sample Equation, Ratio, Proportion, Variation.
Percentage, Profit & Loss, Partnership.
Averages, Mixtures, Allegations: Simple & Compound Interest.
Time Work, Time Distance.
Geometry & Mensuration.
Permutation, Combination & Probability.
Data Interpretation & Data Sufficiency.

Analytical reasoning:
Non- Verbal Reasoning
Word problem

EVALUATION:

1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION:
Marks allocated for regular participation in all oral activities in class.

SCHEME OF EXAMINATION:
Complete internal evaluation on regular basis.

ASB241 CAD LAB **L T P C**
0 0 3 2

GOAL

To aid in the design, analysis, and manufacture of products

OBJECTIVES

The course should enable to

1. Understand the drawing with curves like parabola, spiral, involute
2. Understand the three view of simple solids.
3. Creation of 3D models of simple objects.
4. Understand a simple steel truss.
5. Understand the isometric projection of simple objects

OUTCOME

Student should able to

1. Draw the different curves with B spline or cubic spline method.
2. Draw the front view, side view and top view of solids.
3. Obtaining 2D and multi view drawing of 3D models.
4. Analyze the truss problems using CAD.
5. Plotting the drawings of prism, pyramid, cylinder, and cone.

List of exercises using software capable of drafting and modelling:

1. Study of capabilities of software for drafting and modelling –Co-ordinate system-Creation of simple figures like polygon and general multi line figures

2. Drawing a title block with necessary text and projection symbols

3. Drawing of curves like parabola, spiral, involute using B spline or cubic spline

4. Drawing of front view and top view of simple solids like prism, pyramid,cylinder,cone.etc

5. Drawing of front view, side view and top view of objects from the given pictorial views

6. Drawing of a plan of residential building

7. Drawing of a simple steel truss

8. Drawing sectional views of prism,pyramid,cylinder,cone.etc,

9. Drawing isometric projection of simple objects

10. Creation of 3D models of simple objects and obtaining 2D and multi view drawing of 3D models

Note: Plotting of drawings must be made for each exercise and attached to the records written by students

ASB240 AEROSPACE STRUCTURES LAB L T P C
0 0 3 1

OBJECTIVES

The course should enable the students to:

1) Determine young's modulus of steel using mechanical extensometers.
2) Determine young's modulus of steel using Electrical extensometers.
3) Find the deflection of beams at various end condition
4) Verify Maxwell's reciprocal theorem and principle of super position
5) Determine Column Testing and South - Well's plot
6) Locate Shear Centre for open and closed section.
7) Determine deflection of Unsymmetrical beams
8) Find stresses in circular discs and beams using photo elastic techniques
9) Verify vibrations of beams
10) Wagner beam - Tension field beam

OUTCOME

The students should be able to:

1) Understand the basic concepts of material and science and real experience getting to determine a young's modulus value of Aluminium.
2) Understand the difference of accuracy and precision value from both mechanical and electrical extensometer.
3) Determine the deflection of a simply supported beams and better understand of types of beams and application.
4) Verify the Maxwell's theorem using the supported beam and tested.
5) Determine the buckling load of the column in various section like fixed and hinged and understand about South Well’s theorem.
6) Determine the location of Shear Centre

7) Determine the deflection of unsymmetrical beams and better understand of types of beams and application.
8) Determine the stresses in circular discs using photo elastic techniques with various loads
9) Determine various parameters during the vibration of the beams
10) Study about the wagner beam and tension field beam.

LIST OF EXPERIMENTS

1.	Determination of Young's modulus of steel using mechanical extensometers.	6
2.	Determination of Young's modulus of aluminum using electrical extensometers	6
3.	Deflection of beams with various end conditions.	3
4.	Verification of Maxwell's Reciprocal theorem & principle of superposition	6
5.	Column - Testing and South - well's plot.	3
6.	Shear centre location for open sections and closed sections	3
7.	Unsymmetrical bending of beams	3
8.	Stresses in circular discs and beams using photo elastic techniques	3
9.	Vibrations of beams	6
10.	Wagner beam - Tension field beam	6
		TOTAL 45

LIST OF EQUIPMENTS

Sl. No.	Equipments	Qty	Experiments No.
1.	Universal Testing Machine	1	1,2,3,4,5,10
2.	Mechanical Extensometer	1	1
3.	Electrical stain gauge	10	2
4.	Stain indicator	1	2,5
5.	Dial Gauges	12	3,4
6.	Beam Test set up with various end conditions	2	6,7
7.	Weight 1 Kg	10	6,7
8.	Weight 2 Kg	10	6.7.8
9.	Weight Pans	6	6,7,8
10.	Column Test Apparatus	1	5,6.7,8
11.	Rivet	30	10

ASB242 AERODYNAMICS LAB-I **L T P C**
0 0 3 2

OBJECTIVES

The course should enable the student :

1. To study performance of subsonic wind tunnel.
2. To study experimentally the pressure distribution of circular, symmetric and unsymmetrical aerofoil
3. To know the Force measurement using wind tunnel balance
4. To study Flow visualization studies in low speed flow over airfoil with different angle of incidence
5. To study performance of supersonic wind tunnel.

OUTCOME

The students should be able to:

1. Measure the velocity of the subsonic wind tunnel at various RPM
2. Pressure distribution of various airfoils can be identified and lift can be calculated.
3. Coefficient of Lift and drag for symmetric and unsymmetrical airfoils are analysed.
4. Identify the various flows acting on the aerofoil
5. Study the Supersonic flow and characteristics of it.

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 Schifrin system.

LIST OF EQUIPMENT

Sl.	Items	Quantity	Experiment No.
1.	Wind Tunnel test section size around	1 No.	1, 2,3,4,5
2.	Wings of various airfoil sections	2 Nos. each	3, 4
3.	Angle of incidence changing mechanism	1 No.	3, 4
4.	Multiple Manometer stands with	4 Nos.	2,3,4
5.	U-Tube Manometer	1 No.	1,2,3,4
6.	Static Pressure Probes	4 Nos.	1,2,3,4
7.	Total Pressure Probes	4 Nos.	1,2,3,4
8.	Piton-Static Tubes	4 Nos.	1,2,3,4
9.	Wooden Models of Three Dimensional bodies (egg. Cylinder etc.,)	2 Nos. each	2
10.	Wind Tunnel balances	1 No.	5
11.	Pressure Transducers with digital display	1 No.	1,2,3,4
12.	Heel-Shaw apparatus, Smoke Tunnel, Water flow channel	1 each	6,7,8
13.	Supersonic Wind tunnel of test section size 100 x 100 mm with storage tank capacity of 500ft^2 at 20 bar	1 No.	9,10
14.	Wooden models of cone, wedge and blunt body configurations of suitable size for flow visualization in a	1 No.	9,10
15.	Schifrin System	1 No.	9,10

Semester V

ASB301 AERODYNAMICS - II

L T P C
3 1 0 4

GOAL

To understand the behavior of airflow both internal and external in compressible flow regime with particular emphasis on supersonic flows

OBJECTIVES

The course should enable the student to:
1) Study the basic equations of one dimensional compressible flow.
2) Study about the normal, oblique shock waves and expansion waves.
3) Study the differential equations of motion for steady compressible flow.
4) Study about the airfoils in high speed flows.
5) Study about the high speed wind tunnels.

OUTCOME

The students should be able to:
1) The energy, momentum and continuity equations.
2) The various parameters affecting the normal and oblique shock waves.
3) The various theories regarding the steady compressible flow.
4) The various parameters of airfoil in high speed flow.
5) The various methods for creating supersonic flow in wind tunnels.

UNIT I ONE DIMENSIONAL COMPRESSIBLE FLOW 10

Energy, Momentum, continuity and state equations, velocity of sound, adiabatic steady state flow equations, Flow through converging, diverging passages, Performance under various back pressures.

UNIT II NORMAL, OBLIQUE SHOCKS AND EXPANSION WAVES 18

Prandtl equation and Rankine - Hugonoit relation, Normal shock equations, Pitot static tube, corrections for subsonic and supersonic flows, Oblique shocks and corresponding equations, Hodograph and pressure turning angle, shock polars, flow past wedges and concave corners, strong, weak and detached shocks, Rayleigh and Fanno Flow. Flow past convex corners, Expansion hodograph, Reflection and interaction of shocks and expansion, waves, Families of shocks, Methods of Characteristics, Two dimensional supersonic nozzle contours.

UNIT III DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOW **12**

Small perturbation potential theory, solutions for supersonic flows, Mach waves and Mach angles, Prandtl-Glauert affine transformation relations for subsonic flows, Linearised two dimensional supersonic flow theory, Lift, drag pitching moment and center of pressure of supersonic profiles.

UNIT IV AIRFOIL IN HIGH SPEED FLOWS **9**

Lower and upper critical Mach numbers, Lift and drag divergence, shock induced separation, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule, Tip effects.

UNIT V HIGH SPEED WIND TUNNELS **11**

Blow down, indraft and induction tunnel layouts and their design features, Transonic, supersonic and hypersonic tunnels and their peculiarities, Helium and gun tunnels, Shock tubes, Optical methods of flow visualization.

TOTAL 60

TEXT BOOK

1. Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2003.

REFERENCES

1. Shapiro, A.H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronold Press, 1982.
2. Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1989.
3. McCornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, New York, 1979.
4. Anderson Jr., D., - "Modern compressible flows", McGraw-Hill Book Co., New York 1999.

ASB302 PROPULSION - II

L T P C
3 1 0 4

GOAL

To study in detail about fundamentals of aircraft propulsion, advanced propulsion systems in gas turbine engine.

OBJECTIVES

The course should enable the student to:

1) Know the design and performance of subsonic and supersonic inlets.
2) Study the axial compressors and their working principles.
3) Study the centrifugal compressors and their working principle.
4) Know the different types of combustion chambers and factors affecting the combustors.
5) Study the types of nozzles and flow conditions in nozzles.

OUTCOME

The students should be able to:

1) Understand the internal flow and external characteristics near the inlets. Starting problems and different modes of operation in supersonic inlets.
2) Know the types and working principles of axial compressors, its velocity diagrams, and blade design and performance characteristics of compressors.
3) Know about the working principles of centrifugal compressors, its velocity diagrams.
4) Understand the types and working methods in combustion chambers. The flame stabilization and flame techniques.
5) Understand the flow through nozzle, choking, losses in nozzle, variable area nozzle and thrust vectoring.

UNIT I DIFFUSER 12

Subsonic inlet and Internal flow - Major features of external flow - Relation between minimum area ratio and external deceleration ratio - Supersonic inlets - Starting problem on supersonic inlets - Shock swallowing by area variation - External deceleration - Modes of inlet operation.

UNIT II AXIAL COMPRESSOR 12

Working principle of axial compressor, Elementary theory - Velocity triangles, Degree of reaction - Three dimensional flow - Compressor blade design & stage performance calculation - Factors affecting stage pressure ratio , off design performance- Axial compressor performance characteristics.

UNIT III CENTRIFUGAL COMPRESSOR 12

Working principle of centrifugal compressor - Work done and pressure rise - Inducer and impellor - Velocity diagrams - Compressor stage design - Concept of pre-whirl -

Rotation stall -Centrifugal compressor performance characteristics.

UNIT IV COMBUSTION CHAMBERS **12**

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 V NOZZLES **12**

Theory of flow in isentropic nozzles - Convergent nozzles and nozzle choking - Nozzle throat conditions - Nozzle efficiency - Losses in nozzles - Over expanded , under - expanded nozzles , Ejector and variable area nozzles.

TOTAL 60

TEXT BOOK

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.

REFERENCES

1. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., "Gas Turbine Theory", Longman Co., ELBS Ed., 1989.
2. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988.

ASB303 AEROSPACE STRUCTURES -II

L	T	P	C
3	1	0	4

GOAL

To study the behaviour of various aerospace structural components and different types of loads.

OBJECTIVES

The course should enable the students to :

1) Understand Unsymmetrical bending
2) Understand shear centre and shear flow
3) Resistance of torque by cells

4) Understand buckling problems
5) Study Tension field beams

OUTCOME

The students should be able to:

1) Analyze for maximum bending stress in unsymmetrical sections
2) Analyze for flexural shear stress
3) Analyze for Torsional shear stress
4) Panel Buckling allowable load
5) Analyze for flange and web load

UNIT I UNSYMMETRICAL BENDING 11

Bending stresses in beams of unsymmetrical sections - Bending of symmetric sections with Skew loads.

UNIT II SHEAR FLOW IN OPEN SECTIONS 13

Thin walled beams, Concept of shear flow, shear centre, Elastic axis. With one axis of Symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT III SHEAR FLOW IN CLOSED SECTIONS 13

Bredt - Batho formula, Single and multi cell structures. Approximate methods. Shear flow in single& multi cell structures under torsion. Shear flow in single and multi-cell under bending with walls effective and ineffective.

UNIT IV BUCKLING OF PLATES 13

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

UNIT V STRESS ANALYSIS IN WING AND FUSELAGE 10

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

TOTAL 60

TEXT BOOK

1. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri - state off set company, USA, 1973.

REFERENCES

1. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2nd edition, McGraw-Hill, N.Y., 1993.
2. Megson, T.M.G., "Aircraft Structures for Engineering Students", Edward Arnold, 1995.
3. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, 1993.

ASB305 CONTROL ENGINEERING

L T P C
3 0 0 3

GOAL

To understand the basic concepts of flight control system.

OBJECTIVES

The course should enable the students to:

1) Study and solve problems on Simple pneumatic, hydraulic and thermal systems, Mechanical and electrical component analogies.
2) Study and solve problems on Block diagram representation of control systems, Reduction of block diagrams, Signal flow graph.
3) Study and solve problems on Response of systems to different inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.
4) Study and solve problems on Routh - Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.
5) Study about digital control system, Digital Controllers and Digital PID Controllers.

OUTCOME

The students should be able to know about:

1) The Simple pneumatic, hydraulic and thermal systems, Mechanical and electrical component analogies based problems.
2) The Block diagram representation of control systems, Reduction of block diagrams, Signal flow graph and problems based on it.
3) The Response of systems to different inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit and problems based on it.

4. The Routh - Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response and problems based on it.
5. The digital control system, Digital Controllers and Digital PID Controllers.

UNIT I INTRODUCTION **6**

Historical review - Simple pneumatic, hydraulic and thermal systems, Series and parallel systems, Analogies - Mechanical and electrical components, Development of flight control systems.

UNIT II OPEN AND CLOSED LOOP SYSTEMS **6**

Feedback control systems - Block diagram representation of control systems, Reduction of block diagrams, Output to input ratios, Signal flow graph.

UNIT III CHARACTERISTIC EQUATION AND FUNCTIONS **10**

Laplace transformation, Response of systems to different inputs viz., Step input, impulse, ramp, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

UNIT IV CONCEPT OF STABILITY **15**

Necessary and sufficient conditions, Routh - Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.

UNIT V SAMPLED DATA SYSTEMS **8**

Introduction to digital control system, Digital Controllers and Digital PID Controllers.

TOTAL 45

TEXT BOOKS

1. OGATO, "Modern Control Engineering", Prentice - Hall of India Pvt. Ltd. New Delhi, 1991.
2. GOPAL.M. "Control Systems, Principles and design" - Tata McGraw-Hill Publication, New Delhi, 2000.

REFERENCES

1. Azzo, J.J.D. and C.H. Houpis, "Feed back control system analysis and synthesis", McGraw - Hill International, 3rd Edition, 1998.
2. Kuo, B.C., "Automatic control systems", Prentice - Hall of India Pvt. Ltd., New Delhi, 1998.

3. Houpis, C.H. and Lamont, G.B., "Digital Control Systems", McGraw-Hill Book Co. New York, USA 1995.
4. Naresh K. Sinha, "Control Systems", New Age International Publishers, New Delhi

CYA302 ENVIRONMENTAL SCIENCE AND ENGINEERING

L T P C
3 0 0 3

OBJECTIVES

- To make the students aware of the existing natural resources such as forest water resources etc. and to educate them to understand the need for preserving the resources.
- To educate the students about the functions of various ecosystems and biodiversity.
- To provide knowledge on the various aspects of different types of pollution such as air pollution, water pollution, soil pollution etc.
- To give a basic knowledge on the social issues such as global warming, acid rain, ozone layer depletion, nuclear hazards etc. and to educate them about the various Environmental Protection Acts.
- To create an awareness among the present generation about the various aspects of human population and their effect on environment

OUTCOME

- The students would have understood the effects of over exploitation of water resources, forest resources etc. and their impact on day to day life on earth.
- Knowledge on the functions of several of ecosystems will help the students to design the processes that are ecofriendly.
- Knowledge on the different types of pollution will help the young minds to device Exposure on the issues such as global warming, acid rain, ozone layer depletion, and nuclear hazards will make the students understand the significances of sustainable development and the need to enforce Environmental Acts.

  Effective control measures to reduce rate of pollution.
- Educating on the various aspects of population explosion will create awareness on population control for effective utilization of the resources and the need to explore new alternate energy resources for a healthy environment.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – bio geographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Field study of common plants, insects, and birds- Field study of simple ecosystems – pond, river, and hill slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION 8

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Field Study of local polluted site – Urban / Rural / Industrial / Agricultural

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.

TOTAL: 45

TEXT BOOKS

1. Gilbert McMasters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co., 1971.
3. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, 1999.

4. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications, 1998.

REFERENCES

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India, 2004.
2. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
4. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelph

ASB311 PROPULSION LAB - I

L T P C
0 0 3 1

GOAL

To understand concepts of aircraft propulsion and carry out experiments

OBJECTIVES

The course should enable the students to:

1) Study aircraft piston engine, and the assembly of sub systems
2) Understand aircraft piston engine's components, functions, operating principles
3) Study aircraft jet engine, and the assembly of sub systems
4) Understand aircraft jet engine's components, functions, operating principles
5) Study about forced Convective Heat transfer
6) Study about free Convective heat transfer

OUTCOME

The students should be able to:

1) Knowledge about the various systems of aircraft piston engine and show the systems on the engines available in the Lab
2) Learn about the working cycle of the aircraft piston engine and description of various components and its functions.
3) Gain knowledge about systems that form a jet engine by showing the systems on the engines that are available in the Aero Hangar

4) Learn about the working cycle of the aircraft jet engine and description of various components and its functions by visually them on the engines available in the Aero Hangar.

5) Understanding the concept of forced convective heat transfer and perform experiment on the heat transfer apparatus

6) Understanding the concept of free convection heat transfer and perform experiment on the heat transfer apparatus

LIST OF EXPERIMENTS

1. Study of an aircraft piston engine - assembly of sub systems 6
2. Study of an aircraft piston engine - various components, their functions and operating principles 9
3. Study of an aircraft jet engine - assembly of sub systems, 6
4. Study of an aircraft jet engine - various components, their functions and operating principles 9
5. Study of forced convective heat transfer. 6
6. Study of free convective heat transfer. 9

TOTAL : 45

LIST OF EQUIPMENTS

Sloe	**Equipments**	**Qty**	**Experiments No.**
1	Piston engines	2	1,2
2	Jet Engine /Engine model	1	3,4
3	Forced Convective apparatus	1	5
4	Free Convective apparatus	1	6

ASB312 AERODYNAMICS LAB - II

L T P C
0 0 3 1

GOAL

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

OBJECTIVES

The course should enable the students to:

1) A flat plate at different angles of incidence
2) Flow visualization over cylinder at low speeds.
3) Flow visualization over an airfoil at low speeds with various angle of incidence.
4) Calibration of supersonic wind tunnel
5) Supersonic flow visualization with Schlieren method
6) Flow visualization over a missile body.
7) Boundary Layer Calculation.

OUTCOME

The students should be able to:

1) Flow over the flat plate at low speed.
2) Flow patterns on the cylinder.
3) Flow patterns on the airfoil with various angle of attack.
4) The methods involved in calibrating the supersonic wind tunnel.
5) The Schliren method of flow visualisation
6) Flow patterns on a missile body.
7) The method for calculating the boundary layer.

LIST OF EXPERIMENTS

1.	Flow over a flat plate at different angles of incidence	6
2	Flow visualization studies in low speed flows over cylinders	6
3.	Flow visualization studies in low speed flows over airfoil with different angle of incidence	6
4.	Calibration of supersonic wind tunnel.	6
5.	Supersonic flow visualization with Schlieren system.	9
6.	Flow visualization over missile body.	6
7.	Boundary Layer Calculation.	6

TOTAL : 45

LIST OF EQUIPMENT

Sl.No	Equipments	Qty	Experiments No.
1.	Pressure Transducers with digital display	1 No.	1,2,3,4
2.	Hele-Shaw apparatus, Smoke Tunnel, Water flow channel	1 each	1,2,3
3.	Supersonic Wind tunnel of test section size 100 x 100 mm with storage tank capacity of 500 ft 2 at 20 bar	1 No.	4,5
4.	Wooden models of cone, wedge and blunt body configurations of suitable size for flow visualization in a supersonic wind tunnel test section	1 No.	4,5
5.	Schlieren System	1 No.	4,5

Semester VI

ASB341 PROPULSION – III

L T P C
3 1 0 4

GOAL

To study in detail about fundamentals of rocket propulsion, chemical rockets, advanced propulsion systems.

OBJECTIVES

The course should enable the student:

1) To study the basics of ramjet with their performance characteristics
2) To study the solid rocket propellant and their working principles
3) To study about liquid rocket propellants and their components
4) To study the advances in rocket propulsion and space propulsion
5) To study the basics of scramjet with their performance characteristics

OUTCOME

The student should be able to know about:

1) The operating principle of ramjet, combustion and its performance.
2) The solid rocket operating principles and components of solid rocket motor.
3) In detail about liquid propellant rockets and the various types of propellants used with their burning rates.
4) About electric, ion and nuclear rockets. The basics of solar sails and its operating principle.

UNIT I RAMJET PROPULSION 13

Operating principle - Sub critical, critical and supercritical operation - Combustion in ramjet engine - Ramjet performance - Sample ramjet design calculations - Introduction to scramjet - supersonic combustion - Numerical problems.

UNIT II SOLID PROPELLANT ROCKETS 13

Solid propellant rockets - Selection criteria of solid propellants, hazards - Important hardware components of solid rockets - Propellant grain design considerations, combustion of solid propellants, Numerical problems.

UNIT III LIQUID PROPELLANT ROCKETS 13

Liquid propellant rockets - Selection of liquid propellants - Thrust control in liquid rockets - Cooling in liquid rockets - Limitations of hybrid rockets - Relative advantages of liquid rockets over solid rockets-Numerical Problems.

UNIT IV ADVANCED PROPULSION TECHNIQUES 9

Electric rocket propulsion -Electrostatic , Electro thermal ,Electromagnetic thruster , Ion propulsion techniques - Nuclear rocket propulsion - Types , applications - Solar propulsion system, solar sail.

UNIT V SCRAMJET PROPULSION 12

Fundamentals of hypersonic air birthing vehicles, Preliminary concepts in engine airframe integration, various types of supersonic combustors, Requirements for supersonic combustors, Performance estimation of supersonic combustors.

TOTAL 60

TEXT BOOKS

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edition, 1993.
2. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.

REFERENCES

1. Gorden, C.V., "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1989.
2. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988. Basics of scramjet engine and integral ram engine.

ASB342 FLIGHT MECHANICS-I

L T P C
3 1 0 4

GOAL

To study the aircraft properties and performances and to learn the drag characteristics of the airplane.

OBJECTIVES

The course should enable the student to:

1) Study about the various characteristics of aircraft.
2) Understand drag force acting on an airplane, and variations due to velocity and altitude.
3) Study about the various types of power plant and its characteristics.
4) Understand elements of airplane performance.
5) Understand the basics of helicopter mechanics

OUTCOME

The students should be able to:

1) Understand the airplane as a dynamic system, equilibrium conditions.
2) The different types of drag and drag polar.
3) Understand the variation of thrust, power, SFC with velocity and altitude.
4) Understanding about performance in level flight, minimum drag and power required, climbing, gliding and turning flight, VN diagram and load factor.
5) Understand the principles and mechanics behind the Helicopter flight.

UNIT I AIRCRAFT PROPERTIES 12

The airplane as a rigid body, the airplane as a dynamic system, Equilibrium conditions, Static stability conditions, Airplane dynamics, Airplane control .Aerodynamic properties of wing and its components.

UNIT II DRAG ESTIMATION 12

Drag aerodynamics - Dimensional Analysis, Potential flow, induced drag, Flow of viscous fluid, parasite drag, and flow of a compressible fluid. Aerodynamic data - section characteristics, plan form characteristics, high lift and control devices, Determination of three dimensional wing data. Estimation of airplane drag, low speed drag estimation, high speed drag estimation.

UNIT III PROPULSION 12

Power plant type & efficiency, power plant data, reciprocating engine cooling drag, propeller charts.

UNIT IV AIRPLANE PERFORMANCE 12

Performance computation, generalized performance method, compressibility speed

correction, Range and Endurance, Take - off and landing distances, acceleration in climb, turning performance, design performance.

UNIT V HELICOPTER ROTOR AERODYNAMICS AND PERFORMANCE **12**

Introduction, effect of gyroscopic precession, Torque reaction and directional control, dissymmetry of lift, Blade tip stall , Translating tendency and its correction, coriolis effect and compensation, vortex ring state, power settling, over pitching, Auto-rotation, Ground effect.

TOTAL 60

TEXT BOOKS

1. Perkins, C.D., and Hage, R.E., "Airplane Performance Stability and Control", John Wiley &soInc., New York, 1988.
2. Leishman, J.G., "Principle of Helicopter Aerodynamics", Cambridge Aerospace.

REFERENCES

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
3. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
4. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998

ASB351 PROPULSION LAB - II

L T P C
0 0 3 1

GOAL

To understand the basic concepts and carryout experiments in Aerospace Propulsion.

OBJECTIVES

The course should enable the students to:

1) Cascade testing of a model of axial compressor blade row.
2) Study of performance of propeller.
3) Determination of heat of combustion of aviation fuel using bomb calorimeter.

4) Combustion performance studies in a jet engine combustion chamber.

5) Study of free jet.

6) Study of wall jet.

OUTCOME

The students should be able to perform:

1) The techniques and methods used in cascade testing of axial compressor.

2) The performance of propeller and the parameters of propellers.

3) The methods used for finding the heat combustion value of ATF.

4) The methods used for evaluating combustion performance of combustion chamber in jet engine.

5) The methods used for determining the velocity in free jet.

6) The methods used for determining the velocity in wall jet

LIST OF EXPERIMENTS

1.	Cascade testing of a model of axial compressor blade row.	9
2.	Study of performance of a propeller.	6
3.	Determination of heat of combustion of aviation fuel.	9
4.	Combustion performance studies in a jet engine combustion chamber.	9
5.	Study of free jet.	6
6.	Study of wall jet	6

TOTAL 45

LIST OF EQUIPMENTS

(For a batch of 30 students)

Sl.No	Equipments	Qty	Experiments No.
1.	Axial compressor blade row model with pressure tapping	1	1
2.	water tube manometers (20 tubes)	2	1,5,6
3.	Subsonic wind tunnel	1	2
4.	Propeller model static and total pressure probes	4	2,5,6
5.	2-D travers in mechanism	2	1
6.	Free jet test setup	1	5
7.	Aluminium plates with deflection mechanisms	1	6

ASB352 AERODYNAMICS DESIGN LABORATORY

L T P C
0 0 3 1

GOAL

To study and design of model and measurement of Turbulence and Boundary.

OBJECTIVES

The course should enable the students to:

1) Calibration Technique
2) Modelling and scaling
3) Design of a model
4) Flow visualisation
5) Boundary layer & Turbulences

OUTCOME

The students should be able to :

1) Different techniques used in Wind tunnel
2) Parameters related to modelling
3) Steps involved in design
4) Understanding of flows
5) Effect of Boundary and turbulences

LIST OF EXPERIMENTS

1.	Simulation of Wind tunnel and calibration	6
2.	Oil flow visualisation technique	9
3.	Modelling and scaling	9
4.	Design of a model and verification of pressure distribution	6
5.	Boundary layer measurement	9
6.	Turbulence effect measurement	6

TOTAL 45

LIST OF EQUIPMENT

Sl.No.	Items	Quantity	Experiment No.
1.	Wind Tunnel test section size around 300 x 300 mm with test section flow speed		

	of 70 m/s.	1 No.	1, 2,3,4,5
2.	Angle of incidence changing mechanism	1 No.	3, 4
3.	Multiple Manometer stands with 20 - 30 manometer tubes	4 Nos.	2,3,4
4.	U-Tube Manometer	1 No.	1,2,3,4
5.	Static Pressure Probes	4 Nos.	1,2,3,4
6.	Total Pressure Probes	4 Nos.	1,2,3,4
7.	Pitot-Static Tubes	4 Nos.	1,2,3,4
8.	Wooden Models of Three Dimensional bodies (eg. Cylinder etc.,)	2 Nos. each	2
9.	Wind Tunnel balances (3 or 5 or 6 components)	1 No.	5
10.	Pressure Transducers with digital display	1 No.	1,2,3,4

Communication Skills & Personality Development (Lab)

SYLLABUS ELA331

(Common to all Undergraduate Third-year Branches)

SEMESTER VI – 2015-2016

L T P C

0 0 2 1

UNIT – I **9**

Listening and typing – Listening and sequencing of sentences – Filling in the blanks – Listening and answering the questions - Filling in the blanks - Cloze Exercises – Vocabulary building – Reading and answering questions.

UNIT – II **9**

Phonetics: Intonation – Ear Training – Correct Pronunciation – Sound recognition exercises -Common Errors in English - Conversations: Face to Face Conversation - Telephone conversation –Role play activities (Students take on roles and engage in conversation)

UNIT – III **9**

Resume / Report presentation / Letter writing - Structuring the resume / report – Letter writing / E-mail communication Samples, Presentation Skills - Elements of an effective presentation – Structure of a presentation – Presentation tools – Voice Modulation – Audience analysis – Body Language – Video Samples

UNIT – IV **9**

Soft Skills - Time Management – Articulativeness – Psychometrics – Innovation and Creativity – Stress Management & Poise – Video Samples, Group Discussion - Why is GD part of selection process? – Structure of a GD – Moderator – led and other GDs – Strategies in GD – Team work – Body Language – Mock GD – Video Samples

UNIT – V **9**

Interview Skills - Kinds of Interviews – Required key Skills – Corporate culture – Mock Interviews – Video Samples

References:

Books:

1. Meenakshi Raman and Sangeetha Sharma: Technical Communication – Principles and Practice, Oxford University Press, New Delhi (2004)
2. Barker. A –Improve your communication Skills – Kogan Page India Pvt. Ltd., New Delhi (2006)
3. John Seely, The Oxford Guide to writing and speaking. Oxford University Press, New Delhi (2004).
4. M. Ashraf Rizan: Effective technical communication, Tat Mcgraw Hill company Ltd (2005)

CD's

1. Communication skills Software by Globarena
2. Train2success series: 1. Telephone Skills, 2. Interview Skills, 3. Negotiation Skills by Zenith Global Consultants Ltd, Mumbai
3. 21 Steps to Personality Development by SP software (P) Ltd, Hyderabad.

Mode of Examination: **Online examination, Group Discussion and Presentation**

Semester – VII

ASB401 FLIGHT MECHANICS II

L	T	P	C
3	0	0	3

GOAL

To understand the performance of an aircraft in various operating conditions, and static, dynamic response for different disturbances

OBJECTIVES

The course should enable the students to:

1) Understand static longitudinal stability of an aircraft(stick fixed)
2) Understand static longitudinal stability of an aircraft(stick free condition)
3) Understand lateral and directional stability
4) Understand dynamic stability of an aircraft
5) Understand the helicopter flight dynamics

OUTCOME

The students should be able to get:

1) Knowledge about degrees of stability stability, stability criteria, effect of fuselage and CG location, stick forces, aerodynamic balancing. (stick fixed)
2) Knowledge about degrees of stability stability, stability criteria, effect of fuselage and CG location, stick forces, aerodynamic balancing. (stick free condition)
3) Understanding about lateral control, rolling and yawing moments, static directional stability, rudder and aileron control requirements and rudder lock
4) Understanding about dynamic longitudinal stability, stability derivatives, modes and stability criterion, lateral and directional dynamic stability
5) Understanding the rotor function in vertical flight, rotor mechanism

UNIT I STATIC LONGITUDINAL STABILITY AND CONTROL (Stick Fixed) 13

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.

UNIT II STATIC LONGITUDINAL STABILITY AND CONTROL (Stick Free) 13

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 and maneuver points from flight test.

UNIT III LATERAL AND DIRECTIONAL STABILITY 11

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 IV DYNAMIC STABILITY 13

Dynamic longitudinal stability: 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, divergence, Dutch roll, auto rotation and spin.

UNIT V HELICOPTER FLIGHT DYNAMICS 10

Rotor function in vertical flight, Rotor Mechanism for forward flight, Trim, Stability and control.

TOTAL 60

TEXT BOOKS

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son: Inc, New York, 1988.
2. J.Seddon, "Basic Helicopter Aerodynamics", AIAA Series, 1990.

REFERENCES

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
3. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
4. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998.

ASB402 ROCKET AND MISSILES

L T P C
3 0 0 3

GOAL

To introduce basic concepts of design and trajectory estimation of rocket and missiles, to study the performance of rocket and missiles under various operating conditions and the fundamentals of design concepts.

OBJECTIVES

The course should enable the student to:

1) Know the various system of rocket, its functions and operations.
2) Know the working principle and System in rockets.
3) Understand the Aerodynamics of Rockets, Missiles and Airframe Components.
4) Study the Rocket Motion in Free Space and Gravitational Field.
5) Determination of range and Altitude Simple Approximations to Burnout Velocity.
6) Know the Staging and Control of Rockets and Missiles.
7) Selection of Materials for Rockets and Missiles.

OUTCOME

The students should able to:

1) Design Consideration of liquid Rocket Combustion Chamber.
2) Igniter Design Considerations and types of igniters.
3) Describe the drag and lift forces acting on rocket and missile.
4) Describing Aerodynamic Forces and Moments. Lateral Damping Moment and Longitudinal Moment of a Rocket.
5. Explain the One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields.
6. Explain the description of Vertical and Inclined and Gravity Turn Trajectories. It will give the various methods of thrust determinations and thrust vector control. It will also describe the rocket s Separation Techniques.
7. Understanding of selection criteria for materials and Special Requirements of Materials to Perform under Adverse Conditions.

UNIT I ROCKETS SYSTEM 10

Ignition System in rockets - types of Igniters - Igniter Design Considerations - Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines,

Valves, Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems - Propellant Slosh and Propellant Hammer - Elimination of Geysering Effect in Missiles - Combustion System of Solid Rockets.

UNIT II AERODYNAMICS OF ROCKETS AND MISSILES 13

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

UNIT III ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD 10

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

UNIT IV STAGING AND CONTROL OF ROCKETS AND MISSILES 7

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

UNIT V MATERIALS FOR ROCKETS AND MISSILES 5

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

TOTAL 45

TEXT BOOK

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

REFERENCES

1. Mathur, M., and Sharma, R.P., " Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1991.
2. Cornelisse, J.W., " Rocket Propulsion and Space Dynamics", J.W., Freeman & Co. Ltd., London, 1912.
3. Parket, E.R., " Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1912.

ASB403 INTRODUCTION TO COMPOSITE MATERIALS AND STRUCTURES

L T P C
3 0 0 3

GOAL

Analysis and design of composite structures using moulding methods of construction, fabrication to evaluate and understand the concept of laminated plates.

OBJECTIVES

The course should enable the student to:

1) Know the types of composites
2) Understand the need for stress strain relation
3) Understand the fabrication methods
4) Understand the laminated plates
5) Study and understand the different methods & analysis of composite materials.

OUTCOME

The students should be able to:

1) Analysis of composite structures
2) Should do microscopic and macroscopic analysis
3) Should analyze sandwich and laminated plates
4) Should be aware of fabrication techniques
5) Should be able to construct and analysis different composite technique.

UNIT I STRESS STRAIN RELATION 9

Introduction- Advantages and application of composite materials, reinforcements and matrices - Generalized Hooke's Law - Elastic constants for anisotropic, orthotropic and isotropic materials.

UNIT II METHODS OF ANALYSIS 15

Micro mechanics - Mechanics of materials approach, elasticity approach to determine material properties - Macro Mechanics - Stress-strain relations with respect to natural axis, arbitrary axis - Determination of material properties. Experimental characterization of lamina.

UNIT III LAMINATED PLATES **15**

Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.

UNIT IV SANDWICH CONSTRUCTIONS **11**

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

UNIT V FABRICATION PROCESS **10**

Various Open and closed mould processes. Manufacture of fibers - Types of resins and properties and applications - Netting analysis.

TOTAL 60

TEXT BOOKS

1. Calcote, L R. "The Analysis of laminated Composite Structures", Von - Noastrand Reinhold Company, New York 1991.
2. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 1915.

REFERENCES

1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.
2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1919.

ASB411 STRUCTURAL DESIGN LABORATORY

L T P C
0 0 3 1

GOAL

To understand the structural behaviour of advanced material systems.

OBJECTIVES

The course should enable the students to:

1) Fabrication of Composite plate
2) Measurement of Volume fraction

3) Testing of Composite Plate (buckling test)

4) Identification of Mechanical properties (Tensile test).

OUTCOME

The students should be able to:

1) Method of fabricating composites.

2) Method of measuring volume fraction of composites.

3) Method of performing buckling test in composite plate.

4) Method of performing tensile test in composite plate to get the mechanical properties.

LIST OF EXPERIMENTS

1.	Fabrication of Composite plate	12
2.	Measurement of Volume fraction	12
3.	Testing of Composite Plate (buckling test)	9
4.	Identification of Mechanical properties (Tensile test)	12

TOTAL 45

LIST OF EQUIPMENT

Sl.No.	Items	Quantity	Experiment No.
1.	Universal Testing Machine	1	1,2,3,4
2.	Oven	1	1,2,3,4
3.	Fabrication Setup	1 set	1,2,3,4

ASB412 SPACE PROPULSION LABORATORY

L T P C
0 0 3 1

GOAL

To understand the advanced space propulsion system.

OBJECTIVES

The course should enable the students to :

1. Preparation of propellant for rockets.
2. Identifying the burning rate of the propellant.

3. Finding the calorific value of the propellant.
4. Ignition delay measurement on rocket engine.
5. Study about water jet.
6. Testing of hybrid motor.

OUTCOME

The students should be able to:

1. Method of preparing the propellants.
2. Method of identifying the burning rate of the propellant.
3. Method of finding the calorific value of the propellant.
4. Method of finding the ignition delay in rocket.
5. The principle of water jet and measuring the velocity.
6. Testing the hybrid motor.

LIST OF EXPERIMENTS

1.	Preparation of propellant	9
2.	Identification of burning rate	6
3.	Calorific value estimation	6
4.	Ignition Delay Measurement	9
5.	Water jet study	6
6.	Hybrid motor testing	9
		TOTAL 45

LIST OF EQUIPMENT

Sl.No.	Items	Quantity	Experiment No.
1.	Flash Point / Fire Point Apparatus	1	2
2.	Bomb Caloriemeter	1	3
3.	Free / Force Convection Apparatus	1	5
4.	Wall Jet	1	5

ENGINEERING ELECTIVE COURSES

Engineering Elective Courses (Semester III)

ASD221 AIRCRAFT DESIGN	L T P C
	3 0 0 3

GOAL

Computer Integrated Manufacturing aims in portraying the flexible manufacturing system and the ability of user to interact with the system to increase the production by software interfacing.

OBJECTIVES

The course should enable the students to :

1. Understand the basic types and configurations of aircraft layouts,Maneouvering loads on tail planes
2. Know the different types of power plants and characteristics of propeller and its configurations
3. Know the basic manoeuvres such as gliding flight and calculations of takeoff and landing
4. Know the layout of special designs and specifications of aircraft
5. Understand the structural design of fuselage, wing and other aircraft parts.

OUTCOME

The students should be able to:

1) Understand the basic configurations of aircraft layouts and balancing loads effects on aircraft
2) Identify the power plant and the procedures for the propeller configuration
3) Solve the calculations of take offend landing, gliding and manoeuvring flight
4) Be clear in design of new prototype of aircrafts and able to present new layout or plan
5) Understand the various designs of wing, fuselage, U/C and other aircraft parts with good knowledge about the aircraft materials.

UNIT I REVIEW OF DEVELOPMENTS IN AVIATION 12

Categories and types of aircraft specifications - various configurations - Layouts and their relative merits - strength, stiffness, fail safe and fatigue requirements.

UNIT II POWER PLANT TYPES AND CHARACTERISTICS 12

Characteristics of different types of power plants - Propeller selection - Relative merits and effect on stability based on location of power plant.

UNIT III PRELIMINARY DESIGN **12**

Drag estimation, Weight estimation of complete aircraft - Level flight, climb, take - off and landing calculations - range and endurance - control requirements.

UNIT IV SPECIAL PROBLEMS **12**

Layout peculiarities of subsonic and supersonic aircraft – changes in wing and fuselage design for supersonic aircraft – transonic and supersonic airfoils

UNIT V STRUCTURAL DESIGN **12**

Structural design of fuselage, wings and undercarriages and joints. Materials for modern aircraft - Methods of analysis, testing.

TOTAL: 60

REFERENCES

- G. Corning, "Supersonic & Subsonic Airplane Design", II Edition, Edwards Brothers Inc., Michigan, 1953.
- E.F. Bruhn, "Analysis and Design of Flight Vehicle Structures", Tristate Offset Co., U.S.A., 1980.

ASD220 ELEMENTS OF AVIONICS L T P C

3 0 0 3

OBJECTIVE

The course should enable the students to:

1. Study about the need for Avionics in civil & military aircraft & space systems.
2. Study about the principles of digital systems
3. Study about some of the digital avionics architecture
4. Study about the flight deck & cockpit instruments.
5. Study about avionics systems like communication system and navigation systems.

OUTCOMES

The student should be able to:

1. Understand the avionic system in weapons and technologies are studied.
2. Understand the digital computers, microprocessor and memories are studied.
3. Understand the avionics system architecture like data bus MIL STD 1552, B ARNIC 429 are studied.

4. Understand the control and display technologies like CRT, LED, LCD, EL & plasma panel are studied.

5. Understand the communication system, flight control system and radar electronic warfare.

UNIT I INTRODUCTION TO AVIONICS 6

Need for Avionics in civil and military aircraft and space systems - Integrated Avionics and Weapon system - Typical avionics sub systems - Design and Technologies.

UNIT II PRINCIPLES OF DIGITAL SYSTEMS 10

Digital Computers - Microprocessors - Memories

UNIT III DIGITAL AVIONICS ARCHITECTURE 6

Avionics system architecture-Data buses MIL-STD 1553 - B, ARINC 429, and ARINC 629.

UNIT IV FLIGHT DECK AND COCKPITS 8

Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) - Civil cockpit and military cockpit: MFDS, HUD, MFK, HOTAS

UNIT V INTRODUCTION TO AVIONICS SYSTEMS 15

Communication Systems - Navigation systems - Flight control systems - Radar electronic warfare - Utility systems Reliability and maintainability - Certification.

TOTAL: 45

TEXT BOOKS

- Malcrno A.P. and Leach, D.P., "Digital Principles and Application", Tata McGraw-Hill, 1990.
- Gaonkar, R.S., "Microprocessors Architecture - Programming and Application", Wiley and Sons Ltd., New Delhi, 1990.

REFERENCES

1. Middleton, D.H., Ed., "Avionics Systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1919.
2. Spitzer, C.R., "Digital Avionic Systems", Prentice Hall, Englewood Cliffs, N.J., USA., 1917

Engineering Elective Courses (Semester IV)

ASD251 AIRCRAFT MAINTENANCE PRACTICES **L T P C**
3 0 0 3

OBJECTIVE

The course should enable the students to:

6) Know the various maintenance practices made in an aircraft.
7) Study about the various devices, tools and drawings of components.
8) Study about the various aircraft materials and corrosion types.
9) Study about the various NDT methods, welding, soldering and brazing.
10) Study about the electric cables, connectors, hoses and cables

OUTCOME

The students should be able to:

1) The maintenance practices, tools and wrenches.
2) The tools used and drawings and diagrams of nuts and bearings.
3) The various materials and corrosion control and protection.
4) The NDT methods, welding, soldering and brazing
5) The electric cables, connectors, instruments, testing equipment's and calibration methods

.

Unit I Aircraft Maintenance Practice

Standard Maintenance Practices - Aircraft Maintenance Practices - General Purpose Tools - Measuring Tools - Torque Wrenches and Torque Loading Practice

UNIT II TOOLS **7**

Aircraft Fastening Devices - Bolts and Screws, Nuts and Washers, Locking Devices and springs, Engineering Drawings and Diagrams, Bearings and Gears,

UNIT III AIRCRAFT MATERIALS **11**

Aircraft Materials - Ferrous, Non-Ferrous and Composite/Non-Metallic. Corrosion and Corrosion Control and Protection

UNIT IV NON-DESTRUCTIVE TESTING (NDT) AND WELDING 11

Penetrant Methods, Non-Destructive Testing Processes. Soldering, Welding and Brazing

UNIT V AIRCRAFT MISCELLANOUS **7**

Electrical Cables and Connectors, Usage of Electrical Instruments and Equipment, Testing and Calibration Methods, Pipes, Hoses and Control Cables, Aircraft Weight and Balance Control, Quality System and Procedures.

TOTAL 45

REFERENCES:

1. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic)
2. Airframe &Power plant Mechanics (General Handbook EA-AC 65-9A)
3. James Anderson Earl E. Tatro , "Shop Theory"
4. Dale Crane, "Training Manual General Section Book 1 thru 7"
5. Titterton , "Aircraft Materials & Processes"
6. AC Parkinsons, "Machine Drawing"
7. Cindy Foreman, "Advanced Composites (EA-358)"
8. Malvino and Leech , "Digital Fundamentals"
9. Standard Aviation Maintenance Handbook EA-282-0
10. Larry Reithmaier , "Standard Aircraft Handbook (5th Edition)"

ASD252 INTRODUCTION TO NDT **L T P C**

3 0 0 3

OBJECTIVE

The course should enable the students to:

1. Study the basics of NDT, its history and applications.
2. Study the process of various visual testing techniques used in NDT.
3. Study the process of radiographic testing and its applications.
4. Study the process of ultrasonic testing and its applications.
5. Study the other methods used in NDT techniques.

OUTCOME

The student should be able to:

1. Understand the background of NDT & its applications.
2. Understand the different methods of visual testing & their advantages.
3. Understand the technique of radiographic testing and its equipments.
4. Understand the technique of ultrasonic testing & its equipments.

5. Understand other different method used in NDT.

UNIT I INTRODUCTION 8

Introduction to NDT, concern in NDT, History, NDT vs. Destructive, Conditions for NDT, Personal Considerations, Certification, Primary production of metal, castings, cracks, welding discontinuities, corrosion induced discontinuities, fatigue cracking, creep, brittle fracture, geometric discontinues.

UNIT II VISUAL TESTING 10

History and Development, Theory and Principles, Equipment and Accessories, Applications and Techniques, Evaluation of Test Results, Advantages and Limitations, Penetrate Testing- Introduction, History and Development, Theory and Principles, Penetrate Equipment and Materials, Penetrant Procedures, Techniques and Variables, Evaluation and Disposition, Penetrate Testing Applications, Quality Control Considerations, Advantages and Limitations, Glossary of Penetrate Testing Terms, Magnetic Particle Testing - History and Development, Theory and Principles, Equipment and Accessories, Techniques, Variables, Evaluation of Test Results and Reporting, Applications, Advantages and Limitations.

UNIT III RADIOGRAPHIC TEST 10

History and Development, Theory and Principles, Radiographic Equipment and Accessories, Variables, Techniques and Procedures, Radiographic Evaluation, Applications, Advantages and Limitations of Radiography, Compendium of Radiography

UNIT IV ULTRASONIC TESTING 10

History, Theory and Principles, Equipment for Ultrasonic Applications, Techniques, Variables, Evaluation of Test Results, Applications, Advantages and Limitations, Eddy Current Testing- History and Development, Theory and Principles, Alternating Current Principles, Eddy Currents, Test Equipment, Eddy Current Applications and Signal Display, Advantages and Limitations, Other Electromagnetic Test Techniques

UNIT V OTHER METHODS 7

Thermal Infrared Testing - History and Development, Theory and Principles, Equipment and Accessories, Techniques, Variables, Data Storage, Applications, Advantages and Limitations, Acoustic Emission Testing - History and Development, Principles of Acoustic Emission Testing, Advantages and Limitations of Acoustic Emission Testing.

TOTAL 45

TEXT BOOK:

- P. E. Mix, "Introduction to non-destructive testing", Wiley Inter science,, John Wiley & Sons, Inc, Publ., 2005

REFERENCE:

C. Hellier, "Handbook of Non-destructive Evaluation", McGraw-Hill, 1994.

Engineering Elective Courses (Semester V)

ASD321 EXPERIMENTAL STRESS ANALYSIS

L T P C
3 0 0 3

GOAL

To determines the stress and strain in materials and structures subjected to static or dynamic forces or loads.

OBJECTIVES

The course should enable the students to:

1. Understand instrumentation concepts
2. Understand optics and its application to photo elasticity
3. Understand strain gauges and their applications
4. Understand significance of NDT Methods.
5. Understand the Concept of two dimensional photo elasticity.

OUTCOME

The students should be able to:

1. Analyze instruments for measurements
2. Awareness of NDT methods
3. Use strain gauge effectively
4. Analyze photo elastic results
5. Estimate the Interpretation of fringe pattern

UNITI MEASUREMENTS **4**

Principles of measurements, Accuracy, Sensitivity and range of measurements.

UNITII EXTENSOMETERS **6**

Mechanical, Optical, Acoustical and Electrical extensometers and their uses.

Advantages and disadvantages.

UNIT III ELECTRICAL RESISTANCE STRAIN GAUGES 10

Principle of operation and requirements of electrical strain gauges. Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis. Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT IV PHOTOELASTICITY 10

Two dimensional photo elasticity, Concept of light - photo elastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

UNIT V NON - DESTRUCTIVE TESTING 15

Fundamentals of NDT. Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Introduction to Moiré techniques, Holography, ultrasonic C- Scan, Thermograph, Fiber - optic Sensors.

TOTAL: 45

TEXT BOOK

1. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., "Experimental Stress Analysis", Tata McGraw-Hill, New Delhi, 1914.

REFERENCES

1. Dally, J.W., and Riley, W.F., "Experimental Stress Analysis", McGraw-Hill Inc., New York, 1991.
2. Hetyenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1972.
3. Pollock A.A., "Acoustic Emission in Acoustics and Vibration Progress", Ed. Stephens R.W.B., Chapman and Hall, 1993.

ASD322 COMPUTER INTEGRATED MANUFACTURING

L T P C
3 0 0 3

GOAL

Computer Integrated Manufacturing aims in portraying the flexible manufacturing system and the ability of user to interact with the system to increase the production by

software interfacing.

OBJECTIVE

The course should enable the students to:

1. Understand the basic components of CIM,product planning and production management
2. Know the application of Group technology and CAD/CAM,CAPP process
3. Know the Shop floor control and SIM architecture
4. Know the application of CMS in data communication systems
5. Understand the open system databases for CIM industry.

OUTCOME

The students should be able to:

5) Able to understand the CIM wheel and the sequences to be followed while manufacturing a product in industry
6) Able to work in the CAD ,CAMP softwares for the product design
7) Can understand the shop floor management and CIMOSA for effective production management
8) Be clear in the steps involved in CMS data communication systems while handling a product
9) Apply the concepts of open system database for effective and efficient product management.

UNIT I INTRODUCTION 8

The meaning and origin of CIM- the changing manufacturing and management scene - External communication - islands of automation and software-dedicated and open systems-manufacturing automation protocol - product related activities of a company-marketing engineering - production planning - plant operations - physical distribution-business and financial management.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

History of group technology- role of G.T. in CAD/CAM integration - part families - classification and coding - DCLASS and MICLASS and OPITZ coding systems-facility design using G.T. - benefits of G.T. - cellular manufacturing.

Process planning - role of process planning in CAD/CAM integration - approaches to computer aided process planning - variant approach and generative approaches - CAPP and CMPP process planning systems.

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS **9**

Shop floor control-phases -factory data collection system -automatic identification methods- Bar code technology-automated data collection system.

FMS-components of FMS - types -FMS workstation -material handling and storage systems- FMS layout -computer control systems-application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION **10**

CIM and company strategy - system modeling tools -IDEF models - activity cycle diagram CIM open system architecture (CIMOSA)- manufacturing enterprise wheel-CIM architecture- Product data management-CIM implementation software.

Communication fundamentals- local area networks -topology -LAN implementations - network management and installations.

UNIT V OPEN SYSTEM AND DATABASE FOR CIM **8**

Open systems-open system inter connection - manufacturing automations protocol and technical office protocol (MAP /TOP).Development of databases -database terminology- architecture of database systems-data modeling and data associations - relational data bases - database operators - advantages of data base and relational database.

TOTAL 45

TEXT BOOK

1. Mikell.P.Groover "Automation, Production Systems and computer integrated manufacturing", Pearson Education 2001.

REFERENCES

1. Yoremkoren, "Computer Integrated Manufacturing System", McGraw-Hill, 1913.
2. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International, 1916.
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe "Computer Integrated Design and Manufacturing", McGraw-Hill Inc.
4. Roger Hanman "Computer Intergrated Manufacturing", Addison - Wesley, 1997.
   Mikell.P.Groover and Emory Zimmers Jr., "CAD/CAM", Prentice Hall of India Pvt. Ltd., New Delhi-1, 1991.
5. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
6. Radhakrishnan P, SubramanyanS.and Raju V., "CAD/CAM/CIM", 2nd Edition New Age International (P) Ltd., New Delhi, 2000.

Engineering Elective Courses (Semester VI)

ASD361 FUNDAMENTALS OF SPACE VEHICLE DESIGN

L	T	P	C
3	0	0	3

GOAL

To study the fundamentals of space vehicle, spacecraft configuration, spacecraft design management.

OBJECTIVES

The course should enable the students to:

1) Understand Space Mission analysis and Design process
2) Impart spacecraft configuration and structural design
3) Gain knowledge on thermal control on space craft
4) Understand space craft attitude, control and instrumentation
5) Understand space craft design management

OUTCOME

The students should be able to know about:

1) Mission objectives, needs, requirements and constraints, logistics
2) Design requirements, process, analysis and verification with future space structure
3) Thermal design, balance and analysis of satellite
4) Basic launch vehicle consideration, selection process, spacecraft design envelope, Attitude requirements, Space control system, Navigation & Telecommunication, Onboard systems, Science instruments
5. Vehicle design and mission concept, System engineering, Product assurance, Spacecraft integration and test, reliability and quality assurance, Small satellite engineering and application and its costing system.

UNIT I SPACE MISSION ANALYSIS AND DESIGN PROCESS 9

Space mission life cycle, Mission objectives, Mission needs, Mission requirements and constraints, Space environment and survivability, Space logistics and reliability, Orbital debris

UNIT II SPACECRAFT CONFIGURATION AND STRUCTURAL DESIGN **9**

Design requirements, Design process, Material solution, Analysis, Design verification, Impact protection, Configuration, The future of space structure.

UNIT III THERMAL CONTROL OF SPACECRAFT **9**

Thermal environment, Thermal balance, Thermal analysis, Thermal design, Thermal technology, Thermal design verification, Satellite thermal design.

UNIT IV SPACECRAFT ATTITUDE, CONTROL AND INSTRUMENTATION **9**

Basic launch vehicle consideration, Launch system selection process, determining the spacecraft design envelope, Attitude requirements, kinematics, measurements, estimation and dynamics, Space control system, Telecommunication, Onboard systems, Science instruments, Navigation.

UNIT V SPACECRAFT DESIGN MANAGEMENT **9**

Vehicle design and mission concept, System engineering, Product assurance, Spacecraft integration and test, Spacecraft reliability and quality assurance, Small satellite engineering and application, Cost.

TOTAL 45

TEXT BOOK

1. V.L. Pisacane and R.C. Moore, "Fundamentals of Space Systems", AIAA Series, 2003

REFERENCES:

1. P. Fortescue, J. stark, and G. Swinerd, " Spacecraft Systems Engineering" AIAA Series, 2005
2. W.J. Larson and J. R. Wertz., "Space Mission Analysis and design", AIAA Series, 1998
3. M.J.L. Turner, "Rocket and Spacecraft Propulsion" (Principles, Practice and New Developments).

ASD362 WIND TUNNEL TECHNIQUES

L T P C
3 0 0 3

GOAL

Wind tunnel techniques course depicts the types, working and characteristics of wind tunnels in the laboratory. The flow characteristics, flow visualisation in the tunnel are recorded for further observations

OBJECTIVES

The course should enable the students to:

1. Understand the Non dimensional number by Buckingham theorem
2. Differentiate the wind tunnels on the basis of circuit, air flow and working...
3. Know the calibration of a wind tunnel.
4. Understand the pressure and force measurements in wind tunnel.
5. Deduce the flow visualization techniques used in the wind tunnel testing

OUTCOME

The students should be able to :

1. Solve the Buckingham theory to find the SI unit of a parameter
2. Clearly understand the working of Blow down,Indraft tunnels and their specifications
3. Know about horizontal buoyancy, Flow angularities are checked while calibration
4. Know about component axis balance and internal balances are read and understood for the measurements in wind tunnel
5. Get a clear idea about the smoke and tuft flow visualisation procedures in WT testing

UNITI PRINCIPLES OF MODEL TESTING **6**

Buckingham Theorem - Non-Dimensional Numbers -Scale Effect Types of Similarities.

UNIT II WIND TUNNELS **8**

Classification - Special problems of Testing in Subsonic, Transonic, supersonic and hypersonic speed regions - Layouts - sizing and design parameters.

UNIT III CALIBRATION OF WIND TUNNELS **11**

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

UNIT IV WIND TUNNEL MEASUREMENTS **12**

Pressure and velocity measurements - Force measurements - Three component and six component balances - Internal balances.

UNIT V FLOW VISUALIZATION 8

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

TOTAL 45

TEXT BOOK

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

REFERENCE

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

ASD363 THEORY OF ELASTICITY

L T P C
3 0 0 3

UNIT I: INTRODUCTION & BASIC EQUATIONS OF ELASTICITY

DEFINITION AND NOTATION**:** Stress, Stress at a Point, Equilibrium Equations, Principal Stresses, Mohr's Diagram, Maximum Shear Stress, Boundary Conditions.

STRAIN AT A POINT: Compatibility Equations, Principal Strains, Generalised Hooke's law, Methods of Solution of Elasticity Problems – Plane Stress-Plane Strain Problems.

UNIT II: PLANE STRESS AND PLANE STRAIN PROBLEMS

TWO DIMENSIONAL PROBLEMS: Cartesian co-ordinates – Airy's stress functions – Investigation of Airy's Stress function for simple beam problems – Bending of a narrow cantilever beam of rectangular cross section under edge load – method of Fourier analysis – pin ended beam under uniform pressure.

UNIT III: POLAR CO-ORDINATES

GENERAL EQUATIONS IN CYLINDRICAL CO-ORDINATES: Thick cylinder under uniform internal and / or external pressure, shrink and force fit, stress concentration.

UNIT IV: TORSION

STRESSES IN AN INFINITE PLATE (with a circular hole) subjected to uniaxial and biaxial loads, stress concentration, stresses in rotating discs and cylinders.

TORSION OF CIRCULAR, ELLIPTICAL AND TRIANGULARBARS: membrane analogy, torsion of thin open sections and thin tubes.

UNIT V: THERMAL STRESSES AND UNIQUENESS THEOREMS

THERMAL STRESSES: Thermo elastic stress strain relationship, Equations of equilibrium Thermal stresses in thin circular discs and in long circular cylinder, sphere.

UNIQUENESS THEOREM: Principle of super position, reciprocal theorem, saint venant principle

Total 45 Hrs

Text Books:

1. **Advanced Mechanics of solids**, L. S. Srinath, Tata Mc. Graw Hill, 2003
2. **Theory of Elasticity:** S. P. Timoshenko and J. N Gordier, Mc. Graw Hill International, 3rd edition, 1972

Reference Books:

1. **Theory of Elasticity:** Dr. Sadhu Singh, Khanna Publications, 1988
2. **Elasticity, Theory, Applications & Numerical:** Martin H Sadd, Elsevier. 2005
3. **Applied Elasticity,** Seetharamu & Govindaraju, Interline Publishing
4. **Applied Elasticity,** C.T. WANG Sc. D. Mc. Graw Hill Book Co.

Engineering Elective Courses (Semester VII)

ASD421 VIBRATIONS AND AROELASTICITY

L T P C
3 0 0 3

GOAL

Vibration and Aero elasticity deals with the motion of aircraft motions alongside their interactions and their vibrations.

OBJECTIVES

The course should enable the students to:

1. Understand the SHM and terminologies involved in D Alembert principle of motion
2. Divide vibrations based on parameters and their significance and characteristics
3. Know the multi degree freedom of a system and its importance.
4. Know the natural frequency of a given object by numerical method
5. Understand the application of Aero elasticity and its effects on aircraft components

OUTCOME

The students should be able to:

1. Understand the basics of vibrations and simple harmonic motion.
2. Differentiate types of vibrations according to dampness and particle motion.
3. Clearly understand the need of a multi degree of freedom particle and its characteristics.
4. Solve Rayleigh and Holzer method to find natural frequency of an object.
5. Understand the formation of Aileron reversal, flutter and wing divergence.

UNIT I BASIC NOTIONS 8

Simple harmonic motion - Terminologies - Newton's Law - D' Alembert's principle - Energy Methods

UNIT II SINGLE DEGREE OF FREEDOM SYSTEMS 12

Free vibrations - Damped vibrations - Forced Vibrations, with and without damping - support excitation - Vibration measuring instruments.

UNIT III MULTI DEGREES OF FREEDOM SYSTEMS 10

Two degrees of freedom systems - Static and Dynamic couplings vibration absorber- Principal co-ordinates, Principal modes and orthogonal condition - Eigen value problems.

Hamilton's principle- Lagrangean equation and application - Vibration of elastic bodies- Vibration of strings- Longitudinal, Lateral and Torsional vibrations.

UNIT IV APPROXIMATE METHODS **5**

Rayleigh's and Holzer Methods to find natural frequencies.

UNIT V ELEMENTS OF AEROELASTICITY **10**

Concepts - Coupling - Aero elastic instabilities and their prevention - Basic ideas on wing divergence, loss and reversal of aileron control - Flutter and its prevention.

TOTAL 45

TEXT BOOKS

1. TIMOSHENKO S., "Vibration Problems in Engineering"- John Wiley and Sons, New York, 1993.
2. FUNG Y.C., "An Introduction to the Theory of Aero elasticity" - John Wiley & Sons, New York, 1995.

REFERENCES

1. BISPLINGHOFF R.L., ASHELY H and HOGMAN R.L., "Aero elasticity" - Addision Wesley Publication, New York, 1913.
2. TSE. F.S., MORSE, I.F., HUNKLE, R.T., "Mechanical Vibrations", - Prentice Hall, New York, 1914.
3. SCANLAN R.H. & ROSENBAUM R., "Introduction to the study of Aircraft Vibration & Flutter", John Wiley and Sons. New York, 1912.
4. BENSON H.TONGUE, "Principles of Vibration", OxfordUniversity Press, 2000.

ASD422 FATIGUE AND FRACTURE MECHANICS

L T P C
3 0 0 3

GOAL

To understand the basic characteristics of fatigue and creep mechanisms in the aircraft structures.

OBJECTIVES

The course should enable the students to:

1. Understand fatigue load
2. Understand low and high cycle fatigue
3. Understand crack initiation and growth
4. Understand potential energy and surface energy
5. Understand safe life and fail safe design

OUTCOMES

The students should be able to:

1. Become familiar with definitions
2. Analyze for cumulative damage
3. Analyze for crack initiation & crack growth
4. Analyze for strength of cracked bodies
5. Analyze damage tolerant structures

UNIT I FATIGUE OF STRUCTURES 12

S.N. curves - Endurance limit - Effect of mean stress - Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - plastic stress concentration factors - S-N curves for typical notched geometries.

UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR 11

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 - Miner's theory - other theories.

UNIT III PHYSICAL ASPECTS OF FATIGUE 10

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

UNIT IV FRACTURE MECHANICS 15

Strength of cracked bodies - potential energy and surface energy - Griffith's theory - Irwin - Orwin 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 TESTING 12

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

TOTAL 60

TEXT BOOKS

1. Prasanth Kumar - "Elements of fracture mechanics" - Wheeter publication, 1999.
2. Barrois W, Ripely, E.L., "Fatigue of aircraft structure", Pergamon press. Oxford, 1913.

REFERENCES

1. Sin, C.G., "Mechanics of fracture" Vol. I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1919.
2. Knott, J.F., "Fundamentals of Fracture Mechanics", Buterworth& Co., Ltd., London, 1913.

PROFESSIONAL ELECTIVE COURSES- PE

Professional Elective Courses- PE (Semester V)

ASC331 AERO ENGINE MAINTENANCE & REPAIR

L T P C
3 0 0 3

GOAL

To make the students to understand the basic concepts of maintenance and repair of both piston and gas turbine engines and the procedures followed for overhaul of aero engines.

OBJECTIVE

The course should enable the students to:

4. Understand the types of piston engines, principle of operation.
5. Know the inspection, maintenance and troubleshooting procedure of aircraft piston engines
6. Understand the piston engine overhaul procedure and engine testing procedure.
7. Familiarize with 112 types of jet engines and its principle of operations.
8. Understand the maintenance troubleshooting, testing procedure of gas turbine engines.
9. Understand the overhaul procedure of aircrafts gas turbine engines.
10. Familiarize with gas turbine engine, health monitoring and corrective methods.

OUTCOME

The students should be able to:

1. Describe the function of each component in piston engines and its materials.
2. Carryout inspections and maintenance checks on aircraft piston engines.
3. Describe the piston engine overhaul procedure.
4. Know the types and function of each component in gas turbine engines.
5. Describe the troubleshooting and rectification procedures of gas turbine engines.
6. Know the overhaul procedures and balancing of gas turbine components.
7. Describe the detail procedure for gas turbine engine, health monitoring.

UNIT I CLASSIFICATION OF PISTON ENGINE COMPONENTS 5

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

UNIT II INSPECTION OF PISTON ENGINES 8

Inspection and maintenance and troubleshooting - Inspection of all engine components - Daily and routine checks - Overhaul procedures - Compression testing of cylinders -

Special inspection schedules - Engine fuel, control and exhaust systems - Engine mount and super charger - Checks and inspection procedures.

UNIT III INSPECTION OF PISTON ENGINES 10

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

UNIT IV CLASSIFICATION OF JET ENGINE COMPONENTS 12

12 Types of jet engines - Principles of operation - Functions of components - Materials used - Details of starting and operating procedures - Gas turbine engine inspection & checks - Use of instruments for online maintenance - Special inspection procedures : Foreign Object Damage - Blade damage - etc.

Maintenance procedures of gas turbine engines - Trouble shooting and rectification procedures - Component maintenance procedures - Systems maintenance procedures.

Gas turbine testing procedures - test schedule preparation - Storage of Engines - Preservation and de-preservation procedures.

UNIT V OVERHAUL PROCEDURES 10

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

Total 45

TEXT BOOK

1. KROES & WILD, "Aircraft Power plants", 7th Edition - McGraw Hill, New York, 1994.

REFERENCES

1. TURBOMECA, "Gas Turbine Engines", The English Book Store, New Delhi, 1993.
2. UNITED TECHNOLOGIES PRATT & WHITNEY, "The Aircraft Gas turbine Engine and its Operation", (latest edition) The English Book Store, New Delhi.

AEC332 ELEMENTS OF VIBRATION

L T P C
3 0 0 3

GOAL

To study the dynamic behaviour of different aircraft components and the interaction among the aerodynamic, elastic and inertia forces

OBJECTIVES

The course should enable the student to:

1. To know the basic notations used in vibration.
2. To study about the systems with single degree of freedom.
3. To study about the systems with two degree of freedom.
4. To study about the systems with multi degree of freedom.
5. To study about the methods used to solve vibration problems

OUTCOME

The student should be able to understand:

1. The SHM, Newton's Law AND Energy methods.
2. The concept of free vibrations, damped vibrations and forced vibrations with and without damping.
3. The concept of static and dynamic coupling vibration absorber and Eigen value problems.
4. The Hamilton's principle- Lagrangean equation its application and Vibration of elastic bodies.
5. The various computational techniques in vibration and equation of motion of complete system.

UNIT I BASIC NOTIONS 7

Simple harmonic motion – Terminologies – Newton's Law – D' Alembert's principle – Energy Methods

UNIT II SINGLE DEGREE OF FREEDOM SYSTEMS 10

Free vibrations – Damped vibrations – Forced Vibrations, with and without damping – support excitation – Vibration measuring instruments.

UNIT III. TWO DEGREES OF FREEDOM SYSTEMS 10

Two degrees of freedom systems – Static and Dynamic couplings vibration absorber- Principal co- ordinates, Principal modes and orthogonal condition – Eigen value problems.

UNIT IV MULTI DEGREE FREEDOM SYSTEM 10

Hamilton's principle- Lagrangean equation and application – Vibration of elastic bodies- Vibration of strings- Longitudinal, Lateral and Torsional vibrations.

UNIT V SOLUTION METHOD 8

Computational technique in vibration, Vibrating string, General method, Beam element, Global matrices, Transformation of matrices, Equation of motion of complete system, Consistent and Lambard mass.

TOTAL: 45

TEXT BOOKS

1.Timoshenko S., "Vibration Problems in Engineering"– John Wiley and Sons, New York, 1993.

REFERENCES

1.Tse. F.s., Morse, I.F., Hunkle, R.T., "Mechanical Vibrations", – Prentice Hall, New York, 1984.
2. Scanlan R.H. & Rosenbaum. R., "Introduction to the study of Aircraft Vibration & Flutter", John Wiley and Sons. New York, 1982. 3.
3.Benson H.Tongue, "Principles of Vibration", Oxford University Press, 2000

ASC333 AIRFRAME MAINTENANCE & REPAIR PRACTICES

L T P C
3 0 0 3

GOAL

Airframe Maintenance & Repair deals with the maintenance and safety precautions and procedures of airframe systems and their troubleshooting practices.

OBJECTIVES

The course should enable the students to:

1. Understand the basic steps in welding and soldering, brazing of aircraft components
2. Depict the composite and plastic components maintenance in aircraft industry
3. Gain knowledge about rigging, jacking of aircraft in maintenance hangar. To explain the steps involved in the maintenance process
4. Know about Hydraulic and Pneumatic system.
5. Understand the safety practices in aircraft maintenance and equipment handling

OUTCOME

The students should be able to:

1. Explain the welding, brazing process with the requirements of the process and significance of NDT
2. Understand the various maintenance practices in plastic and composite parts of aircraft
3. Understand the precautionary steps involved in rigging, jacking process.
4. Gain thorough understanding in parts, working methodology of basic aircraft systems.

5. Get a clear idea about safety practices and troubleshooting of an aircraft.

UNIT I WELDING IN AIRCRAFT STRUCTURAL COMPONENTS **10**

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

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

UNIT II PLASTICS AND COMPOSITES IN AIRCRAFT **10**

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

UNIT III AIRCRAFT JACKING, ASSEMBLY AND RIGGING **8**

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 **10**

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

Inspection. Inspection and maintenance of auxiliary systems - Fire protection systems - Ice protection system - Rain removal system - Position and warning system - Auxiliary Power Units (APUs)

UNIT V SAFETY PRACTICES **7**

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

Total 45

TEXT BOOK

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

REFERENCES

1. LARRY REITHMEIR, "Aircraft Repair Manual", Palomar Books, Marquette, 1992.
2. BRIMM D.J. BOGGES H.E., "Aircraft Maintenance", Pitman Publishing corp. New York, 1940

Professional Elective Courses- PE (Semester VI)

ASC371 FEM IN AEROSPACE

L T P C
3 0 0 3

GOAL

Finite Element Method capable of writing to solve different problems such as Boundary value problems, Linear equation to approximate the solution stepwise integration algorithms have to written in Mathematical Script.

OBJECTIVES

The course should enable the students to:

1) Understand the basic steps in finite element method and convergence criteria
2) Discretize the domain in to finite elements and to obtain stiffness matrix for bar, beam and frame elements.
3) Know the plane stress and plane strain problem application in 2d structures.
4) Know the application of isoperimetric problems in 3d structures.
5) Understand the application of finite element methods in heat transfer and fluid flow problems.

OUTCOME

The students should be able to:

1) Write flow chart of finite element steps and understand the convergence of the problem
2) Solve stiffness matrix for bar, beam and frame problems using suitable boundary condition.
3) Plane stress and plane strain condition are used to understand 2d structures.
4) Modelling of 2d and 3d structures using isoperimetric elements
5) Apply the concepts of finite element methods to solve fluid flow and heat transfer problems.

UNIT I INTRODUCTION 4

Review of basic analysis - Stiffness and Flexibility matrix for simple cases - Governing equation and convergence criteria of finite element method.

UNIT II DISCRETE ELEMENTS 12

Bar, Frame, beam elements - Application to static, dynamic and stability analysis.

UNIT III CONTINUUM ELEMENTS **10**

Various types of 2-D-elements Application to plane stress, plane strain and axisymmetric problems.

UNIT IV ISOPARAMETRIC ELEMENTS **10**

Applications to two and three-dimensional problems.

UNIT V FIELD PROBLEM **9**

Applications to other field problems like heat transfer and fluid flow.

TOTAL 45

TEXT BOOK

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall India, Third Edition, 2003.

REFERENCES

1. Reddy J.N. "An Introduction to Finite Element Method", McGraw-Hill, 2000.
2. Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw-Hill, 2000.
3. Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.

ASC372 HEAT TRANSFER

L T P C
3 0 0 3

GOAL

The course is intended to build up necessary background for understanding the physical behavior of various modes of heat transfer, like, conduction, convection and radiation

OBJECTIVES

The course should enable the students to:

1. The physical behavior of various modes of heat transfer, like, conduction, convection and radiation.
2. The application of various experimental heat transfer correlations in engineering calculations.
3. The thermal Analysis and sizing of heat exchangers.

4. The basic concept of mass transfer, its types & its correlations.
5. Study the Heat Transfer problems in aircraft and rocket engine combustion chamber.

OUTCOME

The students should be able to:

1. Understand the difference between various modes of Heat Transfer and the Resistance Concept used in Heat Conduction.
2. Learn to use the basic methods in Conduction. Understand the concept of Lump Parameter analysis and when it is applicable and earn the concepts of boundary layer.
3. Learn to apply various correlation used in Convective Heat Transfer and Understand the concepts of Black Body, Grey Body, View factor, Radiation shielding.
4. Design/size Heat Exchanger and understand the concept of Mass transfer, its types & laws associated with it.
5. Learn to apply various technique used for high speed flow heat transfer.

UNIT I HEAT CONDUCTION 11

Basic Modes of Heat Transfer - One dimensional steady state heat conduction: Composite Medium - Critical thickness - Effect of variation of thermal Conductivity - Extended Surfaces - Unsteady state.

Heat Conduction: Lumped System Analysis - Heat Transfer in Semi infinite and infinite solids - Use of Transient - Temperature charts - Application of numerical techniques.

UNIT II CONVECTIVE HEAT TRANSFER 12

Introduction - Free convection in atmosphere free convection on a vertical flat plate - Empirical relation in free 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, application of numerical techniques in problem solving.

UNIT III RADIATIVE HEAT TRANSFER 12

Introduction to Physical mechanism - Radiation properties - Radiation shape factors - Heat exchange between non - black bodies - Radiation shields.

UNIT IV HEAT EXCHANGERS 13

Classification - Temperature Distribution - Overall heat transfer coefficient, Heat Exchange Analysis - LMTD Method and E-NTU Method.

UNIT V HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING 12

High-Speed flow Heat Transfer, Heat Transfer problems in gas turbine combustion

chambers - Rocket thrust chambers - Aerodynamic heating - Ablative heat transfer.

TOTAL 60

TEXT BOOKS

7) Yunus A. Cengel., "Heat Transfer - A practical approach", Second Edition, Tata McGraw-Hill, 2002.

8) Incropera. F.P.and Dewitt.D.P. “Introduction to Heat Transfer", John Wiley and Sons - 2002.

REFERENCES

7) Lienhard, J.H., "A Heat Transfer Text Book", Prentice Hall Inc., 1911.

8) Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6thEdn., 1991.

9) Sachdeva, S.C., "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi, 1911.

10) Mathur, M. and Sharma, R.P. "Gas Turbine and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1911.

ASC374 AIRCRAFT GENERAL ENGINEERING MAINTENANCE & PRACTICES

L T P C
3 0 0 3

GOAL

To understand the various Aircraft engine maintenance procedures and standard tools for checks in aircraft engine.

OBJECTIVES

The course should enable the students to:

1. Understand the Ground Handling of Aircraft and special procedures such as Mooring, Jacking etc.
2. Study the Air conditioning and pressurization systems
3. Study the safety precautions in aircraft maintenance procedures
4. Study the Various inspections and ATA specifications while Aircraft maintenance
5. Study the Aircraft Hardware systems and their procedures of implementation.

OUTCOME

The students should be able to:

1. The ground handling procedures and types of equipments with special

maintenance

2. The ground servicing of sub systems in Aircraft
3. The shop safety, Environment cleanliness in an aircraft materials shop
4. The FAA airworthiness regulations and the checklist involved in each inspection of aircraft
5. The terminology and specifications involved in Aircraft hardware selection. Identification of fluid line fittings.

UNIT I AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT **10**

Mooring, jacking, levelling and towing operations - Preparation - Equipment - precautions - Engine starting procedures - Piston engine, turboprops and turbojets - Engine fire extinguishing - Ground power units.

UNIT II GROUND SERVICING OF VARIOUS SUB SYSTEMS **8**

Air conditioning and pressurization - Oxygen and oil systems - Ground units and their maintenance.

UNITIII MAINTENANCE OF SAFETY **5**

Shop safety - Environmental cleanliness - Precautions.

UNIT IV INSPECTION **10**

Process - Purpose - Types - Inspection intervals - Techniques - Checklist - Special inspection - Publications, bulletins, various manuals - FAR Air worthiness directives - Type certificate Data Sheets - ATA specifications.

UNIT V AIRCRAFT HARDWARE, MATERIALS, SYSTEMS PROCESSES **12**

Hand tools - Precision instruments - Special tools and equipments in an airplane maintenance shop - Identification terminology - Specification and correct use of various aircraft hardware (i.e. nuts, bolts, rivets, screws etc.) - American and British systems of specifications - Threads, gears, bearings, etc. - Drills, tapes & reamers. - identification of all types of fluid line fittings. Materials, metallic and non-metallic - Plumbing Connectors - Cables - Swaging procedures, tests, Advantages of swaging over splicing.

TOTAL 45

TEXT BOOK

1. KROES WATKINS DELP, "Aircraft Maintenance and Repair" - McGraw-Hill, New York 1993.

REFERENCES

1. A & P MECHANICS, "Aircraft hand Book" - F. A. A. Himalayan Book House, New Delhi, 1996.
2. A & P MECHANICS, "General hand Book" - F. A. A. Himalayan Book House, New Delhi, 1996.

ASC373 HIGH TEMPERATURE MATERIALS

L T P C
3 0 0 3

GOAL

To learn damage mechanism and failure of components at elevated temperature.

OBJECTIVE

The course should enable the students to:

1. Study creep behaviour and effect of different factors like stress, temporary, strain rate on creep.
2. Study design transient creep, different phenomenon like time hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monk man-Grant relationship.
3. Study fracture and various types and fracture maps for different alloys and oxides.
4. Study oxidation and hot corrosion; alloy additions and effect of alloying elements on oxidation and hot-corrosion.
5. Introduce super alloys and various types; different fabrication methods and inter-metallic, high temperature ceramics.

OUTCOME

The students should be able to:

1) Know about creep behavior, and effect of different factors like stress, temporary, strain rate on creep.
2) Know about design of transient creep, time hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.
3) Know about various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, ductile fracture due to micro-void diffusion controlled void growth; fracture maps for different alloys and oxides.
4) Know about Oxidation, Pilling, Bed-worth ratio, kinetic laws of oxidation-defect structure and control of oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of corrosion.
5) Know about Iron base, Nickel base and Cobalt base super-alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Inter-metallic, high temperature ceramics.

UNIT I CREEP 9

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.

UNIT II DESIGN FOR CREEP RESISTANCE **9**

Design of transient creep time, expressions of rupture life of creep, effect of creep on ductile and brittle materials, Monkman-Grant relationship.

UNIT III FRACTURE **9**

Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, and ductile fracture due to micro void coalescence-diffusion controlled void growth.

UNIT IV OXIDATION AND HOT CORROSION **9**

Oxidation, Pilling, Bedworth ratio, kinetic laws of oxidation-, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, methods of combat hot corrosion.

UNIT V SUPERALLOYS AND OTHER MATERIALS **9**

Iron base, Nickel base and Cobalt base super alloys, TCP phase, Embrittlement, Intermetallic, high temperature ceramics.

TOTAL: 45

TEXT BOOKS

1) Raj. R., "Flow and Fracture at Elevated Temperatures", American Society for Metals, USA, 1915.

2) Hertzberg R. W., "Deformation and Fracture Mechanics of Engineering materials", 4th Edition, John Wiley, USA, 1996.

3) Courtney T.H, "Mechanical Behavior of Materials", McGraw-Hill, USA, 1990.

REFERENCES

1. Boyle J.T, Spencer J, "Stress Analysis for Creep", Butterworths, UK, 1913.
2. Bressers. J., "Creep and Fatigue in High Temperature Alloys", Applied Science, 1911.
3. McLean D., "Directionally Solidified Materials for High Temperature Service", the Metals Society, USA, 1915.

Professional Elective Courses- PE (Semester VII)

ASC431 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

GOAL

To make the students to understand the basic concepts of fluid dynamics and to get a clear picture of the condition of a flow in real motion.

OBJECTIVES

The course should enable the students to:

1. Understand the basic flow equations, characteristics of mathematical models for a given flow.
2. Know the importance and significance of panel methods
3. Understand the concept of discretization, upwind differencing and implicit explicit solutions
4. Familiarize with Finite element techniques in Computational Fluid dynamics.
5. Familiarize with Finite Volume techniques in Computational fluid analysis.

OUTCOME

The students should be able to:

1. Describe the flow phenomena in a flow field with correspondence with elliptic, parabolic and hyperbolic equations
2. Clearly understand the steps involved in Source and panel methods
3. Describe the upwind concept and its effects in a given flow. Can understand the discretization of a flow model for analysis.
4. Can clearly understand the weighted variation formulae and Galerkin method for finite volume technique.

6) Know the numerical finite volume methods(RungeKutta method, Lax wendroff) in Computational analysis.

UNIT I FUNDAMENTAL CONCEPTS 10

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 - Explicit finite difference methods of subsonic, supersonic and viscous flows.

UNIT II PANEL METHODS 7

Introduction - Source panel method - Vortex panel method - Applications.

UNIT III DISCRETIZATION **8**

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

UNIT IV FINITE ELEMENT TECHNIQUES **10**

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 - The Solution Procedure.

UNIT V FINITE VOLUME TECHNIQUES **10**

Finite Volume Techniques - Cell Centered Formulation - ~ Lax - Vendoroff 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 Discretization - Treatment of Derivatives.

TOTAL 45

TEXT BOOK

1. Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics", Vols. I and II, Springer - Verlag, Berlin, 1911.

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, 1911.
3. Klaus A Hoffmann and Steve T. Chiang. "Computational Fluid Dynamics for Engineers", Vols. I & II Engineering Education System, P.O. Box 20071, W.Wichita, K.S., 67201 – 10

ASC432 SATELLITES AND SPACE SYSTEM DESIGN

L T P C
3 0 0 3

GOAL

To study the fundamentals of the spacecraft and satellite systems design.

OBJECTIVES

The course should enable the student to:

1) To study about the Space system design
2) To study the Space craft environment and its effects on design
3) To study the Space craft systems
4) To study the Product assurance of satellite systems and components
5) To study the Satellite engineering and applications

OUTCOME

The students should be able to:

1) Know about the Payloads and missions, system view of spacecraft propulsion system, launch vehicles, and spacecraft mechanisms
2) Know about the about Preoperational spacecraft environment, operational spacecraft environments, Environmental effects on design, the sun, the earth, and spacecraft effects, spacecraft structure and thermal control.
3) Know about the various Attitude control, Electrical power systems, Telecommunications, telemetry command, data handling and process.
4) Know about the various Failures, Reliability, material and process, safety, configuration control, build and verification, system engineering, case studies
5) Know about the Satellite design philosophy, satellite system design, COTS components in the space environment. Micro satellites, mini satellites and nano satellites, in orbit operation, satellite application for meteorology, navigation, communication, geo observation, and space environment study

UNIT I SPACE SYSTEM DESIGN 12

Payloads and missions, system view of spacecraft propulsion system, launch vehicles, spacecraft mechanisms.

UNIT II SPCAECRAFT ENVIRONMENT AND ITS EFFECTS ON DESIGN 12

Preoperational spacecraft environment, operational spacecraft environments, Environmental effects on design, the sun, the earth, and spacecraft effects, spacecraft structure, thermal control.

UNIT III SPACECRAFT SYSTEMS **12**

Attitude control, Electrical power systems, Telecommunications, telemetry command, data handling and process.

UNIT IV PRODUCT ASSURANCE **12**

Failures, Reliability, material and process, safety, configuration control, build and verification, system engineering, case studies

UNIT V SATELLITE ENGINEERING AND APPLICATIONS **12**

Satellite design philoshopy, satellite system design, COTS components in the space environment. Micro satellites, mini satellites and nano satellites, in orbit operation, satellite application for meteorology, navigation, communication, geo observation, and space environment study.

TOTAL 60

TEXT BOOK

1. P.Fortescue J. Stark, and G.Swinerd, "Spcaecraft systems engineering", John Wiley and sons, 2002.

ASC433 FLIGHT MECHANICS III

L T P C
3 0 0 3

GOAL

To study the fundamentals of space mechanics, the basic concepts of orbital mechanics with particular emphasis on satellite launching and interplanetary trajectory.

OBJECTIVES

The course should enable the students to:

1) Study the basic concepts of space mechanics.
2) Study about the N- body problem in the universe.
3) Study about satellite injection and satellite orbit perturbations.
4) Study about the various stages of ballistic missile trajectory.
5) Study about the interplanetary trajectories.

OUTCOME

The students should be able to:

1) Understand solar time solar system and associated basic terms

2) Understand satellite orbits relation between position and time.
3) Understand satellite orbit transfer, special perturbations.
4) Understand about the various phases in missile launching.
5) Understand about the spacecraft trajectories between planets.

UNIT I BASIC CONCEPTS **12**

The solar system, Reference frame and coordinate, the celestial sphere, the ecliptic , sidereal time, solar time, standard time, the earth atmosphere.

UNIT II N- BODY PROBLEM **12**

The many body problem, circular restricted three body problem, liberation points, two body problem, satellite orbits, relation between position and time, orbital elements.

UNIT III SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS **12**

Introduction to satellite injection, satellite orbit transfer, orbit deviation due to injection errors, special and general perturbations, methods of vibration of orbital elements.

UNIT IV BALLISTIC MISSILE TRAJECTORY **12**

The boost phase, the ballistic phase, trajectory geometry, optimal flights, time of flight, re-entry phase, the position of the impact point, influence coefficients.

UNIT V INTERPLANETARY TRAJECTORIES **12**

Two dimensional interplanetary trajectories, Fast interplanetary trajectories, three dimensional interplanetary trajectories, Launch of Interplanetary spacecraft, Trajectory about the target planet.

TOTAL 60

TEXT BOOK

1. Cornelisse, J.W., " Rocket propulsion and space dynamics ", W.H. Freeman & co,1984.

REFERENCE

1. Sutton, G. P., "Rocket Propulsion Elements", John Wiley, 1993
2. Van de Kamp, P., "Elements of Astromechanics", Pitman, 1979
3. Parker, E. R., "Materials for Missile and Spacecraft", McGraw-Hill Book Co. Inc., 1982.

ASC434 THEORY OF COMBUSTION

L T P C
3 0 0 3

GOAL

To study the different processes in combustion, difficulties faced and the methods to overcome them.

OBJECTIVES

The course should enable the students:

1) To understand the basic principles of combustion and its characteristics.
2) To understand the dynamics of combustion and methods for modelling the combustion.
3) To understand the reduced kinetic schemes in combustion.
4) To understand the process of combustion instability.
5) To understand the process of combustion diagnostics.

OUTCOME

The students should be able to:

1) Understand the combustion chemistry and its characteristics.
2) Learn about the problem related to the combustion process and its simulation.
3) Learn about the H-O, H-C flame and propellant deflagration.
4) Learn about the Theory of instability and analysis of instabilities.
5) Learn about the various combustion diagnostics like absorption, fluorescence etc.

UNIT I INTRODUCTION 9

Combustion chemistry, Droplet combustion, reduced kinetic schemes, Combustion instability, Combustion enhancement, Modeling and simulation, Combustion diagnostics.

UNIT II CHEMISTRY AND DYNAMICS 9

Experimental and theoretical methods, Matrix isolation, Computational chemistry methods, Determination of strain energies and heat of formation of model compound, Determination of the chemical mechanism of strain energy.

UNIT III REDUCED KINETIC SCHEMES IN COMBUSTION 9

Different approach, Hydrogen-Oxygen and hydrocarbon flame, Propellant deflagration.

UNIT IV COMBUSTION INSTABILITY 9

Types of instability, Theoretical analysis, Numerical simulation, Experimental studies.

UNIT V COMBUSTION DIAGNOSTICS 9

Non resonant techniques, Absorption, Fluorescence, Algebraic turbulence, Closures for two-phase flows, Stochastic modeling.

TOTAL 45

TEXT BOOK

1. G.D.Roy,"Propulsion Combustion", Taylor & Francis, 1997

REFERENCE

1. N.Kuboto, "Propellants and Explosives", Wiley-VCH Verkeg Gmbh & co KGOA, 2007

SC435 HELICOPTER MAINTENANCE

L T P C
3 0 0 3

GOAL

To make the students to understand the basic concepts of Helicopter maintenance and repair procedures followed for overhauling.

OBJECTIVE

The subject should enable the students to

1. Fundamentals of Helicopter and ground handling of bearings
2. Basic concepts of Head maintenance, vibration tracking of helicopter blades. Flight control systems and mast adjustment concepts
3. Concept of main rotor transmission, spray clutch with importance of torque meter maintenance
4. Importance of power plants and tail rotors servicing and system rigging is executed
5. Basic fuselage maintenance and special hardware requirements

.

OUTCOME

The students should be able to

1. Helicopter basics are clearly understood and various maintenance procedures are followed
2. Get a clear idea about Head maintenance with flight and mast control systems.
3. Understand the transmission process in helicopter rotor and torque meter working.
4. Power plant rotors and tail rotor working is studied. Concept of rigging is clearly understood.
5. Get an idea about fuselage maintenance procedures with special hardware requirements.

UNIT I HELICOPTER FUNDAMENTALS **5**

Basic directions - Ground handling, bearing - Gears.

UNIT II MAIN ROTOR SYSTEM **9**

Head maintenance - blade alignment - Static main rotor balance - Vibration - Tracking - Span wise dynamic balance - Blade sweeping -Electronic balancing - Dampener maintenance - Counter weight adjustment - Auto rotation adjustments - Mast & Flight Control Rotor - Mast - Stabilizer, dampeners- Swash plate flight control systems collective - Cyclic - Push pull tubes - Torque tubes - Bell cranks - Mixer box - Gradient unit control boosts - Maintenance & Inspection control rigging.

UNIT III MAIN ROTOR TRANSMISSIONS **12**

Engine transmission coupling - Drive shaft - Maintenance clutch - Freewheeling units - Spray clutch - Roller unit - Torque meter - Rotor brake - Maintenance of these components - vibrations - Mounting systems - Transmissions.

UNIT IV POWER PLANTS & TAIL ROTORS **12**

Fixed wing power plant modifications - Installation - Different type of power plant maintenance. Tail rotor system - Servicing tail rotor track - System rigging.

UNIT V AIRFRAMES AND RELATED SYSTEMS **7**

Fuselage maintenance - Airframe Systems - Special purpose equipment.

TOTAL 45

TEXT BOOK

1. JEPPESEN, "Helicopter Maintenance", Jeppesons and Sons Inc., 2000.

REFERENCES

1. "Civil Aircraft Inspection Procedures", Part I and II, CAA, English Book House, New Delhi, 1916.
2. LARRY REITHMIER, "Aircraft Repair Manual", Palamar Books Marquette, 1992.