HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Coimbatore – 641 032

B.E. AERONAUTICAL ENGINEERING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

Curriculum & Syllabus

2018-2019

CHOICE BASED CREDIT SYSTEM

Department of Aeronautical Engineering

Vision of the Institute

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills, and high ethical values

Mission of the Institute

IM1: To provide academic excellence in technical education through novel teaching methods

IM2: To empower students with creative skills and leadership qualities

IM3: To produce dedicated professionals with social responsibility

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Vision of the Department

To be a global player and prepare the students with knowledge, skills, and ethics for their successful deployment in Aeronautical Engineering.

Mission of the Department

DM1: To nurture the students technically based on current trends and opportunities in the global Aerospace industry.

DM2: To develop the students as innovative engineers to address the contemporary issues in the Aeronautical field.

DM3: To inculcate professional and social responsibility based on an innate ethical value system.

Program Educational Objectives (PEOs) of the Department

PEO1: Graduates shall exhibit their sound theoretical and practical knowledge with skills for successful employment, advanced education, research, and entrepreneurial endeavors.

PEO2: Graduates shall establish deep-rooted mastering abilities, professional ethics, and communication alongside business abilities and initiative through lifelong learning experiences.

PEO3: Graduates shall become leaders and innovators by devising engineering solutions to care for modern society.

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Program Outcomes (POs)

PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
PO9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Program Specific Outcomes (PSOs)

The graduates will be able to

PSO1: Apply the knowledge of aerodynamics, structures, propulsion, avionics, and aircraft maintenance to give solutions for complex engineering problems.

PSO2: Use progressive methodology and tools involving design, analyze, and experiment in aircraft design.

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CURRICULUM

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. AERONAUTICAL ENGINEERING (UG)

REGULATION-2016

For the students admitted during the academic year 2018-2019 and onwards

SEMESER I

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA1101	Engineering Mathematics I (Matrices and Calculus)	3	1	0	4	25	75	100
2	16PH1101	Engineering Physics	3	0	0	3	25	75	100
3	16CY1101	Engineering Chemistry	3	0	0	3	25	75	100
4	16HE1101R	Essential English for Engineers – I	3	1	0	4	25	75	100
5	16GE1103	Problem Solving and Python Programming	3	0	0	3	25	75	100
6	16GE1102	Engineering Graphics	3	1	0	4	25	75	100
PRACTICAL									
7	16PS1001	Physical Science Lab - I	0	0	2	1	50	50	100
8	16GE1004	Problem Solving and Python Programming Lab	0	0	4	2	50	50	100
9	16GE1002	Engineering Practices Laboratory	0	0	4	2	50	50	100
10	16GE1003	Value Added Course I : Language Competency Enhancement Course-I	0	0	2	1	0	100	100
		Total :	**18**	**3**	**12**	**27**	**300**	**700**	**1000**

SEMESTER II

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA2102	Engineering Mathematics-II	3	1	0	4	25	75	100
2	16PH2102	Physics of Materials	3	0	0	3	25	75	100
3	16CY2102	Environmental Sciences	3	0	0	3	25	75	100
4	16HE2102R	Essential English for Engineers - II	3	1	0	4	25	75	100
5	16GE2101	Engineering Mechanics	3	1	0	4	25	75	100
6	16EE2202	Basics of Electrical and Electronics Engineering	3	0	0	3	25	75	100

PRACTICAL									
7	16PS2001	Physical Sciences Laboratory-II	0	0	2	1	50	50	100
8	16ME2001	Computer Aided Drafting Laboratory	0	0	4	2	50	50	100
9	16GE2001	Value Added Course-II: Language Competency Enhancement Course -II	0	0	2	1	0	100	100
		Total:	**18**	**3**	**8**	**25**	**250**	**650**	**900**

For the students admitted during the academic year 2017-2018 and onwards

SEMESTER III

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA3103	Fourier Analysis and Statistics	3	1	0	4	25	75	100
2	16AE3201	Aero Engineering Thermodynamics	3	0	0	3	25	75	100
3	16AE3202	Solid Mechanics	3	0	0	3	25	75	100
4	16AE3203	Engineering Fluid Mechanics	3	0	0	3	25	75	100
5	16AE3204	Elements of Aeronautics	3	0	0	3	25	75	100
6	16AE3205	Aircraft Systems and Instruments	3	0	0	3	25	75	100
PRACTICAL									
7	16AE3001	Fluid mechanics and Thermodynamics Laboratory	0	0	4	2	50	50	100
8	16AE3002	Aircraft component Drawing Laboratory	0	0	4	2	50	50	100
		Total :	**18**	**1**	**8**	**23**	**250**	**550**	**800**

SEMESTER IV

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA4107	Numerical Methods	3	1	0	4	25	75	100
2	16AE4201	Aerodynamics	3	0	0	3	25	75	100
3	16AE4202	Mechanics of Machines	3	1	0	4	25	75	100
4	16AE4203	Gas Turbine Propulsion	3	0	0	3	25	75	100
5	16AE4204	Aircraft Strength of Materials	3	1	0	4	25	75	100
6	16EI4231	Control Engineering	3	0	0	3	25	75	100
PRACTICAL									
7	16AE4001	Aerodynamics Laboratory	0	0	4	2	50	50	100
8	16AE4002	Aircrafts Strength of Materials Laboratory	0	0	4	2	50	50	100
		Total	**18**	**3**	**8**	**25**	**250**	**550**	**800**

For the students admitted during the academic year 2016-2017 and onwards

SEMESTER V

S.No	Course Code	Study Components and Course Title	L	T	P	C	CIA	ESE	Total
1.	16AE5201	Aircraft Performance	3	0	0	3	25	75	100
2.	16AE5202	High Speed Aerodynamics	3	1	0	4	25	75	100
3.	16AE5203	Aircraft Structures	3	1	0	4	25	75	100
4.	16AE5204	Advanced Propulsion	3	0	0	3	25	75	100
5.	16AE5205	Aircraft General Engineering Maintenance and practice	3	0	0	3	25	75	100
6.	16AE53XX	Professional Elective – I	3	0	0	3	25	75	100
7.	16AE5001	Aircraft Structures Laboratory	0	0	4	2	50	50	100
8.	16AE5002	Propulsion Laboratory	0	0	4	2	50	50	100
		Total	**18**	**2**	**8**	**24**	**250**	**550**	**800**

SEMESTER VI

S.No	Course Code	Study Components and Course Title	L	T	P	C	CIA	ESE	Total
1	16AE6201	Aircraft stability and control	3	0	0	3	25	75	100
2	16AE6202	Finite Element Methods in Engineering	3	1	0	4	25	75	100
3	16AE6203	Composite Materials and Structures	3	0	0	3	25	75	100
4	16AE63XX	Professional Elective – II	3	0	0	3	25	75	100
5	16XX64XX	Open Elective - I	3	0	0	3	25	75	100
6	16AE6001	Aircraft Design Project	0	0	4	2	50	50	100
7	16AE6002	Computer Aided Simulation Laboratory	0	0	4	2	50	50	100
8	16AE6003	Aircraft Systems Laboratory	0	0	4	2	50	50	100
9	16AE6801	Mini Project	0	0	6	3	50	50	100
		Total	**15**	**1**	**18**	**25**	**325**	**575**	**900**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE-I

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16AE5301	Aircraft materials and processes	3	0	0	3	25	75	100
2	16AE5302	Heat Transfer	3	0	0	3	25	75	100
3	16AE5303	Boundary layer Theory	3	0	0	3	25	75	100
4	16AE5304	Principles of Management	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE-II

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16AE6301	Theory of Elasticity	3	0	0	3	25	75	100
2	16AE6302	Introduction to Cryogenics	3	0	0	3	25	75	100
3	16AE6303	Wind tunnel techniques	3	0	0	3	25	75	100
4	16AE6304	Aero Engine Maintenance and Repair	3	0	0	3	25	75	100

OPEN ELECTIVE – I

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16AE6401	Introduction to flight	3	0	0	3	25	75	100

Credit Distribution

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	23	25	24	25	22	16	187

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SYLLABUS

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16MA1101	ENGINEERING MATHEMATICS – I (COMMON TO ALL BRANCHES)	3	1	0	4

Course Objective

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2. Find curvature, evolutes and envelopes using the concept of differentiation.
3. Solve ordinary differential equations of certain types using Wronskian technique.
4. Familiarize the functions of several variables which are needed in many branches of engineering.
5. Understand the concept of double and triple integrals.

Unit	Description	Instructional Hours
I	**MATRICES** Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley - Hamilton Theorem (excluding proof) – Orthogonal matrices – Diagonalization of matrices by orthogonal transformation–Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**DIFFERENTIAL CALCULUS** Curvature in cartesian co-ordinates – Radius and Centre of curvature - Circle of curvature – Involutes and Evolutes(parabola, ellipse, cycloid, asteroid) – Envelopes - single parameter and two parameter family of curves.	12
III	**ORDINARY DIFFERENTIAL EQUATIONS** Second and higher order linear differential equations with constant coefficients and with RHS of the form e^{ax} , x^n, sinax or cosax , $e^{ax}f(x)$ and $xf(x)$ where $f(x)$ is sinbx or cosbx – Method of variation of parameters – Linear differential equations with variable coefficients (Euler's equation)	12
IV	**FUNCTIONS OF SEVERAL VARIABLES** Total differentiation (excluding implicit functions) - Partial derivatives of composite functions - Taylor's series for functions of two variables- Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers – Jacobians.	12
V	**MULTIPLE INTEGRALS** Double integrals in Cartesian coordinates – Change of order of integration – Area enclosed by the plane curves (excluding surface area) – Triple integrals in Cartesian co-ordinates – Volume of solids using Cartesian co-ordinates.	12
	TOTAL INSTRUCTIONAL HOURS	**60**

Course Outcome

CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibrational modes
CO2: Apply the concept of differentiation to find the radius, centre and circle of curvature of any curve
CO3: Develop sound knowledge of techniques in solving ordinary differential equations that model engineering problems
CO4: Identify the maximum and minimum values of surfaces.
CO5: Computation of area of a region in simpler way by changing the order of integration and evaluation of triple integrals to compute volume of three dimensional solid structures

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.
T2- Veerarajan T, "Engineering Mathematics–I", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016

REFERENCE BOOKS :

R1-Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
R2- Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning.2012.
R4-Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol I, Second Edition, Pearson publishing, 2011.
R5- Wylie & Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16PH1101	ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	3	0	0	3

Course Objective

1. Illustrate the fundamental knowledge in mechanical properties of matter and thermal physics.
2. Gain knowledge about laser and their applications.
3. Conversant with principles of optical fiber, types and applications of optical fiber.
4. Discuss the architectural acoustics and applications of Ultrasonics.
5. Extend dual nature of matter and the Necessity of quantum mechanics to explore the behavior of sub atomic particles.

Unit	Description	Instructional Hours
I	**PROPERTIES OF MATTER AND THERMAL PHYSICS** Elasticity – Hooke's law – Stress-strain diagram - Relation between three modulii of elasticity (qualitative) — Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending – I-shaped girder. Modes of heat transfer – Thermal conductivity – Newton's law of cooling - Lee's disc method - Conduction through compound media (series and parallel).	9
II	**LASER AND APPLICATIONS** Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Types of lasers – Nd:YAG laser, CO2 laser, Semiconductor lasers:(homojunction and heterojunction) – Laser Applications – Industrial applications: laser welding, laser cutting, laser drilling – Holography – Construction and reconstruction of images.	9
III	**FIBER OPTICS AND APPLICATIONS** Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Crucible-crucible technique for fiber fabrication – Sources (LED and LASER) and detectors (p-i-n photodiode and avalanche photodiode) for fiber optics - Fiber optical communication link –Fiber optic sensors – Temperature and displacement sensors.	9
IV	**ACOUSTICS AND ULTRASONICS** Classification of sound – Weber–Fechner law – Sabine's formula (no derivation) - Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies. Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Non destructive testing – Ultrasonic pulse echo system.	9
V	**QUANTUM PHYSICS AND APPLICATIONS** Black body radiation – Planck's theory (derivation) –Compton effect experimental verification only - Matter waves – Physical significance of wave function – Schroedinger's wave equations – Time independent and time dependent wave equations –Particle in a box (One dimensional) – Scanning electron microscope – Transmission electron microscope.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

CO1: Enhance the fundamental knowledge in Properties of Matter and Thermal Physics.
CO2: Understand the advanced technology of LASER in the field of Engineering and medicine.
CO3: Exposed the fundamental knowledge of Optical fiber in the field of communication Engineering.
CO4: Understand the production of ultrasonics and its applications in NDT.
CO5: Impart the fundamental knowledge on Quantum Physics.

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications(P) Ltd., New Delhi, 2013.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2010
R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi, 2014
R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2013

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16CY1101	ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	3	0	0	3

Course Objective

1. The student should be conversant with boiler feed water requirements, related problems and water treatment techniques.
2. The student should be conversant with the principles of polymer chemistry and engineering applications of polymers and composites
3. The student should be conversant with the principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
4. To acquaint the student with important concepts of spectroscopy and its applications.
5. To acquaint the students with the basics of nano materials, their properties and applications

Unit	Description	Instructional Hours
	WATER TECHNOLOGY	
I	Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, calculations, estimation of hardness of water – EDTA method - scales and sludges – boiler corrosion – priming and foaming – caustic embrittlement; Conditioning methods of hard water – External conditioning - demineralization process- Internal conditioning - domestic water treatment: screening, sedimentation, coagulation, filtration, disinfection – chlorine – UV method; desalination: definition, reverse osmosis.	9
	POLYMER & COMPOSITES	
II	Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Teflon – moulding of plastics (extrusion and compression); rubber: vulcanization of rubber, synthetic rubber – butyl rubber, SBR; composites: definition, types of composites – polymer matrix composites – FRP.	9
	ENERGY SOURCES AND STORAGE DEVICES	
III	Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	9
	ANALYTICAL TECHNIQUES	
IV	Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – interferences - estimation of nickel by atomic absorption spectroscopy.	9
	NANOMATERIALS	
V	Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: definition, carbon nanotubes (CNT), types of carbon nano tubes – single walled and multi walled carbon nanotubes – synthesis of carbon nanotubes: chemical vapour deposition – laser ablation – arc-discharge method; properties of CNT: mechanical, electrical, thermal and optical properties; applications of carbon nanotubes in chemical field, medicinal field, mechanical field and current applications.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

CO1: Illustration of the basic parameters of water, different water softening processes and effect of hard water in industries.
CO2: Knowledge on basic properties and application of various polymers and composites as an engineering material.
CO3: Summarize the various energy sources and energy storage devices
CO4: Analyze various analytical skills in handling various machines, instruments, apart from understanding the mechanism involved.
CO5: Describe the basic properties and application of nano materials.

TEXT BOOKS

T1 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2015).
T2 - O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCES

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
R2 - B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2005).
R3 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2010).

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16HE1101R	ESSENTIAL ENGLISH FOR ENGINEERS – I (COMMON TO ALL BRANCHES)	3	1	0	4

Course Objective

1. It fulfills the necessary skills needed in today's global workplaces.
2. Student will be able to interpret and illustrate formal communication.
3. It empowers students in choosing right lexical techniques for effective presentation
4. It equips the learner to analyze and list out things in logical order
5. The learner develops the ability to create and integrate ideas in a professional way.

Unit	Description	Instructional Hours
I	Getting to know people – Introduction – Talking about jobs (Present Simple) – Talking about working conditions (Adverb of Frequency) - Talking about company history and structure (Past simple. Prepositions of Time) – Talking about company activities (Connectors of addition and contrast. Present Continuous) – Focus on language – Parts of Speech – Gerund and Infinitives – Instruction-**General Vocabulary**.	12
II	Vocabulary practice – (Telephoning Leaving and taking messages) – requests and obligation – Describing trends (Adjectives and Adverbs) – Talking about company performance (present perfect and past simple. Reasons and consequences) – Reading Test Practice Describing products Dimensions. (Comparatives and Superlatives, Question formation) – Talking about product development (Sequencing words. Present continuous and going to) – Articles – Prepositions- Synonyms – Antonyms- Recommendations-**Interpretation of a chart**.	12
III	Talking about business equipment (Giving Instruction) – Letter Phrases- Writing Test Practice- Talking about facilities (Asking for and giving direction)- Presentation on a general topic -Talking about traffic and transport making predictions)-**Discussion on current affairs**– Tenses- Present –Past-Future-Forms of verbs- Word techniques- Formation-Prefixes-Suffixes.	12
IV	Talking about conference arrangement (checking and confirming) – Talking about a conference before. after. when. until etc. – Listening Test Practice- talking about production process – passive- Talking about quality control Conditional 1 (real) (Making suggestions) – Itinery- Jumbled sentences- Paragraph writing- Essay writing – Checklist- Letter to Inviting Dignitaries – Accepting invitation- Declining Invitation.	12
V	Talking about call centers. insurance and changes in working practices (future possibility/probability)- Talking about banking- Speaking Test practice – Talking about delivery services (preposition of Time)- Talking about trading (Tense review)- Talking about recruitment conditional 2 (hypothetical) – talking about job applications (indirect questions) – Reading. Writing and Listening Test – Job application Letter and Resume Writing- Permission letters.	12
	TOTAL INSTRUCTIONAL HOURS	**60**

Course Outcome

CO1: Recognize different parts of speech for better usage.
CO2: Interpret and illustrate formal communication
CO3: Choosing right lexical techniques for effective presentation.
CO4: Analyze and list out things in logical order.
CO5: Create and integrate ideas in a professional way.

TEXT BOOKS:

T1 - Norman Whitby. Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.
T2 - Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

REFERENCE BOOKS :

R1 - Meenakshi Raman and Sangeetha Sharma. "Technical Communication-Principles and Practice", Oxford University Press, 2009.
R2 - Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
R3 - Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16GE1103	PROBLEM SOLVING AND PYTHON PROGRAMMING	3	0	0	3

Course Objective

1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs
3. To develop Python programs with conditionals and loops
4. To define Python functions and call them
5. To use Python data structures – lists, tuples, dictionaries
6. To do input/output with files in Python

UNIT	DESCRIPTION	TOTAL INSTRUCTIONAL HOURS
I	**ALGORITHMIC PROBLEM SOLVING** Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudocode, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems:To find the greatest among three numbers, prime numbers,find minimum in a list, Towers of Hanoi	9
II	**DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list;variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, compute Simple interest for a given amount, Factorial of a given number ,distance between two points.	9
III	**CONTROL FLOW, FUNCTIONS** Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if –elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.	9
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing -list comprehension; Illustrative programs: selection sort, insertion sort, histogram.	9
V	**FILES, MODULES, PACKAGES** Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count,copy file.	9
	TOTAL INSTRCTIONAL HOURS	**45**

Course Outcome

Upon completion of the course, students will be able to
CO1:Develop algorithmic solutions to simple computational problems
CO2:Structure simple Python programs for solving problems.
CO3:Decompose a Python program into functions.
CO4:Represent compound data using Python lists, tuples, dictionaries.
CO5:Read and write data from/to files in Python Programs.

TEXT BOOKS:

T1 –Ashok NamdevKamthane ,Amit Ashok Kamthane ," Programming and Problem solving with Python" McGrawHill Education

T2-Sheetal Taneja, "Python Programming A Modular Approach With Graphics,Database,Mobile and Web Applications, PEARSON .

REFERENCE BOOKS:

R1 - ReemaThareja" Python Programming Using Problem Solvimg Approach " OXFORD.
R2-E.Balagurusamy, "Problem solving and Python Programming" McGrawHill Education

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1102	ENGINEERING GRAPHICS	3	1	0	4

Course Objective
1. To provide drafting skills for communicating the Engineering concepts and ideas
2. To expose to BIS and International standards related to engineering drawings

Unit	Description	Total Hours
I	**PLANE CURVES** Importance of engineering drawing, drafting instruments, drawing sheets – layout and folding. Lettering and dimensioning. BIS standards and scales Geometrical constructions, Construction of ellipse, parabola and Hyperbola by eccentricity method, construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	15
II	**PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	15
III	**PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane and objects inclined to both the planes by rotating object method.	15
IV	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids. Intersection of solids-cylinder vs cylinder.	15
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections of simple and truncated solids such as - Prisms, pyramids, cylinders, cones-combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Perspective projection of solids in simple position using visual ray method.	15
	Total Instructional Hours	**75**

Course Outcome
CO1: Draw the orthographic and isometric views of regular solid objects including sectional views.
CO2:Recognize the International Standards in Engineering Drawing practices.
CO3: Draw the section of solids and development of surfaces of the given objects.
CO4: Draw the isometric projections and perspective projections of the given solids.
CO5: Introduce CAD software to draw simple two dimensional drawings.

TEXT BOOKS:

T1 - K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th Edition New Age International Publishers, New delhi 2016.
T2 - K.V.Natarajan, "A textbook of Engineering Graphics", Dhanalaksmi Publishers, Chennai.

REFERENCE BOOKS:

R1 - BasantAgrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited,New Delhi 2008.
R2 - K. R. Gopalakrishnan, "Engineering Drawing" (Vol. I & II), Subhas Publications, Bangalore, 1998.
R3 - M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson Education, India, 2005.
R4 - N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University press, India 2015.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16PS1001	PHYSICAL SCIENCES LAB – I	0	0	2	1

PHYSICS LAB - I

Course Objective

1. Evaluate the particle size of micro particles and acceptance angle of fibres
2. Employ instrumental method to determine Young's modulus of a beam of metals
3. Apply the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum

Expt. No.	Description of the Experiments
1.	Determination of Wavelength, and particle size using Laser
2.	Determination of acceptance angle and numerical aperature in an optical fiber.
3.	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4.	Determination of wavelength of mercury spectrum – spectrometer grating
5.	Determination of thermal conductivity of a bad conductor – Lee's Disc method
6.	Determination of Young's modulus by Non uniform bending method
7.	Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
8.	Post office box Measurement of an unknown resistance

TOTAL PRACTICAL HOURS 30

Course Outcome

CO1: Point out the particle size of micro particles and acceptance angle of fibres using diode laser.
CO2: Assess the Young's modulus of a beam using non uniform bending methods.
CO3: Illustrate the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum Using spectrometer.
CO4: Identify the velocity of ultrasonic's in the given liquid.
CO5: Illustrate phenomena of thermal conductivity of a bad conductor.

CHEMISTRY LAB-I

Course Objective

1. Acquire practical skills in the determination of water quality parameters.
2. Acquaint the students with the determination of molecular weight of a polymer by viscometry.
3. Acquaint the students with the estimation of chemical substances using instrumental analysis techniques.

Expt. No.	Description of the Experiments
1.	Preparation of molar and normal solutions and their standardization.
2.	Estimation of total, permanent and temporary hardness of Water by EDTA
3.	Determination of chloride content of water sample by argentometric method.
4.	Determination of available chlorine in bleaching powder.
5.	Conductometric titration of strong acid vs strong base (HClvsNaOH).
6.	Conductometric titration (Mixture of weak and strong acids)
7.	Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4
8.	Determination of molecular weight and degree of polymerization using viscometry.
9.	Estimation of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).

Total Practical Hours 30

Course Outcome

CO1: Estimate the different types of hardness in a water sample.
CO2: Determine the chloride content of water sample.
CO3: Calculate the strength of acid using conductometric titrations.
CO4: Calculate the strength of strong and weak acid using conductometric titrations.
CO5: Estimate the amount of salt using conductometric precipitation titrations.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16GE1004	PROBLEM SOLVING AND PYTHON PROGRAMMING LAB	0	0	4	2

Course Objective

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python.

Ex.No	DESCRIPTION	TOTAL INSTRUCTIONAL HOURS
1	Compute the GCD of two numbers.	3
2	Find the square root of a number	3
3	Exponentiation (power of a number)	3
4	Find the factorial of a given number	3
5	Print prime numbers from 1 to n numbers	3
6	Find the maximum of a list of numbers	3
7	Linear search , Binary search	3
8	Selection sort, Insertion sort	3
9	First n prime numbers	3
10	Multiply matrices	3
11	Programs that take command line arguments(word count)	3
12	Find the most frequent words in a text read from a file	3
13	Simulate bouncing ball using Pygame	3
	TOTAL INSTRCTIONAL HOURS	**45**

Course Outcome

CO1: Write, test, and debug simple Python programs.
CO2: Implement Python programs with conditionals and loops.
CO3:Develop Python programs step-wise by defining functions and calling them.
CO4:Use Python lists, tuples, dictionaries for representing compound data.
CO5:Read and write data from/to files in Python.

PLATFORM NEEDED: Python 3 interpreter for Windows/Linux

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1002	ENGINEERING PRACTICES LABORATORY	0	0	4	2

Course Objective: To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

Expt. No. — **Description of the Experiments**

I CIVIL ENGINEERING PRACTICE

Study of plumbing and carpentry components of Residential and Industrial buildings.

(A) PLUMBING WORKS.

1. Study on pipe joints, its location and functions: Valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connection requirements for pumps.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise:
   - Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

(B) CARPENTRY USING POWER TOOLS ONLY:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise in wood works by sawing, planning and cutting.

IIMECHANICAL ENGINEERING

(A) Welding:

1. Preparation of arc welding of Butt joints, Lap joints and Tee joints.

(B) Machining:

1. Practice on Simple step turning and taper turning.
2. Practice on Drilling Practice.

(C) Sheet Metal Work:

1. Practice on Models– Trays, cone and cylinder.

DEMONSTRATION

(D) Smithy

- Smithy operations: Upsetting, swaging, setting down and bending.
- Demonstration of – Production of hexagonal headed bolt.

Gas welding

Foundry Tools and operations.

GROUP B (ELECTRICAL & ELECTRONICS)

S.No — Description of the Experiments

ELECTRICAL ENGINEERING PRACTICES

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring

3 Stair case wiring

4 Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit

5 Measurement of energy using single phase energy meter

ELECTRONICS ENGINEERING PRACTICES

1 Study of Electronic components and equipments – Resistors - colour coding

2 Measurement of DC signal - AC signal parameters (peak-peak, RMS period, frequency) using CRO

3 Study of logic gates AND, OR, NOT and NAND

4 Soldering practice – Components Devices and Circuits – Using general purpose PCB

5 Measurement of average and RMS value of Half wave and Full Wave rectifiers

Total Practical Hours **45**

Course Outcome

CO1: Fabricate wooden components and pipe connections including plumbing works.
CO2: Fabricate simple weld joints.
CO3: Fabricate electrical and electronics circuits.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16GE1003	VALUE ADDED COURSE-I LANGUAGE COMPETENCY ENHANCEMENT COURSE - 1 (COMMON TO ALL BRANCHES)	0	0	2	1

Topic No.	Description of the Experiments
1.	INTRODUCTION TO AERONAUTICAL ENGINEERING
2.	LEADERSHIP FOR ENGINEERS
3.	4G – NETWORK ESSNTIALS
4.	COMP. SCIENCE ESSENTIALS FOR SOFTWARE DEVELOPMENT
5.	INTRODUCTION ANALYTICS MODELLING
6.	MATERIAL SCIENCE AND ENGINEERING
	Total Marks 100

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II SEMESTER

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA2102	ENGINEERING MATHEMATICS–II (Vector Calculus, Complex variables, and Laplace transforms)	3	1	0	4

Course Objective

1. Learn the basics of vector calculus comprising gradient, divergence, Curl and line, surface, volume integrals
2. Understand analytic functions of complex variables and conformal mappings.
3. Know the basics of residues, complex integration, and contour integration
4. Apply Laplace transform techniques to solve linear differential equations.
5. Know the effective mathematical tools for the solutions of partial differential equations that model several physical problems in mathematical physics

Unit	Description	Instructional Hours
I	**VECTORCALCULUS** Gradient, divergence and curl–Directional derivative–Irrotational and solenoidal vector fields– Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs)–Simple applications involving cubes and rectangular parallelopipeds.	12
II	**ANALYTIC FUNCTIONS** Analytic function -Cauchy-Riemann equations -sufficient conditions (excluding proof) – Harmonic - conjugate harmonic functions– Construction of analytic functions (Milne-Thompson method)–Conformal mapping w= z+c,cz, 1/z and bilinear transformation without problems related to the concept of conformal mapping.	12
III	**COMPLEX INTEGRATION** Complex integration–Statements of Cauchy's integral theorem – Taylor's and Laurent's series expansions - Singular points–Residues–Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle.	12
IV	**LAPLACETRANSFORM** Laplace transform–Basic properties –Transforms of derivatives and integrals of functions-Transforms of unit step function and impulse function–Transform of periodic functions. Inverse Laplace transform-Convolution theorem (without proof) – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.	12
V	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions-Solution of standard types of first order partial differential equations of the form f(p,q) = 0, Clairaut's type: z = px + qy + f(p, q) – Lagrange's linear equation- Linear homogeneous partial differential equations of second and higher order with constant coefficient.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Know the gradient, divergence, and curl of vectors useful for engineering application like fluid flow, electricity and magnetism.
CO2: Test the analyticity to construct the analytic function and transform complex functions from one plane to another plane graphically.
CO3: Evaluate real and complex integrals over suitable closed paths or contours.
CO4: Know the applications of Laplace transform and its properties and to solve certain linear differential equations using Laplace transform technique.
CO5: Solve the engineering problems using Partial Differential Equations.

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd., Chennai,2017.
T2- Veerarajan T, "Engineering Mathematics–II", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016

REFERENCE BOOKS:

R1-BaliN.P &Manish Goyal, "ATextbookofEngineeringMathematics",8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
R2- Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.
R4-Sivarama Krishna Das P and Rukmangadachari E.," Engineering Mathematics" Vol II, Second Edition, Pearson publishing, 2011.
R5- Wylie &Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PH2102	PHYSICS OF MATERIALS	3	0	0	3

Course Objective

1. Gain knowledge about conducting materials.
2. Provide fundamental knowledge of semiconducting materials which is related to the engineering program.
3. Extend the properties of magnetic materials, applications and super conducting materials.
4. Defend the various types of dielectric materials and their uses.
5. Expose the students to smart materials and the basis of nano technology.

Unit	Description	Instructional Hours
I	**CONDUCTINGMATERIALS** Introduction – Conductors – Classical free electron theory of metals – Electrical and thermal conductivities – Wiedemann–Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.	9
II	**SEMICONDUCTING MATERIALS** Introduction – Intrinsic semiconductor – Compound and elemental semiconductor (direct and indirect band gap of semiconductors). carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – Extrinsic semiconductor - derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.	9
III	**MAGNETIC & SUPERCONDUCTING MATERIALS** **Magnetic Materials**: Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications. **Superconducting Materials :** Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.	9
IV	**DIELECTRIC & COMPOSITES MATERIALS** Introduction – Electrical susceptibility – dielectric constant – polarization - electronic, ionic, orientation and space charge polarization –internal field – Claussius – Mosotti relation (derivation) – dielectric loss and dielectric breakdown (qualitative) Introduction to composites materials – types of composites materials – polymer, metallic and ceramic matrix composites (qualitative). Application in surgery, sports equipment.	9
V	**SMART MATERIALS AND NANOTECHNOLOGY** **New Engineering Materials:** Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications. **Nano Materials**: Synthesis - plasma arcing – Chemical vapour deposition – properties of nanoparicles and applications. – Carbon nano tubes – fabrication – pulsed laser deposition - Chemical vapour deposition - properties & applications.	9
	Total Instructional Hours	**45**

Course Outcome

CO1:Illustrate the electrical / thermal conductivity of conducting materials.
CO2: Understand the purpose of the acceptor or donor levels and the band gap of a semiconductor.
CO3: Interpret the basic idea behind the process of magnetism and applications of magnetic materials in every day life
CO4: Identify and compare the various types of dielectric polarization and dielectric breakdown.
CO5: Evaluate the properties and applications of various advanced engineering materials and develop the new ideas to synthesis Nanomaterials.

TEXT BOOKS:

T1 - S.O.Pillai "Solid State Physics" New Age International Publishers, New Delhi – 2011
T2- Rajendran V "Materials Science" McGraw-Hill Education" New Delhi -2016.

REFERENCE BOOKS:

R1 – William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2014.
R2 -Raghavan, V. "Materials Science and Engineering – A First Course" Prentice Hall of India, New Delhi 2016.
R3 -Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2013

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CY2102	ENVIRONMENTAL SCIENCES	3	0	0	3

Course Objective

1. To gain knowledge on the importance of environmental education, ecosystem and biodiversity.
2. To acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. To find and implement scientific, technological, economic and political solutions to environmental problems.
4. To study about the natural resources, exploitation and its conservation
5. To be aware of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- energy flow in the ecosystem – ecological succession processes – 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 – biogeographical 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.	9
II	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution – Air pollution standards – control methods- Water pollution – Water quality parameters- Soil pollution - Marine pollution - Noise pollution- Thermal pollution - Nuclear hazards–role of an individual in prevention of pollution – pollution case studies.	9
III	**NATURAL RESOURCES** 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 overutilization of surface and ground 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. 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.	9
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – urban problems related to energy- energy conversion – electrical energy calculations- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Current Environmental issues at Country level – management of municipal sewage, municipal solid waste, Hazardous waste and Bio-medical waste – Global issues – Climatic change, Acid rain, greenhouse effect and Ozone layer depletion. Disaster management: floods, earthquake, cyclone and landslides.	9

V	**HUMAN POPULATION AND THE ENVIRONMENT** Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health – Case studies.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the natural environment and its relationships with human activities.
CO2: Characterize and analyze human impacts on the environment
CO3: Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes
CO4: Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
CO5: Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.

TEXT BOOKS:

T1- Anubha Kaushik and C. P. Kaushik, "Environmental Science and Engineering", Fourth edition, New Age International Publishers, New Delhi, 2014.

T2 – Deeksha Dave and S.S.Katewa, "Textbook of Environmental Studies", Second Edition, Cengage Learning, 2012.

REFERENCES:

R1 - Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.

R2 - G.Tyler Miller, Jr and Scott E. Spoolman"Environmental Science" Thirteenth Edition, Cengage Learning, 2010.

R3 - Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16HE2102R	ESSENTIAL ENGLISH FOR ENGINEERS – II	3	1	0	4

(COMMON TO ALL BRANCHES)

Course Objective

- ✓ The learner will be introduced to global corporate culture and professional communication.
- ✓ It helps the students to focus on organizing professional event and documentation.
- ✓ The student will be able to describe the events and process in an effective way.
- ✓ It trains the student to analyze the problems and to find solution to it.
- ✓ The learner will be familiar with business communication.

Unit	Description	Instructional Hours
I	Introduction- talking about teamwork- Making arrangements- Improving Communication in spoken language – Taking and leaving Voice mail messages (present Tense, Past Tense and Present Perfect) Talking about Business Hotel- (Speaking Activity) Talking about Corporate Hospitality- Formal and Informal Language – Making accepting and declining invitations (Auxiliary Verb, Countable or Uncountable Nouns) – Focus on Language – Definitions and Extended Definitions-**Reading comprehension.**	12
II	Talking about orders – Clarity Written Language – Phone and Letter Phrases – Talking about Company Finances – Conditional 1 and 2 – Managing Cash Flow (Intention and Arrangements Conditional 1 and 2) – Talking about Brands and Marketing – Ethical Banking- Talking about Public Relations – Organizing a PR Event – Describing Duties and Responsibilities – (Future Tense and Articles) – Reported Speech – Modal Verbs and Passive, Impersonal Passive Voice-**interpretation of posters or advertisements.**	12
III	Talking about relocation – Report Phrases – Talking about Similarity and difference- Giving Directions- Asking for Information and Making Suggestions – Talking about Location (Comparatives and Superlatives, Participles) – Talking about Company Performances- Describing Trends – Describing Cause and Effect – Talking about Environmental Impact – Discussing Green Issues – Language of Presentations (Adjectives and Adverbs, Determiners)- Homophones – Homonyms-Acronyms-Abbreviations- British and American words.	12
IV	Talking about Health and Safety – Expressing Obligation- Discussing Regulations- Talking about personnel Problems – Passives – Talking about Problem at Work (modal Verbs, Passives)- Talking about Expenses Claims- Talking about Air Travel (Relative Pronoun, Indirect Questions) – **E-mail Writing - Note completion-** Transcoding.	12
V	Talking about staff Benefits- Talking about Appraisal Systems (gerunds and Infinitives, Reported Speech) – Talking about Marketing Disasters – Expressing hypothetical Situations- Talking about entering Foreign Market (Conditional 3, Grammar review) – Letter for calling quotations, Replying for quotations – Placing an order and Complaint and **reply to a complaint**.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Introduced corporate culture and professional communication.
CO2: It focused on organizing a professional event and its documentation.
CO3: Improved the ability to describe the events and process in an effective way
CO4: Trained to analyze the problems and to find solution to it.
CO5: Practiced to make business communication.

TEXT BOOKS:

T1 - Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition, 2014.
T2 - Ian Wood and Anne Willams, "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

REFERENCE BOOKS :

R1 - Communication Skills for Engineers, Sunitha Misra & C.Murali Krishna, Pearson Publishers
R2 - Technical Communication, Daniel G. Riordan, Cengage learning publishers.
R3 - Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan,2010.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16GE2101	ENGINEERING MECHANICS	3	1	0	4

Course Objective

The main objectives of the course are to:

. Understand the vector and scalar representation of forces and moments
. Understand the static equilibrium of particles and rigid bodies both in two dimensions.
. Understand the principle of work and energy.
. Comprehend the effect of friction on equilibrium.
. Write the dynamic equilibrium equation.

UNIT	DESCRIPTION	TOTAL HOURS
I	**BASICS & STATICS OF PARTICLES** Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vector representation of forces and moments – 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.	12
II	**EQUILIBRIUM OF RIGID BODIES** 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– Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of Rigid bodies in two dimensions.	12
III	**PROPERTIES OF SURFACES AND SOLIDS** 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.	12
IV	**DYNAMICS OF PARTICLES** 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. Co-efficient of restitution.	12
V	**FRICTION** Frictional force – Laws of Coloumb friction – Simple contact friction – Rolling resistance – Wedge friction - Belt friction, Applications of friction.	12
	TOTAL INSTRUCTIONAL HOURS	**60**

Course Outcome

The outcomes of the course are the students shall have the ability:

CO1: To solve engineering problems dealing with force, displacement, velocity and acceleration.
CO2: To analyze the forces in any structure.
CO3: To solve rigid body subjected to dynamic forces.

TEXT BOOKS:

1. F.P.Beer, and Jr. E.R.Johnston., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).

REFERENCE BOOKS:

1. R.C.Hibbeller, and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. S.Rajasekaran and G.Sankarasubramanian, "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
3. S.S.Bhavikatti, and K.G.Rajashekarappa, "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16EE2202	BASICS OF ELECTRONICAL AND ELECTRONICS ENGINEERING	3	0	0	3

Course Objective

1. To explain the basic electronic circuits and the different components.
2. To explain the fundamentals of semiconductor and applications.
3. To explain the fundamentals of power supply circuits.
4. To explain the principles of digital electronics.
5. To impart knowledge of communication engineering

Unit	Description	Instructional Hours
I	**ELECTRIC CIRCUIT ANALYSIS** Ohm's Law – Kirchoff's Laws – Series and Parallel circuits –Voltage and Current division techniques - Mesh current and Node voltage method for DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase Circuits – R,RL,RC,RLC Circuits.	15
II	**SEMI CONDUCTOR DEVICES AND APPLICATIONS** Characteristics of PN Junction Diode – Zener Diode and its Characteristics – Zener Effect – Voltage Regulation. Bipolar Junction Transistor (BJT) – CB, CE, CC Configurations and Characteristics, UJT -Characteristics.	15
III	**POWER TRANSISTORS AND POWER SUPPLY CIRCUITS** Halfwave and Fullwave Rectifier - Filter Types - Capacitive Filter - Configurations and Characteristics of SCR – FET – MOSFET - Linear Mode & Switched Mode Power Supply (Block Diagram Approach only)	15
IV	**DIGITAL ELECTRONICS** Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops: RS, JK, T & D FF – A/D and D/A Conversion (Dual Slope, SAR, Binary-weighted and R-2R)	15
V	**FUNDAMENTALS OF COMMUNICATION ENGINEERING** Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations - Satellite and Optical Fiber communication (Block Diagram Approach only).	15
	TOTAL INSTRUCTIONAL HOURS	**60**

Course Outcome

CO1: Ability to identify the electronic components
CO2: Ability to explain the characteristics of electronic devices.
CO3: Ability to understand power transistors and design power supply circuits.
CO4: Understand the basic principles of digital electronics.
CO5: Understand the fundamentals of Communication Engineering.

TEXT BOOKS:

T1 - Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.
T2 - David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 2004.

REFERENCE BOOKS :

R1 - Mehta V K, "Principles of Electronics", S.Chand& Company Ltd, 1994.
R2 - Donald A Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3rd Edition, 2003.
R3 - Floyd, "Electron Devices", Pearson Asia 5th Edition, 2001.
R4 - MSedha R.S., "Applied Electronics", S. Chand & Co., 2006.
R5 - Wayne Tomasi, "Electronic Communication Systems", Pearson Education, 3rd Edition,2001.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16PS2001	PHYSICAL SCIENCES LABORATORY – II (COMMON TO ALL BRANCHES)	0	0	2	1

PHYSICS LAB-II

Course Objective

1. Evaluate the band gap of a semiconductor.
2. Apply the concept of interference and calculate the thickness of thin wire.
3. Acquire the practical skills in Young's modulus by uniform bending method.

Expt. No.	Description of the Experiments
1.	Determination of Young's modulus by uniform bending method
2.	Determination of band gap of a semiconductor
3.	Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4.	Determination of Dispersive power of a prism – Spectrometer
5.	Determination of thickness of a thin wire – Air wedge method
6.	Determination of Rigidity modulus – Torsion pendulum
7.	Magnetic hysteresis experiment
8.	Calibration of ammeter using potentiometer

TOTAL PRACTICAL HOURS 30

Course Outcome

CO1: Experiment involving the physical phenomena of the Rigidity modulus of wire.
CO2: Determine the band gap of a semiconductor and variation of Energy Gap (E_g) with temperature.
CO3: Assess the Young's modulus of a beam using non uniform bending method.
CO4: Explain the concept of interference and calculate the thickness of thin wire and other fine objects.
CO5: Experiment provides a unique opportunity to validate Dispersive power of a prism using Spectrometer.

CHEMISTRY LAB – II

Course Objective

1. Acquire practical skills in the quantitative analysis of water quality parameters.
2. Acquire practical skills in the instrumental methods for quantitative estimation of metal ion content.
3. Gain knowledge in determination of rate of corrosion.

Expt. No.	Description of the Experiments
1.	Determination of Dissolved Oxygen in water by Winkler's method.
2.	Estimation of alkalinity of water sample by indicator method.
3.	Estimation of hydrochloric acid by pH metry.
4.	Estimation of ferrous iron by Potentiometry.
5.	Estimation of Copper by EDTA
6.	Determination of sodium by flame photometry
7.	Determination of corrosion rate of mild steel by weight loss method.

Total Practical Hours 30

Course Outcome

CO1: Determine the level of DO in a water sample.
CO2: Identify and estimate the different types of alkalinity in water sample.
CO3: Estimate the acidity of water sample using pH metry.
CO4: Estimate the amount of copper in a brass sample.
CO5: Determine the metal ion content using instrumental methods.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16ME2001	COMPUTER AIDED DRAFTING LABORATORY (COMMON TO AERO, AUTO, MECH & MECHATRONICS))	0	0	4	2

Course Objective
1. To develop skills on using software for preparing 2D Drawings.
2. To provide the importance of computer aided drawing in engineering society.

S.No	Description Of The Experiments	Total Practical Hours

Concepts and Conventions:
Understand the basic idea of software and its features like draw panel, modify panel, line types, creating dimensions, hatching techniques, layer Creations, text styles, and template drawings, use of Blocks, Design Center, Tool Palettes and Plotting.

LIST OF EXERCISES USING DRAFTING SOFTWARE

1	Study of drafting software– Coordinate systems (absolute, relative, polar, etc.) – Creation of simple geometries like polygon and general multi-line figures.
2	Drawing the conic and special curves.
3	Draw the orthographic projections of simple solids like Prism, Pyramid, Cylinder, Cone and its dimensioning.
4	Draw the symbols of fasteners, weld, rivets, bolts nuts and screws.
5	Drawing Isometric projection of simple objects.
6	Draw the orthographic projections of Bush bearing.
7	Draw the orthographic projections of Oldham's coupling.
8	Draw the orthographic projections of cotter joint.
9	Draw the orthographic projections of simple gate valve.
10	Draw the Plan and Elevation of simple Residential Building.
	Total Instructional Hours **45**

Course Outcome
The outcome of the course are:
CO1: The students shall be able to use the software package for drafting
CO2: The students shall be able to create 2D Drawing of Engineering Components
CO3: The students shall be able to apply basic concepts to develop construction drawing techniques

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16GE2001	VALUE ADDED COURSE-II: LANGUAGE COMPETENCY ENHANCEMENT COURSE -II (COMMON TO ALL BRANCHES)	0	0	2	1

Topic No.	Description of the Experiments
1.	A HANDS ON INTRODUCTION TO ENG.SIMULATIONS
2.	INTRODUCTION STEEL
3.	ENTERPRENUER DEVELOPMENT
4.	DRINKING WATER TREATMENT
5.	MECHANICAL BEHAVIOUR OF MATERIALS (LINEAR ELASTIC
6.	FASCINATING WORLD OF ROBOTS AND ROBOTICS
	Total Marks 100

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA3103	FOURIER ANALYSIS AND STATISTICS	3	1	0	4

(COMMON TO AERO, AUTO, MECH, EEE AND E&I)

Course Objective

1. Introduce Fourier series analysis which is central to many applications in engineering.
2. Solve boundary value problems by applying Fourier series.
3. Acquaint with Fourier transform techniques used in wide variety of situations.
4. Provide the necessary basic concepts of some statistical methods.
5. Manipulate different kinds of problems occurring in engineering and technology by applying the design of experiments

Unit	Description	Instructional Hours
I	**FOURIER SERIES** Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis. A spring -mass system deriven by an alterating square force, A series circuit with a sqaure –wave voltage, power delievered by a periodic current and modelling radiation intensity..	12
II	**BOUNDARY VALUE PROBLEMS** Classification – solution of one dimensional wave equation – one dimensional heat equation – steady state solutions of two dimensional heat equations (excluding insulated edges) - Fourier series solution in Cartesian coordinates.	12
III	**FOURIER TRANSFORMS** Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem – Parseval's identity.	12
IV	**TESTING OF HYPOTHESIS** Large sample test based on Normal distribution for single mean and difference of means - Tests based on t (for single mean and difference of means) - F distribution – for testing difference of variance, Chi – Square test for Contingency table (Test for Independency) – Goodness of fit	12
V	**DESIGN OF EXPERIMENTS** One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Understand the mathematical principles of Fourier series which would provide them the ability to formulate and solve some of the physical problems of engineering.
CO2: Acquire the knowledge of application of Fourier series in solving the heat and wave equations.
CO3: Obtain the knowledge of Fourier transform techniques which extend its applications in Electrical circuit analysis, control system design and signal processing.
CO4: Acquire skills in analyzing statistical methods.
CO5: Have a clear perception of the statistical ideas and demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

T1 - Veerarajan. T.," Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
T2 - Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Reprint 2011.

REFERENCE BOOKS:

R1 – C.Roy Wylie " Advance Engineering Mathematics" Louis C. Barret, 6th Edition. Mc Graw Hill Education India Private Limited, New Delhi 2003.
R2 - Kandasamy P., Thilagavathy K. and Gunavathy K.,"Engineering Mathematics Volume III", S.Chand & Company Ltd., New Delhi, 1996.
R3- Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition,Pearson Education,Asia,2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE3201	AERO ENGINEERING THERMODYNAMICS	3	0	0	3

Course Objective

6. To provide in-depth study of thermodynamic principles, thermodynamics of state.
7. To teach the basic thermodynamic relations for various equipment's and their flow energy
8. To teach students about properties of pure substances and to analyze the performance of thermodynamic air and vapour power cycles.
9. To teach performance calculation of refrigeration systems.
10. To enlighten the basic concepts of propulsion cycles.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BASIC CONCEPTS AND FIRST LAW** Concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, State, Path and Process, Quasi-static Process, Work, modes of work, Zeroth law of thermodynamics - concept of temperature and heat, internal energy, specific heat capacities, enthalpy - concept of ideal and real gases. First law of thermodynamics - applications to closed and open systems - steady flow processes with reference to various thermal equipment's.	9
II	**SECOND LAW AND ENTROPY** Second law of thermodynamics - Kelvin Planck and Clausius statements of second law. Reversibility and Irreversibility - Carnot theorem, Carnot cycle efficiency - thermodynamic temperature scale - Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.	8
III	**POWER CYCLES** Otto, Diesel, Dual and Brayton cycles - air standard efficiency - mean effective pressure. Properties of pure substances - thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T -S, H-S diagrams, PVT surfaces, thermodynamic properties of steam - calculations of work done and heat transfer in non-flow and flow processes - standard Rankine cycle	10
IV	**REFRIGERATION AND AIR CONDITIONING** Reversed Carnot cycle - COP - principles of refrigeration, air conditioning - heat pumps - vapour compression - vapour absorption types - coefficient of performance, properties of refrigerants.	9
V	**BASICS OF PROPULSION** Classification of jet engines - simple jet propulsion system - thrust equation - specific impulse - ideal and non-ideal cycle analysis - Introduction to rocket propulsion.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Demonstrate an understanding of the concepts such as conservation of mass, conservation of energy, work interaction, heat transfer and first law of thermodynamics.
CO2: Apply the concept of second law to design simple systems and critically analyse the problem of energy flow in various systems.
CO3: Analyze the performance of gas and vapor power cycles and identify methods to improve thermodynamic performance.
CO4: Able to perform the thermodynamic performance analysis in varied refrigeration conditions.
CO5: Apply the thermodynamic principles and laws on the propulsion systems.

TEXT BOOKS:

BOOKS:

T1 - Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
T2 - Rathakrishnan E., "Fundamentals of Engineering Thermodynamics", Prentice-Hall India, 2005.

REFERENCE BOOKS:

R1 - Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006
R2 - Yunus A.Cengal. "Thermodynamics an Engineering Approach", Tata McGraw-Hill Co. Ltd., 3rd Edition, 2002.
R3 - Arora C.P. "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE3202	SOLID MECHANICS	3	0	0	3

Course Objective

1. To introduce various behaviors of materials and analyze the structural components under axial loading conditions.
2. To Sketch the Shear Force and bending moment diagram for beams with various loadings.
3. To calculate the deflections of the beams under various loading conditions.
4. To Predict the Buckling Loads of the columns and to analyze the springs.
5. To give brief descriptions on the behavior of materials due to axial, bending and torsional and combined loads.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Definition of stress, strain and their relations – relations between material constants – axial loading - statically determinate and indeterminate problems in tension & compression.	9
II	**STRESSES IN BEAMS** Shear force & bending moment diagrams: bending and shear stress variation in beams of symmetric sections, beams of uniform strength	9
III	**DEFLECTION OF BEAMS** Double integration method – Macaulay's method – moment area method – conjugate beam method – Maxwell's reciprocal theorem - principle of super position	10
IV	**TORSION – SPRINGS – COLUMNS** Torsion of solid and hollow circular shafts – shear stress variation – open and closed-coiled helical springs – stresses in helical springs - classification of columns – Euler buckling – columns with different end conditions.	10
V	**BIAXIAL STRESSES** Stresses in thin-walled pressure vessels – combined loading of circular shaft with bending, torsion and axial loadings – Mohr's circle and its construction – determination of principal stresses.	7
	Total Instructional Hours	**45**

Course Outcome

CO1: Ability to learn the behaviors of materials under axial loading conditions.
CO2: To draw the Shear Force and bending moment diagram for beams with various loadings.
CO3: To analyze the deflections of the beams under various loading conditions.
CO4: Evaluate the springs and to calculate the Buckling Loads of the columns.
CO5: Ability to draw Mohr's circle for materials due to axial, bending and torsional and combined loads.

TEXT BOOKS:

T1 - William Nash, "Strength of Materials", Tata McGraw Hill, 4th edition, 2010.
T2 - Timoshenko.S. and Young, D.H., 'Elements of Strength of Materials', T.Van Nostrand Co. Inc., Princeton, N.J., 1990.

REFERENCE BOOKS:

R1 - Dym,C.L., and Shames,I.H., 'Solid Mechanics', McGraw Hill, Kogakusha, Tokyo, 1973.
R2 - Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, Third Edition, 2016.
R3-R C Hibbeler, "Mechanics of materials", Pearson Education Inc Sixth Edition, 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE3203	ENGINEERING FLUID MECHANICS	3	0	0	3

Course Objective

1. To be familiar with the fluid properties and flow characteristics
2. To understand the importance of conservation laws to flow through circular conduits.
3. To comprehend the importance of dimensional analysis
4. To examine the performance of Pumps
5. To examine the performance of Turbines

Unit	Description	Instructional Hours
I	**PROPERTIES OF FLUID AND FLOW CHARACTERISTICS** Units and dimensions - Properties of fluids - Continuum, density, viscosity, surface tension, compressibility and bulk modulus, concept of pressure. Flow characteristics - concept of control volume - application of continuity equation, momentum and energy equation.	8
II	**FLOW THROUGH CIRCULAR CONDUITS** Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli - Boundary layer concepts - types of boundary layer thickness - Darcy Weisbach equation - friction factor - Moody diagram - commercial pipes - minor losses - Flow through pipes in series and parallel..	8
III	**DIMENSIONAL ANALYSIS** Need for dimensional analysis - methods of dimensional analysis - Similitude - types of similitude - Dimensionless parameters - application of dimensionless parameters - Model analysis.	9
IV	**HYDRAULIC PUMPS** Impact of jets - Euler's equation - Theory of roto-dynamic machines - various efficiencies - velocity components at entry and exit of the rotor - velocity triangles - Centrifugal pumps - working principle - work done by the impeller - performance curves - Reciprocating pump - working principle - Rotary pumps - classification.	10
V	**HYDRAULIC TURBINES** Classification of turbines - heads and efficiencies - velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbine - working principles - work done by water on the runner - draft tube. Specific speed - unit quantities - performance curves for turbines - governing of turbines.	10
	Total Instructional Hours	**45**

Course Outcome

CO1: Ability to apply mathematical knowledge to predict the properties and characteristics of a fluid.
CO2: Capacity in working with the conservative laws and flow through circular conduits
CO3: Proficiency in Dimensional Analysis
CO4: Capability to analyze the performance of pumps
CO5: Aptitude to evaluate the performance of turbines

TEXT BOOKS:

T1 - R. K. Bansal, "Fluid Mechanics and Hydraulics Machines", 5th Edition, Laxmi Publications Ltd., New Delhi, 2005.
T2 - Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

REFERENCE BOOKS:

R1 - Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
R2 - Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004
R3 - Graebel, W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE3204	ELEMENTS OF AERONAUTICS	3	0	0	3

Course Objective

1. To introduce the concepts of flying and history of aeronautics and to identify the different components of an aircraft
2. To understand the structure of atmosphere and concept of flight mechanics
3. To know about the various systems and instruments used in aircraft
4. To identify and learn about the basic principles of power plants used in airplanes.
5. To comprehend the various material used in aircraft.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction - Balloon flight – ornithopters - biplanes and monoplanes, Early Airplanes- Pre Wright Brothers era, Wright Flyer, developments in aerodynamics, materials, structures and propulsion over the years. Components of an Airplane and their functions. Components of a rotorcraft and their functions.	9
II	**BASICS OF FLIGHT MECHANICS** Physical properties and structure of the atmosphere, temperature, pressure and altitude relationships, Newton's law of motions applied to aeronautics, Evolution of Lift, Drag and Moment., typical wing plan forms, aerodynamic characteristics of Airfoils, concept of boundary layer, Mach Number, Maneuvers.	9
III	**AIRCRAFT CONFIGURATIONS** Different Types of Flight Vehicles, Classifications. Introduction to stability and control- purpose of controls - Conventional Control, Powered Controls, Typical Systems for control Actuation, basic Instruments for flying. Introduction to Rotorcraft, UAV and MAVs.	9
IV	**AIRCRAFT PROPULSION** Basic Ideas about Air breathing and non-air breathing propulsion – working principle of Piston engine, gas turbine engines and RAM Jet and SCRAM jet Engines - Use of Propeller and Jets for Thrust Production. Comparative Merits - Principles of Operation of Rocket - Types of Rocket and typical applications.	10
V	**AIRCRAFT STRUCTURES AND MATERIALS, AIRWORTHINESS** General Types of Construction, Monocoque, Semi monocoque and Geodesic Construction, Typical Wing and Fuselage Structure. Different materials from wood to super alloys for airplane and engine applications. Materials for space vehicles, FRP materials. Airplane design, type certification and airworthiness certificate.	8
	Total Instructional Hours	**45**

Course Outcome

CO1: Able to Identify the component of Flight and familiarize withy the history of aviation
CO2: To perform basic performance calculation of flight mechanics
CO3: Ability to choose the suitable systems and to measure various flying conditions in aircraft
CO4: Apply the thermodynamic principles to study the performances of different power plants used in aircraft
CO5:Ability to identify the suitable materials for different parts of aircraft

TEXT BOOKS:

T1 - Anderson, J.D., "Introduction to flight", 5th edition, McGraw Hill, 2005
T2 - A.C. Kermode, "Flight without formulae", Pearson education, 5th edition, 2010.

REFERENCE BOOKS:

R1 - Kroes et Aircraft Maintenance and Repair al, 7th edition, McGraw Hill, 2013.
R2 - George P. Sutton and Oscar Biblarz, Rocket Propulsion Elements, 7th edition, John Wiley& Sons, Inc., New York, 2001.
R3 - Houghton, E.L., and Caruthers, N.B., "Aerodynamics for Engineering students", 5th edition, Butterworth-Heinemann Publishers, London, 2003.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE3205	AIRCRAFT SYSTEMS AND INSTRUMENTS	3	0	0	3

Course Objective

1. To impart knowledge of the hydraulic and pneumatic systems components
2. To impart knowledge on operation of airplane control system
3. To know the various systems in an aircraft Engine
4. To enumerate the air-conditioning system in an airplane
5. To identify the types of instruments and its operation including navigational instruments to the students

Unit	Description	Instructional Hours
I	**CONVENTIONAL AIRCRAFT SYSTEMS** Hydraulic systems – components – hydraulic systems controllers – modes of operation – pneumatic systems – working principles – brake system – components, landing gear systems – classification – shock absorbers – retractive mechanism.	8
II	**AIRPLANE CONTROL SYSTEMS** Conventional Systems – power assisted and fully powered flight controls – power actuated systems – engine control systems -Full Authority Digital Engine Control (FADEC) system.– modern control systems – digital fly by wire systems – auto pilot system-Advanced flight control systems.	11
III	**ENGINE SYSTEMS** Fuel systems – piston and jet engines – components - multi-engine fuel systems, lubricating systems - piston and jet engines – engine starting system-Main and After burner fuel control systems.	8
IV	**AIRCONDITIONING AND PRESSURIZING SYSTEM** Basic evaporative air cycle systems – evaporative vapour cycle systems, boot-strap air cycle system – oxygen systems – fire protection systems, deicing and anti icing system.	8
V	**AIRCRAFT INSTRUMENTS** Flight instruments, Navigation and Communication instruments, Gyroscope, Accelerometers, Airspeed indicator, Mach meter, Electronic horizontal situation indicator, Horizontal situation indicator, Multi-Function Display, Attitude director indicator, Primary Flight Display, Engine instruments and display – Operation and principles, Flight Data Recorder (FDR), Cockpit Voice Recorder (CVR).	10
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the components of airplane systems.
CO2: Knowledge on operation of airplane control system.
CO3: Identify the various systems in an aircraft Engine.
CO4: Understand the operation of air conditioning and pressing system.
CO5: Know the operation of air data instruments system.

TEXT BOOKS:

T1 - Mekinley, J.L. and R.D. Bent, "Aircraft Power Plants", McGraw Hill 1993.
T2 - Pallet, E.H.J, "Aircraft Instruments & Principles", Pitman & Co 1993.

REFERENCE BOOKS :

R1 - Treager, S., "Gas Turbine Technology", McGraw Hill 1997.
R2 - Mckinley, J.L. and Bent R.D. "Aircraft Maintenance & Repair", McGraw Hill,1993.
R3 - Handbooks of Airframe and Power plant Mechanics, US dept. of Transportation, Federal, Aviation Administration, The English Book Store, New Delhi, 1995.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE3001	FLUID MECHANICS AND THERMODYNAMICS LAB	0	0	4	2

Course Objective

1. Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps and turbines
2. To enhance the basic knowledge in basic thermodynamics, heat transfer and Refrigeration systems
3. To provide the basic knowledge about the refrigeration systems

Expt. No.	Description of the Experiments
1.	Determination of the Coefficient of discharge of given Orifice/Venturi meter.
2.	Calculation of the rate of flow using Water/Rota meter.
3.	Determination of friction factor for a given set of pipes.
4.	Conducting experiments and drawing the characteristic curves for the given pump
5.	Conducting experiments and drawing the characteristic curves for the given turbine.
6.	Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
7.	Determination of thermal conductivity of solid.
8.	Determination of thermal resistance of a composite wall
9.	COP test on a vapour compression refrigeration test rig
10.	COP test on a vapour compression air-conditioning test rig

Total Practical Hours 45

Course Outcome

CO1: Ability to use the measurement equipment for flow measurement
CO2: Carryout Performance trust on different fluid machinery
CO3: Exposure to the characteristics of Pumps and Turbines
CO4: Ability to perform tests on petrol/ diesel engines.
)5: Able to do performance test in the Refrigeration systems

List of Equipment (for a batch of 30 students)

Sl.No.	Name of the Equipment	Qty.
1	Orifice/Venturi meter.	1
2	Water/Rota meter.	1
3	Pipe Flow analysis setup	1
4	Centrifugal/ Submergible/ Reciprocating/ Gear pump	1
5	Pelton wheel/ Francis/ Kaplan turbine setup	1
6	Cut section model of 4 stroke diesel engine and cut section model of 2 stroke petrol engine	1
7	Conductive heat transfer set up	1
8	Composite wall	1
9	Vapour compression refrigeration test rig	1
10	Vapour compression air-conditioning test rig	1

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE3002	AIRCRAFT COMPONENT DRAWING LABORATORY	0	0	4	2

Course Objective

1. To design and draft the different aircraft components.
2. To design and draft the different control components.
3. To draw the three different views of a typical aircraft.

Expt. No.	Description of the Experiments
1.	Layout of simple structural components.
2.	Layout of typical wing structure.
3.	Layout of typical fuselage structure.
4.	Layout of landing gear structure
5.	Layout of aircraft control system.
6.	Modelling and drafting control components of cam.
7.	Modelling and drafting control components of bell crank.
8.	Modelling and drafting control components of gear.
9.	Modelling and drafting control components of push pull rod.
10.	Drafting three views of a typical aircraft.

Total Practical Hours 45

Course Outcome

CO1: To draft the design of control components in the aircraft.
CO2: To draft the primary structures of aircraft.
CO3: To design and draft various aircraft components in control system.
CO4: To draft the complete structure of aircraft in three different views.
CO5: To understand the working of all the control components.

List of Equipment (for a batch of 30 students)

Sl.No.	Name of the Equipment	Quantity
1	Computer Nodes	30
2	Modeling Software	30 licenses
3	UPS	1

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA4107	NUMERICAL METHODS	3	1	0	4

(COMMON TO AERO, AUTO, MECH, EEE &EIE)

Course Objective

Solve algebraic, transcendental and system of linear equations by using various techniques.
Apply various methods to find the intermediate values for the given data.
Be familiar with the concepts of numerical differentiation and integration of the unknown functions.
Understand the concept of solving Ordinary Differential Equations by applying single and multi step methods.
praise the methods introduced in the solution of ordinary differential equations and partial differential equations.

Unit	Description	Instructional Hours
I	**SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS** Solution of equation – Fixed point iteration : x = g(x) method – Newton-Raphson method – Solution of linear system by Gauss Elimination and Gauss Jordan method – Iterative method : Gauss seidel method.	12
II	**INTERPOLATION** Interpolation: Newton's forward and backward difference formulae – Lagrangian interpolation for unequal intervals – Divided difference for unequal intervals : Newton's divided difference formula.	12
III	**NUMERICAL DIFFERENTIATION AND INTEGRATION** Differentiation using interpolation formula – Newton's forward and backward interpolation formulae for equal intervals – Newton's divided difference formula for unequal intervals - Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Double integration using Trapezoidal and Simpson's rules	12
IV	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** Single step methods: Taylor's series method – Euler and Modified Euler methods for first order equation – Fourth order Runge- kutta method for solving first order equations – Multi step method: Milne's predictor and corrector method and Adam – Bash forth predictor corrector method.	12
V	**BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS** Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional Wave equation – Two dimensional Heat equations – Laplace and Poisson Equations.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Solve the system of linear algebraic equations representing steady state models and non linear equations arising in the field of engineering.
CO2: Understand the concept of interpolation in both cases of equal and unequal intervals.
CO3: Express the information from discrete data set through numerical differentiation and summary information through numerical integration.
CO4: Classify and solve ordinary differential equations by using single and multi step methods.
CO5: Acquire knowledge of finding the solution of ordinary and partial differential equations which are useful in attempting any engineering problem.

TEXT BOOKS:

T1 - Sankara Rao K, "Numerical Methods for Scientists and Engineers", 3rd edition, Prentice Hall of India Private limited, New Delhi,2007..

T2 – M.K.Jain, S.R.K.Iyengar, R.K.Jain "Numerical Methods for Scientific and Computation", Fifth Edition.. New age International Publishers 2010.

REFERENCE BOOKS:

R1 - Kreyszig.E. "Advanced Engineering Mathematics", Eight Edition, John Wiley and sons (Asia) limited.

R2 - Grewal B.S. and Grewal J.S. " Numerical Methods in Engineering and Science ", 6th Edition , Khanna publishers, New Delhi 2004.

R3 - S.K.Gupta, Numerical Methods for Engineers" , New Age Internationalm Pvt.Ltd Publishers.2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE4201	AERODYNAMICS	3	0	0	3

Course Objective

1. To provide accumulated knowledge of fluid mechanics.
2. To provide the mathematical understanding of basic flows and their combinations.
3. To demonstrate a fundamental understanding of fluid mechanics applicable to flight, and the forces and moments on airfoil and its conformal transformation.
4. To apply the aerodynamic tools to develop the three dimensional wing and study aerodynamic behavior.
5. To understand the behavior of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime.

Unit	Description	Instructional Hours
I	**REVIEW OF BASIC FLUID MECHANICS** Continuity, momentum and energy equations-Differential and Integral forms	6
II	**TWO DIMENSIONAL FLOWS AND GENERATION OF LIFT** 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 Kutta Joukowski's theorem, Kutta condition.	12
III	**CONFORMAL TRANSFORMATION AND AIRFOIL THEORY** Cauchy-Riemann relations, complex potential, methodology of conformal transformation, Kutta-Joukowski transformation and its applications. Thin airfoil theory and its applications.	11
IV	**SUBSONIC WING THEORY** Vortex filament, Biot and Savart law, bound vortex and trailing vortex, horse shoe vortex, lifting line theory and its limitations.	8
V	**INTRODUCTION TO BOUNDARY LAYER** Newton's law of viscosity, Boundary Layer, Navier-Stokes equation, displacement, Momentum thickness, Flow over a flat plate, Blasius solution.	8
	Total Instructional Hours	**45**

Course Outcome

CO1: To apply governing equation to various fluid flow models
CO2: Able to apply the knowledge of basic flows to the various bodies in the atmosphere for the generation of lift.
CO3: Able to solve the aerodynamic problems associated with the airfoils and the transformation.
CO4: Able to simulate wings with help of aerodynamic tools for various ambient conditions
CO5: Knowledge on incompressible flow and viscous flow.

TEXT BOOKS:

T1 - Houghton, E.L., and Caruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, 1982.
T2 - Anderson, J.D., "Fundamentals of Aerodynamics", McGraw Hill Book Co., 6th edition, 2016.

REFERENCE BOOKS:

R1 - John J Bertin., "Aerodynamics for Engineers", Pearson Education Inc. 2002
R2 - Clancey, L J.," Aerodynamics", Pitman, 1986
R3 - Milne Thomson, L.H., "Theoretical aerodynamics", Macmillan, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE4202	MECHANICS OF MACHINES (COMMON TO AERO, AUTO)	3	1	0	4

Course Objective

1. To know different types of inversions in the mechanisms.
2. Study about the working principle gear and gear applications.
3. To know the frictional forces acting and how to resolve the friction.
4. Students should analyze the forces acting on various members in a mechanism.
5. To know the importance of balancing and vibration acting on systems.

Unit	Description	Instructional Hours
I	**KINEMATIC OF MECHANICS** Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.	13
II	**GEARS AND GEAR TRAINS** Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – Epicyclic gear trains – automotive transmission gear trains.	12
III	**FRICTION** Sliding and Rolling Friction angle – friction in threads – Friction Drives – Friction clutches – Belt and rope drives – brakes – Tractive resistance.	11
IV	**FORCE ANALYSIS** Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members. Dynamic Force Analysis – Inertia Forces and Inertia Torque – Alembert's principle – Superposition principle – Dynamic Force Analysis in simple machine members.	12
V	**BALANCING AND VIBRATION** Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines. Free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration isolation.	12
	Total Instructional Hours	**60**

Course Outcome

CO1. Upon completion of this course, the students can design various mechanical components.
CO2. Students have the knowledge on gears and gear trains.
CO3. Students are able to utilize the frictional force into effect.
CO4. Students can analyze the forces acting on the mechanism.
CO5. Students are having the ability to balance the forces and vibration in a machine.

TEXT BOOKS:

T1 - Ambekar A.G., "Mechanism and Machine Theory" Prentice Hall of India, New Delhi, 2007.
T2 - Shigley J.E., Pennock G.R and Uicker J.J., "Theory of Machines and Mechanisms", Oxford University Press, 2003.

REFERENCE BOOKS:

R1 - Ghosh.A, and A.K.Mallick, "Theory and Machine", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
R2 - Ramamurthi. V, "Mechanisms of Machine", Narosa Publishing House, 2002.
R3 - Robert L. Norton, "Design of Machinery", McGraw-Hill, 2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE4203	GAS TURBINE PROPULSION	3	0	0	3

Course Objective

1. To know the fundamentals of gas turbines and its components
2. To learn about the design and performance of inlets
3. To familiarize with the design and performance characteristics of combustion chamber
4. To understand the design and performance of various aircraft nozzles
5. To teach about the blade design and performance characteristics of different types of compressors

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF GAS TURBINE ENGINES** Illustration of working of gas turbine engine - Thrust equation - Factors affecting thrust. Effect of pressure, velocity and temperature changes of air entering compressor. Methods of thrust augmentation. Characteristics of turboprop, turbofan, turbojet and turbo shaft engines - Performance characteristics- Numerical Problems.	9
II	**SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES** Internal flow and Stall in subsonic inlets - Boundary layer separation - Major features of external flow near a subsonic inlet - Relation between minimum area ratio and external deceleration ratio - Diffuser performance - Supersonic inlets - Starting problem on supersonic inlets - Shock swallowing by area variation - External declaration - Modes of inlet operation.	9
III	**COMBUSTION CHAMBERS FOR JET ENGINES** Introduction to combustion Chemistry- Classification of Gas turbine 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.	7
IV	**COMPRESSORS FOR JET ENGINES** Principle of operation of centrifugal compressor - Work done and pressure rise - Velocity diagrams - Diffuser vane design considerations - Concept of prewhirl - Rotation stall - Elementary theory of axial flow compressor - Velocity triangles - Degree of reaction - Three dimensional - Air angle distributions for free vortex and constant reaction design - Compressor blade design - Centrifugal and axial compressor performance characteristics.	10
V	**TURBINES FOR JET ENGINES** Principle of operation of axial flow turbines– Limitations of radial flow turbines- Work done and pressure rise – Velocity diagrams – Degree of reaction – Free vortex and constant nozzle angle designs – Performance characteristics of axial flow turbine– Turbine blade cooling methods – Stage efficiency calculations – Basic blade profile design considerations – Matching of compressor and turbine.	10
	Total Instructional Hours	**45**

Course Outcome

CO1: Analyze thermodynamics of an aircraft jet engine and calculate the performance measures, such as thrust and specific fuel consumption in terms of design requirement.
CO2: Apply the knowledge to design suitable inlets for aircraft at different conditions
CO3: Ability to choose suitable combustion chamber for various aircraft.
CO4: Ability to design various nozzles and do performance calculations
CO5: Evaluate the operating characteristics of compressors and turbines in terms of given blade shapes, angles, and direction of rotation.

TEXT BOOKS:

T1 - Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.
T2 - Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Longman,5th edition, 2001.

REFERENCE BOOKS:

R1 - Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
R2 - Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", 2nd edition, Standard Publishers & Distributors, Delhi, 2008.
R3 - Gorden, C. V., "Aerothermodynamics of Gas Turbine & Rocket Propulsion", AIAA Education Series, New York, 1997

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE4204	AIRCRAFT STRENGTH OF MATERIALS	3	1	0	4

Course Objective

1. To know the theoretical and methodological approaches to the static analysis of determinate and indeterminate aircraft structural components.
2. To familiarize with different types of beams subjected to various types of loading and support conditions.
3. To analyze the stability of column and determine critical buckling loads for various end conditions.
4. To know about the different failure criteria for engineering materials.
5. To develop the knowledge of induced stresses on the aircraft structural components.

Unit	Description	Instructional Hours
I	**STATICALLY DETERMINATE & INDETERMINATE STRUCTURES** Plane truss analysis – method of joints – method of sections – Clapeyron's 3 moment equation and moment distribution method for indeterminate beams.	12
II	**ENERGY METHODS** Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorems and their applications. Energy theorems – dummy load & unit load methods – energy methods applied to beams & trusses.	13
III	**COLUMNS** Euler's column curve – inelastic buckling – effect of initial curvature – the Southwell plot – columns with eccentricity – theory of beam columns – beam columns with different end conditions – stresses in beam columns.	13
IV	**FAILURE THEORIES** Maximum principal stress theory - maximum principal strain theory - maximum shear stress theory - distortion energy theory – octahedral shear stress theory.	12
V	**INDUCED STRESSES** Thermal stresses – impact loading – Fatigue – Creep - Stress Relaxation - Factors affecting Stress Relaxation and Creep.	10
	Total Instructional Hours	**60**

Course Outcome

CO1: Ability to analysis the forces on beams, trusses under various types of loading and support conditions.
CO2: Ability to calculate deflection and forces for statically determinate and indeterminate aircraft structural components.
CO3: Ability to understand the stability of the column used as aircraft component.
CO4: Ability to design the aircraft structural component using different theories of failure.
CO5: Ability to describe the effects of induced stresses and how this is managed in an aging of aircraft.

TEXT BOOKS:

T1 - Timoshenko and Gere, "Mechanics of Materials", Tata McGraw Hill, 1993.
T2 - Megson T M G, "Aircraft Structures for Engineering students" Elsevier Science and Technology, 2007

REFERENCE BOOKS:

R1 - Donaldson, B.K., "Analysis of Aircraft Structures - An Introduction", McGraw Hill, 1993.
R2 - Peery, D.J. and Azar,J.J., "Aircraft Structures", 2nd Edition, McGraw – Hill, N.Y, 1999.
R3 - Bruhn E F, "Analysis and Design of Flight Vehicle Structures", Tri-State Off-set Company, USA, 1985.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EI4231	CONTROL ENGINEERING	3	0	0	3

Course Objective

1. State the basic elements of control systems and their transfer function models.
2. Describe the methods of representing and construction of control system components.
3. Discuss time response system analysis.
4. Establish methods of stability analysis and Frequency domain specifications.
5. Outline discrete and sampled data control systems.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO CONTROL SYSTEMS** Historical review of control system – Basic elements in control system – Simple Pneumatic, Hydraulic and Thermal systems – Transfer Function models – Mechanical Translational, Rotational systems – Analogies –mechanical and electrical analogous systems – Development of flight control systems, AFCS.	9
II	**OPEN AND CLOSED LOOP SYSTEMS** Feedback control systems – Control system components – Open and Closed loop system – Block diagram representation of control systems, Reduction of block diagrams, Signal flow graphs – Construction– Mason's Gain Formula.	9
III	**TIME RESPONSE ANALYSIS** Laplace transformation – Standard test signals – Order and Type of a system – impulse, step response of first order systems – second order system (under damped and critically damped) –Time domain specifications – Controllers: P,PI,PID – steady state errors and error constants.	9
IV	**STABILITY AND FREQUENCY RESPONSE ANALYSIS** Necessary and sufficient conditions, Routh Array, Routh – Hurwitz criteria – relative stability, Frequency response – advantages – Frequency domain specifications, Types – Root locus and Bode techniques.	9
V	**SAMPLED AND DIGITAL CONTROL SYSTEMS** Z-Transforms, properties – sampled data control systems – sampling process – ZOH and First order Hold – mapping between S and Z planes. Introduction to digital control system, Digital Controllers and Discrete PID controllers – Positional and Velocity Algorithm.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Apply the knowledge for modeling of mechanical and electrical control systems.
CO2: Represent the control system components and reduce them.
CO3: Deduct the different order systems with various inputs and their response.
CO4: Investigate the open and closed loop control systems stability and frequency specifications.
CO5: Analyze sampled and discrete control systems for Aircraft control.

TEXT BOOKS:

T1 - Katsuhiko Ogata, "Modern Control Engineering", Prentice-Hall of India Pvt. Ltd., New Delhi, 1998.
T2 - M.Gopal, "Control Systems: Principles and Design", Tata McGraw-Hill Education, 2002.

REFERENCE BOOKS:

R1 - Houpis, C.H. and Lamont, G.B. "Digital Control Systems", McGraw Hill Book Co.,New York,U.S.A.1995.
R2 – A.Nagoor Kani, "Control Systems Engineerig", RBA Publications,Second Edition, 2012.
R3 - Pallet, E.H.J. "Automatic Flight Control", Shroff Publishers, India, 2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE4001	AERODYNAMICS LABORATORY	0	0	4	2

Course Objective

1. To study Pressure distribution around different profiles
2. To measure Force around Airfoils
3. To visualize flow over a structure

Expt. No.	Description of the Experiments
1.	Study of subsonic wind tunnel
2.	Calibration of a subsonic Wind tunnel.
3.	Determination of lift for the given airfoil section.
4.	Pressure distribution over a rough circular cylinder.
5.	Pressure distribution over a smooth circular cylinder.
6.	Pressure distribution over symmetric airfoil.
7.	Pressure distribution over cambered airfoil.
8.	Smoke flow visualization studies in subsonic flows.
9.	Water flow visualization studies in subsonic flows using water flow channels
10.	Force measurement on an airfoil using blower balance for small aspect ratio models

Total Practical Hours 45

Course Outcome

)1: An exposure in the calibration of Wind Tunnel
)2: Ability to measure force around Airfoils
)3: Ability to measure force for small Aspect ratio models
)4: Expertise in study of pressure around different profiles
)5: Visualize flow using Smoke and water channel

List of Equipment (for a batch of 30 students)

Sl. No.	Name of the Equipment	Quantity
1	Subsonic Wind tunnel	1
2	Models (aerofoil, rough and smooth cylinder, small aspect ratio models)	1 each
3	Blower balance	1
4	Water flow channel	1

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE4002	AIRCRAFTS STRENGTH OF MATERIALS LABORATORY	0	0	4	2

Course Objective

1. To study the properties of materials used in Aircraft structure.
2. To study the failure of different component under different loading condition.
3. Study to improve the hardness of the materials.

Expt. No.	Description of the Experiments
1.	Tension test on mild steel rod.
2.	Double shear test on mild steel and Aluminium rods.
3.	Torsion test on mild steel rod.
4.	Impact test on metal specimen.
5.	Hardness test on metals -Brinell and Rockwell Hardness Number
6.	Compression test on helical spring.
7.	Tempering – Improvement Mechanical properties comparison i) Unhardened specimen ii) Quenched Specimen iii) Quenched and tempered Specimen.
8.	Deflection of a simply-supported beam and cantilever beam.
9.	Verification of superposition theorem
10.	Verification of Maxwell's reciprocal theorem
11.	Construction of south well plot
12.	Truss analysis.
13.	Determination of Elastic constants for a Composite Flexural Specimen.

Total Practical Hours 45

Course Outcome

CO1: Capability to perform various destructive testing.
CO2: Ability to characteristics materials.
CO3: Capability to improve the hardness of the materials.
CO4: Ability to find the deflection of the beams under various loads
CO5: Ability to validate the strength of materials approach with experimental results.

List of Equipment (for a batch of 30 students)

S.No.	Name of the Equipment	Quantity	Experiment No.
1	400 kN Universal Testing Machine	1	1,2,13
2	Torsion testing machine (60 NM capacity)	1	3
3	Impact testing machine (300 J Capacity)	1	4
4	Brinnel Hardness testing machine	1	5
5	Rockwell Hardness testing machine	1	5
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1	6
7	Metallurgical Microscopes	3	5
8	Muffle Furnace	1	7
9	Beams with weight hangers and dial gauges	6	8,9,10
10	Column set up with dial gauges	1	11
11	Truss model	1	12

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5201	AIRCRAFT PERFORMANCE	3	0	0	3

Course Objective

1. To familiarize students with the lift, drag and wing performance.
2. To familiarize students with the cruising flight performance
3. To understand the performance characteristics of climbing and gliding flight.
4. To describe the performance of flight under different maneuvering conditions
5. To familiarize the students with various special performance characteristics of aircraft.

Unit	Description	Instructional Hours
I	**LIFT AND DRAG ON FLIGHT PERFORMANCE** International Standard Atmosphere - Measurement of speed-Forces and moments acting on a flight vehicle -Equation of motion of a rigid flight vehicle - Different types of drag – Methods of drag reduction in airplanes- Drag polar of vehicles from low speed to high speeds - Effects of Reynold's number on skin friction and pressure drag. Variation of thrust, power with velocity and altitudes for air breathing engines.	10
II	**CRUISING FLIGHT PERFORMANCE** Performance of airplane in level flight - Power available and power required curves-Maximum speed in level flight - Conditions for minimum drag and power required.	10
III	**CLIMBING AND GLIDING PERFORMANCE** Climbing Flight- Rate of climb, time to climb - Service and absolute ceiling-Maximum rate of climb and Maximum climb angle -steepest angle of climb-climb hodograph-Gliding flight-minimum rate of sink and shallowest angle of glide- Glide Hodograph	10
IV	**MANEUVERING PERFORMANCE** Turning performance (Turning rate & turn radius)-Bank angle and load factor – limitations on turn - Pull up and push over -V-n diagram, maneuvering envelope.	7
V	**SPECIAL PERFORMANCE** Range and Endurance of jet and propeller type of airplanes. Estimation of take-off and landing distance, High lift devices, Up gust and down gust maneuvering.	8
	Total Instructional Hours	**45**

Course Outcome

CO1: Predict the aerodynamic characteristics of the airplane, the engine performance and how flight altitude affects the airplane performance.
CO2: Calculate the performance of an airplane, mainly for non-accelerating flight states, but also in some simple accelerating cases such as take-off and landing.
CO3: Calculate the aerodynamic and engine data that is needed to perform a performance analysis.
CO4: Design aircraft parameters according to the mission requirement.
CO5: Identify, formulate, and solve engineering problems. This will be accomplished by discussing some open-ended problems in estimating the aircraft performance.

TEXT BOOKS:

T1 - John David Anderson, Jr., 'Aircraft Performance and Design', First Edition, Tata McGraw Hill, 2010.
T2 - Houghton, E. L., and Caruthers, N. B., 'Aerodynamics for Engineering Students', Edward Arnold Publishers, 1988

REFERENCE BOOKS:

R1 - L. J. Clancy, 'Aerodynamics', Pitman, 1986.
R2 - E. L. Houghton, P. W. Carpenter, Steven H Collicott, and Daniel T Valentine, 'Aerodynamic for Engineering Students', Sixth Edition,Butterworth-Heinemann, 2012.
R3 - Barnes W. McCormick, 'Aerodynamics, Aeronautics and Flight Mechanics', Second Edition, John Wiley, New York, 1994.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5202	HIGH SPEED AERODYNAMICS	3	1	0	4

Course Objective

1. To impart knowledge on the basic concepts of compressible flow.
2. To understand about the formation of normal and oblique shocks.
3. To gain knowledge in low speed real flows.
4. To understand the concept of nozzle design.
5. To gain knowledge about the high speed wind tunnels.

Unit	Description	Instructional Hours
I	**FUNDAMENTAL CONCEPTS OF COMPRESSIBLE FLOW** Introduction to isentropic flow-Scope of compressible flow-Review of continuity, momentum and steady flow energy equations and entropy considerations- Energy and momentum equations for compressible fluid flow reference velocities-stagnation states-velocity of sound-critical states-mach number-critical Mach number. Types of waves- mach cones mach angle-effect of Mach number on compressibility flow regimes.	12
II	**SHOCK AND EXPANSION WAVES** Development of normal shocks-governing equations-Stationery and moving normal shock waves-applications, Shock polars, supersonic pitot probes. Oblique shock - Reflection of flow- Prandtl-Meyer expansion flow. Under and over expanded nozzles, shock expansion method for flow over airfoils.	13
III	**FLOW WITH FRICTION AND HEAT TRANSFER** Fanno flow and Rayleigh flow - flow equations and solutions- variation of flow properties-variation of Mach number with duct length-tables and charts for Fanno flow and Rayleigh flow.	11
IV	**TWO DIMENSIONAL COMPRESSIBLE FLOW AND AEROFOIL THEORY** Method of characteristics – Prandtl - Glauert and Goethert rules - Ackeret's supersonic airfoil theory. Small perturbation equations for subsonic, transonic, supersonic and hypersonic flow. Experimental characteristics of Airfoils in compressible flow.	13
V	**EXPERIMENTAL TECHNIQUES FOR HIGH SPEED FLOWS** 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.	11
	Total Instructional Hours	**60**

Course Outcome

CO1: Understanding characteristics of compressible fluid flows.
CO2: Capable of identification of shock patterns at different scenario.
CO3: Manipulating the effect caused by real flows.
CO4: Ability to design shock free nozzle.
CO5: Capable of handling wind tunnels for evaluating flow behaviors.

TEXT BOOKS:

T1 - Radhakrishnan, Ethirajan., Gas Dynamics, John Wiley & Sons,2010
T2 - Yahya, S. M., Fundamentals of Compressible flow with Aircraft and Rocket Propulsion, 3rd edition, New Age International Ltd. Publishers, 2003

REFERENCE BOOKS:

R1 - Shapiro, Ascher. H., The Dynamics and Thermodynamics of Compressible Fluid Flow (Vol I & II). Ronald Press, 1954.
R2 - Anderson J. D., Jr., Modern Compressible Flow with Historical Perspective, McGraw Hill Publishing Co., 2004
R3 - Anderson J. D., Jr., Fundamentals to Aerodynamics, McGraw Hill Publishing Co., 3rd edition, 2001

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5203	AIRCRAFT STRUCTURES	3	1	0	4

Course Objective

1. To Calculate the Bending Stress for Unsymmetrical Bending.
2. To Sketch the Shear Flow Distribution for Open Section shear loads.
3. To Sketch the Shear Flow Distribution for Closed Section due torsional and shear loads.
4. To Predict the Buckling Loads of the Thin Plates.
5. To prepare students for designing structural elements of the wing and fuselage sections with minimum weight.

Unit	Description	Instructional Hours
I	**UNSYMMETRICAL BENDING** Bending of symmetric beams subject to skew loads - bending stresses in beams of unsymmetrical sections – generalized 'k' method, neutral axis method, principal axis method.	12
II	**SHEAR FLOW IN OPEN SECTIONS** Thin walled beams – concept of shear flow – the shear centre and its determination – shear flow distribution in symmetrical and unsymmetrical thin-walled sections –shear flow variation in idealized sections.	12
III	**SHEAR FLOW IN CLOSED SECTIONS** Bredt - Batho theory – single-cell and multi-cell tubes subject to torsion – shear flow distribution in thin-walled single & multi-cell structures subject to bending – with walls effective and ineffective – shear centre of closed sections.	12
IV	**BUCKLING OF PLATES** Bending of thin plates – rectangular sheets under compression - local buckling stress of thin walled sections – crippling strength estimation – load carrying capacity of sheet stiffener panels – effective width.	11
V	**STRESS ANALYSIS OF WING AND FUSELAGE** Loads on an aircraft – the V-n diagram – shear force and bending moment distribution over the aircraft wing and fuselage – shear flow in thin-webbed beams with parallel and non-parallel flanges – complete tension field beams – semi-tension field beam theory.	13
	Total Instructional Hours	**60**

Course Outcome

CO1: Ability to Analysis the Bending stress for wing and fuselage structural component.
CO2: Ability to analyze the shear flow distribution for open section.
CO3: Ability to analyze the shear flow distribution for closed section subjected to torsion and shear.
CO4: Ability to Construct the Aircraft skin with stiffener and their location.
CO5: Ability to identify design features of aircraft wing and fuselage structures, and to calculate load factors and margins of safety for various loading conditions.

TEXT BOOKS:

T1 - Megson T M G , "Aircraft Structures for Engineering Students", Elsevier Ltd, 2007
T2 - Bruhn. E.H., "Analysis and Design of Flight Vehicles Structures", Tri-state off-set Company, USA, 1985.

REFERENCE BOOKS:

R1- Rivello. R.M., "Theory and Analysis of Flight Structures", McGraw Hill, 1993.
R2 - Howard D Curtis, "Fundamentals of Aircraft Structural Analysis", WCB-McGraw Hill, 1997.
R3- Michael Chun-Yung Niu, "Airframe Structural Design: Practical Design Information and Data on Aircraft Structures", 2nd edition, Adaso/Adastra Engineering Center, 2006.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5204	ADVANCED PROPULSION	3	0	0	3

Course Objective

1. To impart knowledge in hypersonic propulsion
2. To know the basics of rocket propulsion
3. To understand the working of solid rockets
4. To analyze the performance of liquid propellant engines
5. To understand various propulsion technologies associated with space launch vehicles, missiles and space probes.

Unit	Description	Instructional Hours
I	**RAMJET AND SCRAMJET PROPULSON** Operating principle of ramjet engine – Various components of ramjet engines and their efficiencies – Combustion in ramjet engine –Modes of operation -Ramjet engine and its performance characteristics – Sample ramjet design calculations – Flame stability problems in ramjet combustors. Introduction to hypersonic air breathing propulsion, need for supersonic combustion for hypersonic propulsion – Scramjet engine and its applications for hypersonic vehicles – Problems associated with supersonic combustion - Various types scramjet combustors – Fuel injection schemes in scramjet combustors	10
II	**INTRODUCTION TO CHEMICAL ROCKET PROPULSION AND NOZZLES** Operating principle of a rocket – Specific impulse of a rocket – Internal ballistics – Types of igniters – Air augmented rockets – Pulse rocket motors - Nozzles - Isentropic flow through nozzles - Convergent nozzles and nozzle choking - Nozzle throat conditions. Effect of back pressure in nozzles- Classification of rocket nozzles	9
III	**SOLID ROCKET PROPULSION** Selection criteria of solid propellants – Estimation of solid propellant adiabatic flame temperature - Propellant grain design considerations – Erosive burning in solid propellant rockets – Combustion instability – Strand burner and T-burner – Applications and advantages of solid propellant rockets.	9
IV	**LIQUID ROCKET PROPULSION** Selection of liquid propellants – Various feed systems and injectors for liquid propellant rockets - Thrust control and cooling in liquid propellant rockets and the associated heat transfer problems – Combustion instability in liquid propellant rockets – Peculiar problems associated with operation of cryogenic engines - Introduction to hybrid rocket propulsion	9
V	**ADVANCED PROPULSION TECHNIQUES** Electric rocket propulsion– Types of electric propulsion techniques - Ion propulsion – Nuclear rocket – Future applications of electric propulsion systems - Solar sail	8
	Total Instructional Hours	**45**

Course Outcome

CO1: Knowledge on hypersonic propulsion
CO2: Ability to classify rocket engines
CO3: Ability to calculate various performance parameters
CO4: Knowledge in rocket propulsion systems
CO5: Application of nuclear propulsion in rocketry

TEXT BOOKS:

T1 - Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 8th Edition, 2010.
T2 - B. Mathur, M.L., and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", 2nd edition, Standard Publishers and Distributors, Delhi, 2008.

REFERENCE BOOKS:

R1 - Gorden, C. V., "Aerothermodynamics of Gas Turbine & Rocket Propulsion", AIAA Education Series, New York, 1997
R2 - Philip Hill, and Carl Peterson, "Mechanics and Thermodynamics of Propulsion", 2nd edition, Pearson Education Ltd, 2009.
R3 - K Ramamurthi., " Rocket Propulsion", Macmillan 2010

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5205	AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE PRACTICES	3	0	0	3

Course Objective

1. To handle the aircraft ground support equipment.
2. To examine the various sub systems of an aircraft.
3. To enumerate various safety procedures
4. To know various types of inspection procedures
5. To identify the various types of aircraft hardware and fluid line fittings.

Unit	Description	Instructional Hours
I	**AIRCRAFT GROUND HANDLING** Mooring, jacking, leveling and towing operations – Preparation – Equipment – precautions– Engine starting procedures – Piston engine, turboprops and turbojets – Ground power unit.	10
II	**GROUND SERVICING OF VARIOUS SUB SYSTEMS** Air conditioning and pressurization – Oxygen and oil systems and their Maintenance – Engine mount and supercharger check	7
III	**MAINTENANCE OF SAFETY** Shop safety – Environmental cleanliness – Precautions – Preservation and De-preservation procedure	8
IV	**INSPECTION** Process – Purpose – Types – Inspection intervals – Techniques – Checklist – Special inspection – Publications, bulletins, various manuals – FAR Air worthiness directives – Type certificate Data sheets – ATA Specifications	10
V	**AIRCRAFT HARDWARE, MATERIALS, SYSTEM PROCESSES** Hand tools – Precision instruments – Special tools and equipments in an airplane maintenance shop – Identifiation 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 and 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.	10
	Total Instructional Hours	**45**

Course Outcome

CO1: Ability to carry out ground servicing of critical aircraft systems.
CO2: Understand various subsystems and the safety precautions in maintenance.
CO3: Identify the various safety procedures.
CO4: Knowledge on various inspection procedures
CO5: Knowledge in specifications standards of aircraft hardware systems.

TEXT BOOKS:

T1 - Kroes Watkins Delp, Aircraft Maintenance and Repair, McGraw Hill, New York, 1993.
T2 - Larry Reithmaier, Lawrence .W. Reithmaier, Standard Aircraft Handbook for Mechanics and Technicians, McGraw Hill Professional, 6th Edition, 1999.

REFERENCE BOOKS:

R1 - A&P Mechanics, Aircraft Hand Book, FAA Himalayan Book House, New Delhi, 1996.
R2 - A&P Mechanics, General Hand Book, FAA Himalayan Bok House, New Delhi, 1996.
R3 - Aviation Maintenance Technician Handbook-Power plant, FAA, Aviation Supplies & Academics, 2012, Vol. 2

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5001	AIRCRAFT STRUCTURES LABORATORY	0	0	4	2

Course Objective

1. To enable to understand the behavior of aircraft structural components under different loading conditions.
2. To provide the Principle involved in photo elasticity and its applications in stress analysis.
3. To study about non-destructive testing methods.

Expt. No.	Description of the Experiments
1.	Unsymmetrical Bending of a Cantilever Beam
2.	Constant strength Beam
3.	Combined bending and Torsion of a Hollow Circular Tube
4.	Material Fringe Constant of a Photo elastic Models
5.	Shear Centre of an open Channel Section
6.	Shear Centre of a Closed Section
7.	Vibration of a Cantilever Beam
8.	Fabrication of a Composite Laminate.
9.	Tension field beam.
10.	Study of non-destructive testing procedures
11.	Shear failure of bolted and riveted Joints
12.	Influence line study on beams

Total Practical Hours 45

Course Outcome

CO1: To perform Bending and Torsion test on beams.
CO2: Capability to locate the Shear center for the various cross section.
CO5: Ability to conduct Vibration test on beams.
CO4: Capability to fabricate composite specimen
CO5: Ability to perform non-destructive testing to predict the properties of metabolic materials used in aircraft application.

List of Equipment (for a batch of 30 students)

S.No.	Name of the Equipment	Quantity	Experiment No.
1	400 kN Universal Testing Machine	1	10
2	Photo elasticity set up	1	4
3	Vibration set up with accessories	1	7
4	Wagner beam	1	9
5	Unsymmetrical bending set up	1	1
6	Set up for combined bending and torsion	1	3
7	Constant strength beam	1	2
8	Beams with weight hangers and dial gauges	1	12

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5002	PROPULSION LABORATORY	0	0	4	2

Course Objective

1. To familiarize students and to expose them practically to various aircraft piston and gas turbine engines
2. To practically determine the flow behavior of jets
3. To impart the knowledge of characteristics of fuel

Expt. No.	Description of the Experiments
1.	Study of aircraft piston engines
2.	Study of aircraft gas turbine engines
3.	Velocity profiles of free jets.
4.	Velocity profiles of wall jets.
5.	Study of Subsonic Ramjet engine
6.	Cascade testing of compressor and turbine blades
7.	Performance test on a 4-stroke engine
8.	Determination of effectiveness of a parallel flow heat exchanger
9.	Determination of effectiveness of a counter flow heat exchanger
10.	Determination of heating value of a fuel

Total Practical Hours 45

Course Outcome

CO1: Understand details of piston and gas turbine engine
CO2: Perform various testing on ducts, propellants, jet engine components
CO3: Perform test on diesel/petrol engine
CO4: Explain the characteristics of the diesel/Petrol engine
CO5: Determine the properties of the fuels.

List of Equipment (for a batch of 30 students)

Sl.No.	Name of the Equipment	Quantity	Experiment No.
1.	Aircraft Piston engine	1	1
2.	Aircraft gas turbine engine	1	2
3.	Jet facility with compressor and storage tank	1	3,4
4.	Multitube manometer	2	3,4
5.	Ramjet facility	1	5
6.	Cascade Wind tunnel	1	6
7.	Compressor and turbine blade set	1 each	6
8.	4 stroke twin cylinder diesel engine	1	7
9.	Parallel and counter flow heat exchanger test rig	1	8,9
10.	Bomb Calorimeter	1	10

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6201	AIRCRAFT STABILITY AND CONTROL	3	0	0	3

Course Objective

1. To understand the static and dynamic response and controls.
2. To familiarize with the concept of Stability and control of Aircraft.
3. To familiarize with various Aircraft motions and related stability.
4. To familiarize with the concept of dynamic stability of Aircraft.
5. To analyze the longitudinal, lateral, directional stability modes of an aircraft.(static & dynamic)

Unit	Description	Instructional Hours
I	**GENERAL** Degrees of freedom of a system, Static and dynamic stability, Need for stability in an airplane, purpose of controls, Inherently and marginally stable airplanes.	6
II	**STATIC LONGITUDINAL STABILITY** Stick fixed: Basic equations of equilibrium, Stability criterion, Wing and tail moments, Effect of fuselage and nacelles, Effect of c.g. location, Power effects, Stabilizer setting and c.g. location, Elevator effects, stick fixed neutral point. Stick free: Hinge moment coefficients, Stick free neutral point symmetric maneuvers, stick force gradients and stick force per cg. Aerodynamic balancing of control surfaces.	14
III	**STATIC LATERAL STABILITY** Dihedral effect, coupling between rolling moment and yawing moment, Adverse yaw, Aileron power, Aileron reversal.	8
IV	**SATATIC DIRECTIONAL STABILITY** Weather cocking effect, rudder requirements. One engine inoperative conditions, rudder lock.	7
V	**DYNAMIC STABILITY** Equation of motion, Stability derivatives, Routh's discriminant, solving the stability quadratic, Phugoid motion, factors affecting the period and damping- Dutch roll and spiral instability Auto rotation, spin and spin recovery, Two control airplane.	10
	Total Instructional Hours	**45**

Course Outcome

CO1: Calculate aircraft trim and static stability characteristics.
CO2: Perform preliminary design computations to meet static stability and trim requirements.
CO3: Identify the lateral and longitudinal modes and relate the important physical influences of aircraft properties on these modes.
CO4: Determine the stability of the aircraft from the linearized equations of motion.
CO5: Design the control surfaces according to the stability requirements.

TEXT BOOKS:

T1 -Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, New York, 1988.
T2 - Nelson, R.C., 'Flight Stability and Automatics Control', Second Edition, McGraw Hill, 1997.

REFERENCE BOOKS:

R1 - Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.
R2 - L. J. Clancy, 'Aerodynamics', Pitman, 1986.
R3 -Houghton, E. L., and Caruthers, N. B., 'Aerodynamics for Engineering Students', Edward Arnold Publishers, 1988

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6202	FINITE ELEMENT METHODS IN ENGINEERING	3	1	0	4

Course Objective

1. To give exposure to the formulation and the procedure of the finite element method.
2. To provide the mathematical foundations of the finite element formulation for engineering applications and solve the same.
3. To study about the various structural elements and their properties.
4. To enumerate the loads acting on various structural elements.
5. To analyze the field variable problems like heat transfer, fluid problems.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction To Finite Element Method – Basic Concepts And Steps In Fem – Overview Of Approximate Methods For The Solution Of The Mathematical Models: Rayleigh-Ritz Methods, Methods Of Weighted Residuals (Galerkin, Least-Squares & Collocation Methods).	11
II	**DISCRETE ELEMENTS** Bar Elements - Uniform Section, Varying Sections - Mechanical And Thermal Loading – Linear And Quadratic Elements, Elimination And Penalty Approach. Plane Truss Analysis: Formulation Of Truss Element - Stiffness Matrix And Force Vector – Element Stress. Beam Bending-Governing Differential Equation For Beam Bending -Two Node Beam Element - Calculation Of Stresses In Beams.	15
III	**CONTINUUM ELEMENTS** Triangular (CST, LST): Plane Stress And Plane Strain Problems - Shape Function - Strain Displacement Matrix – Stress Strain Relationship Matrix - Force Vector – Nodal Displacements – Element Stress. Axisymmetric Elasticity Problems: Axisymmetric Triangular Element – Stress In Cylinders Subjected To Internal Pressure.	13
IV	**ISOPARAMETRIC ELEMENTS** Isoparametric Elements: Shape Functions For Quadrilateral Elements – Four Node Quadrilateral Elements – Serendipity Elements – Numerical Integration For Quadrilateral And Triangular Element Problems - Matrix Solution Techniques.	11
V	**DYNAMIC AND FIELD VARIABLE PROBLEMS** Longitudinal Vibration Of Bars, Lateral Vibration Of Beams, Steady State Heat Transfer: Element Formulations, Treatment To Boundary Conditions With Application To 1-D Heat Conduction, Heat Transfer Through Thin Fins, Fluid Flow Problems, Potential Flow Problems.	10
	Total Instructional Hours	**60**

Course Outcome

CO1. Can understand different mathematical techniques used in FEM analysis and use them for solving structural and thermal problems.
CO2. Calculate the stresses in one dimensional structures.
CO3. Calculate the stresses in two dimensional and axi-symmetric structures
CO4. Evaluate the stresses in non-uniform higher order structures.
CO5. Solving the field variable problems.

TEXT BOOKS:

T1 - Tirupathi.R. Chandrapatla and Ashok D. Belegundu., "Introduction to Finite Elements in Engineering", Prentice Hall India, Third Edition, 2003.
T2 - Rao.S.S., "Finite Element Method in Engineering", 3rd Ed., Butterworth-Heinemann, 1998.

REFERENCE BOOKS:

R1 - Larry J Segerlind., "Applied Finite Element Analysis", Second Edition, John Wiley and Sons, Inc.1984.
R2 - Daryl L. Logan., "A First Course in the Finite Element Method", Cengage Learning, 2011.
R3 - Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6203	COMPOSITE MATERIALS AND STRUCTURES	3	0	0	3

Course Objective

1. To make the student understand the analysis of composite laminates under different loading conditions.
2. To gain knowledge in failure theories of lamina.
3. To provide the mathematical foundations of laminated plates.
4. To give exposure in various methods of fabrication of composite laminates.
5. To Apply the knowledge in failure of sandwich construction

Unit	Description	Instructional Hours
I	**MICROMECHANICS** Introduction - advantages and application of composite materials – types of reinforcements and matrices - micro mechanics – mechanics of materials approach, elasticity approach- fiber volume ratio – mass fraction – density of composites.	10
II	**MACROMECHANICS** Generalized Hooke's Law - elastic constants for anisotropic, orthotropic and isotropic materials - macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis – determination of in plane strengths of a lamina - experimental characterization of lamina. Failure theories of a lamina.	10
III	**LAMINATED PLATE THEORY** Governing differential equation for a laminate. Stress – strain relations for laminate - Different types of laminates - In plane and flexural constants of a laminate. Hygrothermal stresses and strains in a laminate. Impact resistance and interlaminar stresses. Netting analysis	11
IV	**FABRICATION PROCESS AND REPAIR METHODS** Various open and closed mould processes, manufacture of fibers, importance of repair and different types of repair techniques in composites – autoclave and non-autoclave methods.	7
V	**SANDWICH CONSTRUCTIONS** Basic design concepts of sandwich construction - materials used for sandwich construction - failure modes of sandwich panels - bending stress and shear flow in composite beams.	7
	Total Instructional Hours	**45**

Course Outcome

CO1: Understanding the mechanics of composite materials.
CO2: Identify and analyze the failure modes based on failure theories.
CO3: Calculate the stresses and strains in a laminate.
CO4: Apply knowledge gained in manufacturing and repair of composites.
CO5: Solve the structural problems of sandwich panels.

TEXT BOOKS:

T1 - Dam Ishai., "Mechanics of Composite Materials."
T2 - Autar K Kaw, „Mechanics of Composite Materials", CRC Press, 1997..

REFERENCE BOOKS:

R1 - Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites." John Wiley and sons. Inc., New York, 1995.
R2 - Madhuji Mukhapadhyay, Mechanics of Composite Materials and Structures, University Press, 2004.
R3 - Allen Baker, "Composite Materials for Aircraft Structures", AIAA Series, II Edition, 1999.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6001	AIRCRAFT DESIGN PROJECT	0	0	4	2

Course Objective

1. To enable to understand the behavior of aircraft structural components under different loading conditions.
2. To provide the Principle involved in photo elasticity and its applications in stress analysis.
3. To study about non-destructive testing methods.

Expt. No.	Description of the Experiments
1.	Comparative studies of different types of airplanes and their specifications an performance details with reference to the design work under taken.
2.	Comparative graphs preparation and selection of main parameters for the design.
3.	Preliminary weight estimation.
4.	Power plant selection, aerofoil selection, fixing the geometry of Wing, tail, control surfaces
5.	Drag Estimation
6.	Detailed performance calculations and stability estimates.
7.	V-n diagram.
8.	Landing gear selection & design
9.	Preliminary design of an aircraft wing – Shrenck's curve, structural load distribution, shear force, bending moment and torque diagrams
10.	Detailed design of an aircraft wing – design of spars and stringers, bending stress and shear flow calculations
11.	Preliminary design of an aircraft fuselage – load distribution on an aircraft fuselage
12.	tailed design of an aircraft fuselage – design of bulkheads and longerons –bending stress and shear flow calculations.
13.	Preparation of a detailed design report with CAD drawings
	Total Practical Hours **45**

Course Outcome

CO1: Ability design aircraft and demonstrate the performance of the design
CO2: Capacity to design g aircraft wings, fuselage, loading gears.
CO3: Ability to angle the design in terms of structural point of view.
CO4: Apply the knowledge of aircraft structure to choose suitable materials to different components of aircraft.
CO5: Ability to visualize and draw three view diagrams of the aircraft.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6002	COMPUTER AIDED SIMULATION LABORATORY	0	0	4	2

Course Objective

1. To make the students familiarize with computational fluid dynamics.
2. To practice on structural analysis software tools.
3. By employing these tools for Aerospace applications students will have an opportunity to expose themselves to simulation software.

Expt. No.	Description of the Experiments
1.	Simulation of flow through a Converging-diverging nozzle
2.	Simulation of flow through an axial flow compressor blade passage
3.	Simulation of supersonic flow over a wing of biconvex cross section
4.	Hot flow simulation through an axial flow turbine blade passage
5.	Simulation of flow through subsonic and supersonic diffusers
6.	Structural analysis of a tapered wing
7.	Structural analysis of a fuselage structure
8.	Analysis of a composite laminate structure
9.	Structural analysis of a landing gear
10.	Thermo structural analysis of a composite laminate structure

Total Practical Hours 45

Course Outcome

CO1. Explore different simulation and analysis software tools.
CO2. Execute design and analysis of various components.
CO3. Simulate flow behavior and perform structural analysis.
CO4. Analyze the problems for the better solution.
CO5. Students can meet the industry requirement excel in structural and flow analysis

List of Equipment (for a batch of 30 students)

Sl. No.	Equipment	Qty.
1	Internal server (or) Work station	1
2	Computers	30
3	Modelling packages (i) CATIA (ii) ANSYS (iii) Pro E (iv) NASTRAN	30 licenses
4	UPS	1
5	Printer	1

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6003	AIRCRAFT SYSTEMS LABORATORY	0	0	4	2

Course Objective

1. To train the students "ON HAND" experience in maintenance of various air frame systems in aircraft and rectification of common snags.
2. To impart knowledge on various checks of aircraft.
3. To gain knowledge about various trouble shooting methods.

Expt. No.	Description of the Experiments
1.	Aircraft "Jacking Up" procedure
2.	Aircraft "Levelling" procedure
3.	Control System "Rigging check" procedure
4.	Aircraft "Symmetry Check" procedure
5.	"Flow test" to assess of filter element clogging
6.	"Pressure Test" To assess hydraulic External/Internal Leakage
7.	"Functional Test" to adjust operating pressure
8.	"Pressure Test" procedure on fuel system components
9.	"Brake Torque Load Test" on wheel brake units
10.	Maintenance and rectification of snags in hydraulic and fuel systems.

Total Practical Hours 45

Course Outcome

CO1: Ability to carry out basic maintenance activities involved in aircraft.
CO2: Capable of carrying out symmetry checks.
CO3: Ability to conduct various pressure and functional tests.
CO4: Enable to rectify the snags in aircraft hydraulic & pneumatic systems.
CO5: Identification of reasons involved at the time of malfunctioning.

List of Equipment (for a batch of 30 students)

Sl. No.	Item	Quantity	Experiment No.
1	Serviceable aircraft with all above systems	1	1,2,3,4,5,6,7,8,9,10
2	Hydraulic Jacks (Screw Jack)	5	1,2,4,8
3	Trestle adjustable	5	1,2,4,8
4	Spirit Level	2	8
5	Levelling Boards	2	8
6	Cable Tensiometer	1	8
7	Adjustable Spirit Level	1	8
8	Plumb Bob	1	8

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PROFESSIONAL ELECTIVE-I

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5301	AIRCRAFT MATERIALS AND PROCESSES	3	0	0	3

Course Objective

1. To study the various types of materials and its structure
2. To analyze mechanical behavior of materials
3. To understand various types of corrosion in the materials
4. To identify the various types of composite materials and its uses
5. To understand Heat treatment processes of aircraft materials

Unit	Description	Instructional Hours
I	**ELEMENTS OF AEROSPACE MATERIALS** Structure of solid materials – Atomic structure of materials – crystal structure – miller indices – density– packing factor – space lattices – x-ray diffraction – imperfection in crystals – physical metallurgy -general requirements of materials for aerospace applications.	9
II	**MECHANICAL BEHAVIOUR OF MATERIALS** Linear and non linear elastic properties – Yielding, strain hardening, fracture, Bauchinger's effect – Notch effect testing and flaw detection of materials and components – creep - fatigue – fracture mechanics.	9
III	**HEAT TREATMENT AND CORROSION** Types of corrosion – effect of corrosion on mechanical properties – stress corrosion cracking – corrosion resistance materials used for space vehicles heat treatment of carbon steels – aluminium alloys, magnesium alloys and titanium alloys – effect of alloying treatment, heat resistance alloys – Corrosion Resistant materials used in aircraft	10
IV	**CERAMICS AND COMPOSITES** Introduction – powder metallurgy - modern ceramic materials – cermets - cutting tools – glass ceramic –production of semi fabricated forms - plastics and rubber – carbon/carbon composites, fabrication processes involved in metal matrix composites - shape memory alloys – wood and fabric in aircraft construction	9
V	**HIGH TEMPERATURE MATERIALS CHARACTERIZATION** Classification, production and characteristics – methods and testing – determination of mechanical and thermal properties of materials at elevated temperatures – application of these materials in thermal protection systems of aerospace vehicles – Emerging trends in aerospace application	8
	Total Instructional Hours	**45**

Course Outcome

CO1. Knowledge in evolution of materials and its structure.
CO2. Ability to understand various material behaviour.
CO3. Understand the role of corrosion and heat treatment processes of aircraft materials.
CO4. Knowledge in usage of composite materials in aircraft component design.
CO5. Exposure to high temperature materials for space applications.

TEXT BOOKS:

T1 - Titterton.G., "Aircraft Materials and Processes", V Edition, Pitman Publishing Co., 1995.
T2 - Raghavan.V., "Materials Science and Engineering", Prentice Hall of India, New Delhi, 1993

REFERENCE BOOKS:

R1 - Martin, J.W., "Engineering Materials, Their properties and Applications", Wykedham Publications (London) Ltd., 1987.
R2 - Popov., "Engineering Mechanics of Solids", Prentice Hall of India,2003.
R3 - Van Vlack.L.H., "Materials Science for Engineers", Addison Wesley, 1985

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5302	HEAT TRANSFER	3	0	0	3

Course Objective

1. To introduce the concepts of heat transfer to enable the students understand the thermal systems and conduction behavior of various solids.
2. To give mathematical knowledge of convection heat transfer for various ambience.
3. To give analytical knowledge to the Radiation heat transfer.
4. To give exposure to numerical methods employed to solve heat transfer problems.
5. To provide the basic knowledge about heat transfer problems in the Aerospace field.

Unit	Description	Instructional Hours
I	**HEAT CONDUCTION** 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	11
II	**CONVECTIVE HEAT TRANSFER** 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.	10
III	**HEAT EXCHANGERS** Classification – Temperature Distribution – Overall heat transfer coefficient, Heat Exchange Analysis – LMTD Method and E-NTU Method.	8
IV	**RADIATIVE HEAT TRANSFER** Introduction to Physical mechanism – Radiation properties – Radiation shape factors – Heat exchange between non – black bodies – Radiation shields.	8
V	**HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING** High-Speed flow Heat Transfer, Heat Transfer problems in gas turbine combustion chambers – Rocket thrust chambers – Aerodynamic heating – Ablative heat transfer.	8
	Total Instructional Hours	**45**

Course Outcome

CO1: Able to do basic calculations involving conduction heat transfer in various solids.
CO2: Able to perform the convection phenomenon to the varied environment conditions and the equipment's
CO3: Able to understand the radiation heat transfer in the ambient conditions of the various equipment's
CO4: Able to solve the heat transfer problems with help of numerical methods
CO5: Able to predict heat transfer problems in the propulsive device.

TEXT BOOKS:

T1-Yunus A.Cengel.,"Heat Transfer – A practical approach", Second Edition, Tata McGraw-Hill, 2002.

T2-Sachdeva, S.C., "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi, 1981.

REFERENCE BOOKS:

R1- Mathur, M. and Sharma, R.P. "Gas Turbine and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1988.

R2 - Holman,J.P., "Heat Transfer", McGraw Hill Book Co.,Inc., New York, Sixth Edition,1991.

R3 - Lienhard,J.H., A Heat Transfer Text Book, Prentice Hall Inc., 1981.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5303	BOUNDARY LAYER THEORY	3	0	0	3

Course Objective

1. To gain knowledge about the concepts of basic flow equations.
2. To impart knowledge on the growth of boundary layer.
3. To understand the various boundary layer profile.
4. To gain knowledge on the wake formation.
5. To understand about various boundary layer control techniques.

Unit	Description	Instructional Hours
I	**FUNDAMENTAL EQUATIONS OF VISCOUS FLOW** Fundamental equations of viscous flow, Conservation of mass, Conservation of Momentum-Navier-Stokes equations, Energy equation, Mathematical character of basic equations, Dimensional parameters in viscous flow, Non-dimensionalising the basic equations and boundary conditions, vorticity considerations, creeping flow, boundary layer flow	8
II	**SOLUTIONS OF VISCOUS FLOW EQUATIONS** Solutions of viscous flow equations, Couette flows, Hagen-Poisuelle flow, Flow between rotating concentric cylinders, Combined Couette-Poiseuille Flow between parallel plates, Creeping motion, Stokes solution for an immersed sphere, Development of boundary layer, Displacement thickness, momentum and energy thickness.	10
III	**LAMINAR BOUNDARY LAYER** Laminar boundary layer equations, Flat plate Integral analysis of Karman – Integral analysis of energy equation – Laminar boundary layer equations – boundary layer over a curved body-Flow separation- similarity solutions, Falkner–Skan wedge flows, Boundary layer temperature profiles for constant plate temperature –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen method – Thermal boundary layer calculations.	10
IV	**TURBULENT BOUNDARY LAYER** Turbulence-physical and mathematical description, Two-dimensional turbulent boundary layer equations — Velocity profiles – The law of the wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent boundary layer on a flat plate – Boundary layers with pressure gradient.	10
V	**BOUNDARY LAYER CONTROL** Boundary layer control in laminar flow-Methods of Boundary layer control: Motion of the solid wall- Acceleration of the boundary layer-Suction- Injection of different gas-Prevention of transition-Cooling of the wall-Boundary layer suction-Injection of a different gas.	7
	Total Instructional Hours	**45**

Course Outcome

CO1. Capable of identifying the flow types.
CO2. Manipulating the growth of boundary layer thickness.
CO3. Capable of evaluating the effect of boundary layer.
CO4. Ability to understand the effect of wake in turbulent flow.
CO5. Acquire knowledge on control of boundary layer growth.

TEXT BOOKS:

T1 - White, F. M., Viscous Fluid Flow, McGraw-Hill & Co., Inc., New York 2008.
T2 - NASA Technical reports, Numerical Simulation of Boundary Layers, 1986.

REFERENCE BOOKS:

R1 - Schlicting, H., Boundary Layer Theory, McGraw-Hill, New York, 1979.
R2 - Reynolds, A. J., Turbulent Flows Engineering, John Wiley and Sons, 1980.
R3 - Stephen B.Pope,Turbulent flows, Cambridge University Press, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE5304	PRINCIPLES OF MANAGEMENT (ONLY FOR AERO)	3	0	0	3

Course Objective

1. To introduce the basic of management.
2. To impart knowledge about planning
3. To gain more knowledge on organizing and staffing
4. To impart knowledge about directing
5. Students will also gain some basic knowledge on controlling

Unit	Description	Instructional Hours
I	**INTRODUCTION TO MANAGEMENT** Definition of Management - Science or Art - Manager Vs Entrepreneur- Management and Administration - Development of Management Thought - Contribution of Taylor and Fayol – Functions of Management - Types of Business Organisation.	9
II	**PLANNING** Nature & Purpose - Steps involved in Planning - Objectives – Setting Objectives - Process of Managing by Objectives - Strategies, Policies & Planning Premises- Forecasting - Decision-making.	8
III	**ORGANISING AND STAFFING** Nature and Purpose - Types of Organization - Organization Chart - Structure and Process – Departmentalization by difference strategies - Line and Staff authority - Benefits and Limitations - Difference between authority and power- Centralization, De-Centralization and Delegation of Authority - Staffing - Selection Process - Techniques – Human Recourse management.	10
IV	**DIRECTING** Scope - Human Factors - Creativity and Innovation - Leadership - Types of Leadership Motivation - Hierarchy of needs - Motivation theories - Motivational Techniques - Job Enrichment - Communication - Process of Communication - Barriers and Breakdown - Effective Communication - Electronic media in Communication.	9
V	**CONTROLLING** System and process of Controlling - Requirements for effective control - budgetary and non-budgetary control techniques - Information Technology in Controlling - Use of computers in handling the information - Productivity - Problems and Management - Direct and Preventive Control - Reporting - The Global Environment - Globalization and Liberalization.	9
	Total Instructional Hours	**45**

Course Outcome

CO1. Knowledge of management
CO2. Ability to have clear understanding of planning
CO3. Ability to have clear understanding of organizing and staffing
CO4. Ability to have clear understanding of staffing
CO5. Have some basic knowledge on international aspect of management.

TEXT BOOKS:

T1 - Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata McGraw-Hill, 1998
T2 - Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

REFERENCE BOOKS:

R1 - Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill.
R2 - Joseph L Massie "Essentials of Management", Prentice Hall of India, (Pearson) Fourth Edition, 2003.
R3 - Stephen P. Robbins & Mary Coulter, "Management", 10th Edition, Prentice Hall (India) Pvt. Ltd., 2009.

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PROFESSIONAL ELECTIVE-II

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6301	THEORY OF ELASTICITY	3	0	0	3

Course Objective

1. Ability to analyze some real problem and to formulate the conditions of theory of elasticity application
2. To make the student understand the elastic behavior of different structural components under various loadings and boundary conditions.
3. Students can able to analyze the result of solution by standard computational programs
4. To execute a reasonable choice of parameters of the model (geometry, material properties, boundary conditions)
5. To understand the theoretical concepts of material behavior with particular emphasis on their elastic property.

Unit	Description	Instructional Hours
I	**BASIC EQUATIONS OF ELASTICITY** Definition of Stress and Strain: Stress - Strain relationships - Equations of Equilibrium, Compatibility equations, Boundary Conditions, Saint Venant's principle - Principal Stresses, Stress Ellipsoid - Stress invariants.	9
II	**PLANE STRESS AND PLANE STRAIN PROBLEMS** Airy's stress function, Bi-harmonic equations, Polynomial solutions. Simple two-dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams.	9
III	**POLAR COORDINATES** Equations of equilibrium, Strain - displacement relations, Stress – strain relations, Airy's stress function, Axi – symmetric problems, Introduction to Dunder's table, Curved beam analysis, Lame's, Kirsch, Michell's and Boussinesque problems – Rotating discs.	9
IV	**TORSION** Navier's theory, St. Venant's theory, Prandtl's theory on torsion, semi- inverse method and applications to shafts of circular, elliptical, equilateral triangular and rectangular sections. Membrane Analogy.	9
V	**INTRODUCTION TO THEORY OF PLATES AND SHELLS** Classical plate theory – Assumptions – Governing equations – Boundary conditions – Navier's method of solution for simply supported rectangular plates – Levy's method of solution for rectangular plates under different boundary conditions.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the fundamental equations used for forming the equilibrium equations.
CO2: Able to find stress in two dimensional structures using Cartesian co-ordinates
CO3: Able to find stress in polar co-ordinates and axi-symmetric structures.
CO4: Able to solve stress in cylindrical structures.
CO5: Introduction to methods used for solving plate and shell structures.

TEXT BOOKS:

T1 - Timoshenko, S., and Goodier, T.N., "Theory of Elasticity", McGraw – Hill Ltd., Tokyo, 1990.
T2 - Bhaskar, K., and Varadan, T. K., "Theory of Isotropic/Orthotropic Elasticity", CRC Press USA, 2009.

REFERENCE BOOKS:

R1 - Volterra & J.H. Caines, "Advanced Strength of Materials", Prentice Hall, New Jersey, 1991
R2 - Sokolnikoff, I. S., "Mathematical Theory of Elasticity", McGraw – Hill, New York, 1978.
R3 - Wang, C. T., "Applied Elasticity", McGraw – Hill Co., New York, 1993

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6302	INTRODUCTION TO CRYOGENICS	3	0	0	3

Course Objective

1. To impart knowledge on the cryogenic fluids
2. To predict the storage problems of cryogenic fluids
3. To analyze the operating cycles
4. To understand the thermodynamics of cryogenics
5. To enumerate the applications of cryogenics

Unit	Description	Instructional Hours
I	**INTRODUCTION** Historical Background - Introduction to cryogenic propellants - Liquid hydrogen, liquid helium, liquid nitrogen and liquid oxygen and their properties	7
II	**LOW TEMPERATURE PRODUCTION** Theory behind the production of low temperature - Expansion engine heat exchangers - Cascade process Joule Thompson Effect - Magnetic effect - Ortho and H2 - Helium4 and Helium 3	10
III	**EFFICIENCY OF CRYOGENIC SYSTEMS** Types of losses and efficiency of cycles - specific amount of cooling - The fraction liquified – Cooling coefficient of performance - Thermodynamic efficiency – The energy balance Method	10
IV	**OPERATION CYCLES OF CRYOGENIC PLANTS** Classification of cryogenic cycles - The structure of cycles - Throttle expansion cycles - Expander cycles - Thermodynamic analysis - Numerical problems	10
V	**CRYOGENIC IN AEROSPACE APPLICATIONS** Cryogenic liquids in missile launching and space simulation Storage of cryogenic liquids - Effect of cryogenic liquids on properties of aerospace materials – Cryogenic loading problems - Zero gravity problems associated with cryogenic propellants - Phenomenon of tank collapse - Elimination of Geysering effect in missiles	8
	Total Instructional Hours	**45**

Course Outcome

CO1.	Understand the evolution of cryogenic fluids
CO2.	Understand the storage problems of cryogenic fluids
CO3.	Ability to predict the heat transfer characteristics
CO4.	Identification of operating cycles
CO5.	Knowing the application of cryogenics

TEXT BOOKS:

T1 - Haseldom, G., Cryogenic Fundamentals, Academic Press, 1971
T2 - Barron, R. F., Cryogenic Systems, Oxford University, 1985

REFERENCE BOOKS:

R1 - Parner, S. F., Propellant Chemistry, Reinhold Publishing Corpn., New York 1985
R2 - Randall Barron., Cryogenics systems , Mc Graw Hill Book Co
R3 - Valery V. Kostionk., "A Text Book Of Cryogenics", Discovery Publishing House, 2003

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6303	WIND TUNNEL TECHNIQUES	3	0	0	3

Course Objective

1. To interpret the basic concepts of measurement of forces and moments on models during the wind tunnel testing.
2. To understand the application of various types of wind tunnels.
3. To know the calibration techniques used in wind tunnels.
4. To learn the basic measurement procedure involving wind tunnel testing
5. To study the various flow visualization methods in wind tunnels.

Unit	Description	Instructional Hours
I	**PRINCIPLES OF MODEL TESTING** Buckingham Theorem – Non-Dimensional Numbers –Scale Effect Types of Similartes.	6
II	**WIND TUNNELS** Introduction to wind tunnels - Classification – Special problems of Testing in Subsonic, Transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.	8
III	**CALIBRATION OF WIND TUNNELS** Test section speed – Horizontal buoyancy – Flow angularities – Turbulence measurements – Associated instrumentation – Calibration of supersonic tunnels.	11
IV	**WIND TUNNEL MEASUREMENTS** Pressure and velocity measurements – Force measurements – Three component and six component balances – Internal balances	12
V	**FLOW VISUALIZATION** Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.	8
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the principles and opretion of windtunnels
CO2: Analyse the different components in wind tunnel
CO3: Calibrate the wind tunnel
CO4: Ability to measure various flow parameters
CO5: Visualize the flow over the component by using various techniques

TEXT BOOKS:

T1 - Rae, W.H. and Pope, A. "Low Speed Wind Tunnel Testing", John Wiley Publication, 1984.
T2 - NAL-UNI Lecture Series 12:" Experimental Aerodynamics", NAL SP 98 01 April 1998

REFERENCE BOOKS:

R1 - Pope, A., and Goin, L., "High Speed wind Tunnel Testing", John Wiley, 1985.
R2 - Lecture course on "Advanced Flow diagnostic techniques" 17-19 September 2008 NAL, Bangalore.
R3 - Rathakrishnan, E., "Instrumentation, Measurements, and Experiments in Fluids," CRC Press – Taylor & Francis, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6304	AERO ENGINE MAINTENANCE AND REPAIR	3	0	0	3

Course Objective

1. To make the students understand about the piston engine and its operation.
2. To interpret the basic concepts of inspections of piston engines
3. To learn the fundamentals of propeller and its inspection methods.
4. To make the students to familiarize with the Aircraft engine maintenance procedure and practice.
5. To study the basic concepts of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.

Unit	Description	Instructional Hours
I	**PISTON ENGINE** 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 – Lubrication system, Maintenance and inspection checks to be carried out.	8
II	**INSPECTIONS OF PISTON ENGINES** 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. Methods and instruments for non-destructive testing techniques – Equipment for replacement of part and their repair	8
III	**PROPELLERS** Propeller theory - operation, construction assembly and installation - Pitch change mechanism- Propeller axially system- Damage and repair criteria - General Inspection procedures - Checks on constant speed propellers - Pitch setting, Propeller Balancing, Blade cuffs, Governor/Propeller operating conditions – Damage and repair criteria.	10
IV	**JET ENGINES , TESTING AND INSPECTION** Types of jet engines – Fundamental principles – Bearings and seals - Inlets - compressors- turbines- exhaust section – classification and types of lubrication and fuels- Materials used - Details of control, starting around running and operating procedures – Inspection and Maintenance- permissible limits of damage and repair criteria of engine components- internal inspection of engines- compressor washing- field balancing of compressor fans- Component maintenance procedures - Systems maintenance procedures - use of instruments for online maintenance - Special inspection procedures- Foreign Object Damage - Blade damage . Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures.	12
V	**OVERHAULING** Engine overhaul – Overhaul procedures- inspection and cleaning of the components – repair schedules for overhaul- balancing of gas turbine components Trouble shooting: procedures for trouble shooting – condition monitoring of the engine on ground and at flight – engine health monitoring and corrective methods.	7
	Total Instructional Hours	**45**

Course Outcome

CO1:Apply maintenance procedure to Aircraft Engines
CO2: Identify the engine components and faults
CO3:Knowing the fundamentals of propellers.
CO4:Apply non-destructive testing procedures to identify the defects
CO5: Apply overhauling procedure to new engines

TEXT BOOKS:

T1 - KROES & WILD, "Aircraft Power plants", 7th Edition – McGraw Hill, New York, 1994.
T2 - Brimm D.J. Bogges H.E., "Aircraft Maintenance", Pitman Publishing corp., New York, 1940.

REFERENCE BOOKS:

R1 - Turbomeca, " Gas Turbine Engines ", The English Book Store ", New Delhi, 1993.
R2 - United Technologies Pratt & Whitney, "The Aircraft Gas turbine Engine and its Operation", The English Book Store, New Delhi.
R3 - Mekinly, J.L. and Bent, R.D., "Aircraft Power Plants", McGraw Hill, 1993.

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OPEN ELECTIVE - I

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16AE6401	INTRODUCTION TO FLIGHT	3	0	0	3

Course Objective

1. To understand the concept of flying and instruments associated with it.
2. To gain knowledge about the structural design and material of aircraft components.
3. To provide the basic idea about the working principle of aircraft power plants.
4. To understand the concept of space vehicles.
5. To gain knowledge on helicopter flight mechanism.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO AIRPLANES** Introduction, historical background, Different types of flight vehicles, Components of an airplane and their functions. Conventional control. Basic instruments for flying. Physical properties and structure of the atmosphere, (Temperature, Pressure and altitude relationships), Evolution of lift, Drag and moment. Aero foils, Avionics: Flight deck and cockpit.	9
II	**AIRPLANE STRUCTURES AND MATERIALS** Introduction to structural design of Aircraft and spacecraft, flight loads, general types of construction, Monocoque, Semi-monocoque and composite structure construction, Typical wing and fuselage structure, Metallic and Non metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials in aerospace.	9
III	**AIRCRAFT ENGINES** Selection of power plants: piston, turbo-propeller, turbofan, and jet engines with after burner / thrust augmentation thrust vector control, FADEC. Use of propeller and jets for thrust production, Comparative merits. Theory of Propellers.	9
IV	**SPACE SYSTEM DESIGN** Overview on space environment, introduction to space debris, Launch site selection, Brief introduction to rockets, ramjet, and SCRAMJET, Thrust vector control mechanisms, staging of rockets, space mission, re-entry vehicles, life support systems for manned space missions, Fuel cells, Introduction to space mechanics to satellites, Interplanetary missions, Space exploration.	9
V	**ROTORCRAFT, UAVs, AND AIRCRAFT SYSTEMS** Introduction to Helicopters and Micro-lights. Introduction to UAVs and MAVs. Types and applications, Maintenance, safety and operations. Basic principles and lay out of various aircraft systems: Hydraulic system, Aircraft Fuel system, Engine fuel system, Air conditioning and Pressurization system Flight control system, Navigation and Weapon control system, Under carriage and Brake system, High lift devices.	9
	Total Instructional Hours	**45**

Course Outcome

CO1. Understand about the fundamentals of various flight configurations.
CO2. Capable of choosing the correct material for specified components.
CO3. Understand about the basic science of aircraft engines.
CO4. Ability to understand about the space vehicles behavior.
CO5. Capable of implementing the ideas on helicopter aerodynamics.

TEXT BOOKS:

T1 - Anderson J.D., Introduction to Flight, McGraw-Hill 7th edition, 2013.
T2 - Austin R., Unmanned Aircraft Systems, AIAA Education Series, 2010.

REFERENCE BOOKS:

R1 - Dava Newman, Interactive Aerospace Engineering and Design, McGraw-Hill. 2nd edition., 2002.
R2 - Kermode, A.C., "Mechanics of Flight", Himalayan Book, 1997
R3 - Kermode A.C, " Flight without formulae", Pearson Education,, Fifth edition,1989.

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MAPPING OF COURSE OUTCOMES (COs), PROGRAM OUTCOMES (POs) AND PROGRAM SPECIFIC OUTCOME (PSOs)

B. E. AERONAUTICAL ENGINEERING (UG)

Academic Year 2018-2019

REGULATION-2016 (Revised)

SEMESTER-I														
16MA1101-Engineering Mathematics I														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	2	2	-	-	-	-	-	-	2	2	2
AVG	3	3	3	2	2	-	-	-	-	-	-	2	2	2
16PH1101-Engineering Physics														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	1	-	-	-	-	-	-	2	2
CO2	3	2	1	1	1	-	-	-	-	-	-	-	2	1
CO3	3	2	1	2	2	1	-	-	-	-	-	-	2	2
CO4	3	2	1	1	2	-	2	-	-	-	-	-	2	1
CO5	3	2	-	1	2	-	-	-	-	-	-	-	2	1
AVG	3	2.2	1	1.2	1.8	1	2	-	-	-	-	-	2	1.4
16CY1101-Engineering Chemistry														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	1
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	1
CO3	3	2	2	-	2	1	1	-	-	-	-	1	1	1
CO4	3	2	2	2	2	1	-	-	-	-	-	1	1	1
CO5	3	2	2	2	2	1	1	-	-	-	-	1	1	1
AVG	3	2	2	2	2	1	1	-	-	-	-	1	1	1
16HE1101R- Essential English For Engineers I														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	1	-	-	-	-	1	1	-	-	3	-	1	-	1
CO2	1	1	-	2	-	2	1	-	2	3	-	2	1	1
CO3	1	-	1	-	-	3	-	-	2	3	-	1	-	1
CO4	1	1	1	1	-	1	1	-	2	3	-	2	1	1
CO5	1	-	1	1	-	2	1	-	-	3	-	2	1	1
AVG	1	1	1	1.33	-	1.8	1	-	2	3	-	1.6	1	1
16GE1103 - Problem Solving and Python Programming														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	2	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	2	-	-	-	2	-	-	3	3	1
CO3	3	3	2	1	2	-	-	-	2	-	-	3	3	2
CO4	3	3	2	1	2	-	-	-	-	-	-	3	3	1
CO5	3	3	-	-	2	-	-	-	-	2	-	-	2	2
AVG	3	3	2	1	2	-	-	-	2	2	-	3	2.6	1.6
16GE1102-Engineering Graphics														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	3	-	1	-	1
CO2	3	2	2	-	-	-	-	-	-	2	-	-	-	1
CO3	3	2	3	-	2	-	-	-	-	2	-	1	-	2
CO4	3	2	3	-	2	-	-	-	-	2	-	-	2	2
CO5	3	2	3	-	2	-	-	-	-	2	-	-	2	2
AVG	3	2	2.6	-	2	-	-	-	-	2.2	-	1	2	1.6
16PS1001-Physical Science Lab - I														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	1	-	-	-	-	-	-	2	2
CO2	3	2	1	1	1	-	-	-	-	-	-	-	2	1
CO3	3	2	1	2	2	1	-	-	-	-	-	-	2	2
CO4	3	2	1	1	2	-	2	-	-	-	-	-	2	1
CO5	3	2	-	1	2	-	-	-	-	-	-	-	2	1
AVG	3	2.2	1	1.2	1.8	1	2	-	-	-	-	-	2	1.4
16GE1004 - Problem Solving and Python Programming Lab														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	2	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	2	-	-	-	2	-	-	3	3	1
CO3	3	3	2	1	2	-	-	-	2	-	-	3	3	2
CO4	3	3	2	1	2	-	-	-	-	-	-	3	3	1
CO5	3	3	-	-	2	-	-	-	-	2	-	-	2	2
AVG	3	3	2	1	2	-	-	-	2	2	-	3	2.6	1.6
16GE1002-Engineering Practices Lab														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	3	-	1	-	1
CO2	3	2	2	-	-	-	-	-	-	2	-	-	-	1

CO3	3	2	3	-	2	-	-	-	-	2	-	1	-	2
CO4	3	2	3	-	2	-	-	-	-	2	-	-	2	2
CO5	3	2	3	-	2	-	-	-	-	2	-	-	2	2
AVG	3	2	2.6	-	2	-	-	-	-	2.2	-	1	2	1.6
16GE1003- VAC 1 - Language Competency Enhancement course-1														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	1	1	-	-	3	-	1	-	1
CO2	1	1	-	2	-	2	1	-	2	3	-	2	1	1
CO3	1	-	1	-	-	3	-	-	2	3	-	1	-	1
CO4	1	1	1	1	-	1	1	-	2	3	-	2	1	1
CO5	1	-	1	1	-	2	1	-		3	-	2	1	1
AVG	1	1	1	1.33	-	1.8	1	-	2	3	-	1.6	1	1
SEMESTER-II														
16MA2102-Engineering Mathematics- II														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	1
CO3	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	1
CO5	3	3	3	2	2	-	-	-	-	-	-	2	1	2
AVG	3	3	3	2	2	-	-	-	-	-	-	2	1.8	1.4
16PH2102-Physics Of Materials														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	-	-	-	-	-	-	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	-	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	-	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	-	2	2
CO5	3	2	2	3	2	1	-	-	-	-	-	-	2	3
AVG	3	2.4	1.2	1.8	1.8	1	-	-	-	-	-	-	2	2.2
16CY2102-Environmental Sciences														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	2	3	3	2	-	2	2	2	1
CO2	2	1	1	-	-	2	3	3	2	-	2	2	2	1
CO3	2	0	0	-	-	2	3	3	2	-	2	2	2	1
CO4	2	1	2	-	-	2	3	3	2	-	2	2	2	2
CO5	2	1	2	-	-	2	3	3	2	-	2	2	2	2
AVG	2	0.75	1.25	-	-	2	3	3	2	-	2	2	2	1.4
16HE2102R- Essential English For Engineers-II														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	1	3	-	-	2	-
CO2	2	2	-	-	-	2	-	-	3	3	-	2	2	2
CO3	2	-	2	-	-	-	-	-	2	3	-	-	2	1

CO4	-	1	-	1	-	-	-	-	1	2	-	2	-	-
CO5	2	1	2	-	1	-	-	-	1	3	-	-	2	2
AVG	2	1.33	2	1	1	2	-	-	1.6	2.8	-	2	2	1.67
16GE2101-Engineering Mechanics														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	1	2	-	-	2	-	2	2	2
CO2	2	3	2	2	-	-	1	-	-	1	-	1	2	2
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	1
CO4	2	2	2	1	-	-	1	-	-	-	-	1	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-	-	-
AVG	2.4	2.4	2.2	1.5	-	1	1.33	-	-	1.5	-	1.33	1.67	1.67
16EE2202-Basics Of Electrical And Electronics														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	2	2	2
CO3	2	-	3	-	1	-	-	-	-	-	-	1	3	3
CO4	2	-	3	2	-	-	-	-	-	-	-	1	3	3
CO5	3	-	-	-	2	-	1	-	-	-	-	2	2	1
AVG	2.6	2.5	2	2	1.5	-	1	-	-	-	-	1.4	2.6	2.2
16PS2001-Physical Sciences Lab - II														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	1	-	-	-	-	-	-	2	2
CO2	3	2	1	1	1	-	-	-	-	-	-	-	2	1
CO3	3	2	1	2	2	1	-	-	-	-	-	-	2	2
CO4	3	2	1	1	2	-	2	-	-	-	-	-	2	1
CO5	3	2	-	1	2	-	-	-	-	-	-	-	2	1
AVG	3	2.2	1	1.2	1.8	1	2	-	-	-	-	-	2	1.4
16ME2001-Computer Aided Drafting Lab														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	3	-	1	-	1
CO2	3	2	2	-	-	-	-	-	-	2	-	-	-	1
CO3	3	2	3	-	2	-	-	-	-	2	-	1	-	2
CO4	3	2	3	-	2	-	-	-	-	2	-	-	2	2
CO5	3	2	3	-	2	-	-	-	-	2	-	-	2	2
AVG	3	2	2.6	-	2	-	-	-	-	2.2	-	1	2	1.6
16GE2001-VAC 2 - Language Competency Enhancement course-2														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	1	3	-	-	2	-
CO2	2	2	-	-	-	2	-	-	3	3	-	2	2	2
CO3	2	-	2	-	-	-	-	-	2	3	-	-	2	1
CO4	-	1	-	1	-	-	-	-	1	2	-	2	-	-
CO5	2	1	2	-	1	-	-	-	1	3	-	-	2	2

AVG	2	1.3	2	1	1	2	-	-	1.6	2.8	-	2	2	1.67

SEMESTER-III

16MA3103-Fourier Analysis and Statistics

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	2
	3	3	2	2	1	-	-	-	-	-	-	2	3	2

16AE3201-Aero Engineering Thermodynamics

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	-	-	-	1	-	-	-	-	1	3	2
CO3	3	3	2	-	-	-	1	-	-	-	-	1	3	2
CO4	3	3	2	-	-	-	1	-	-	-	-	1	3	2
CO5	3	3	2	-	-	-	1	-	-	-	-	2	3	2
	3	3	2	-	-	-	1	-	-	-	-	1.2	3	2

16AE3202-Solid Mechanics

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	1	1	-	-	-	-	2	3	2
CO2	3	3	1	-	-	1	1	-	-	-	-	2	3	2
CO3	3	3	1	-	-	1	1	-	-	-	-	2	3	2
CO4	3	3	1	-	-	1	1	-	-	-	-	2	3	2
CO5	3	3	1	-	-	1	1	-	-	-	-	2	3	2
	3	3	1	-	-	1	1	-	-	-	-	2	3	2

16AE3203-Engineering Fluid Mechanics

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	2	3	1
CO2	3	2	-	-	-	-	-	-	-	-	-	2	3	1
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	1
CO4	3	3	2	3	-	-	-	-	-	-	-	2	2	2
CO5	3	3	2	3	-	-	-	-	-	-	-	2	2	2
AVG	3	2.8	2	2.667	-	-	-	-	-	-	-	2	2.6	1.4

16AE3204-Elements of Aeronautics

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	1
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	1
CO3	3	-	-	-	-	-	-	-	-	-	-	-	2	1
CO4	3	-	-	-	-	-	-	-	-	-	-	-	2	1
CO5	3	-	-	-	-	-	-	-	-	-	-	-	2	1
AVG	3	-	-	-	-	-	-	-	-	-	-	-	2	1

16AE3205-Aircraft Systems and Instruments

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	-	-	-	-	-	-	-	-	3	2
CO2	3	-	2	-	-	-	-	-	-	-	-	-	3	2
CO3	3	-	2	-	-	-	-	-	-	-	-		3	2
CO4	3	-	2	-	-	-	2	-	-	-	-	3	3	2
CO5	3	2	2	-	2	-	-	-	-	-	-	-	3	2
AVG	3	2	2	-	2	-	2	-	-	-	-	3	3	2

16AE3001-Fluid mechanics and Thermodynamics Lab

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	2	-	-	1	3	2
CO2	3	3	3	3	-	-	-	-	2	-	-	2	3	2
CO3	3	3	3	2	-	-	-	-	2	-	-	1	3	2
CO4	3	3	3	2	-	-	-	-	2	-	-	2	3	2
CO5	3	3	3	2	-	-	2	-	2	-	-	1	3	2
AVG	3	3	2.8	2.4	-	-	2	-	2	-	-	1.4	3	2

16AE3002-Aircraft component Drawing Laboratory

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	2	3	-	-	-	1	2	1	2	2	2
CO2	3	-	3	2	3	-	-	-	1	2	1	2	1	2
CO3	3	-	3	2	2	-	-	-	1	2	1	2	1	2
CO4	3	-	3	2	3	-	-	-	1	2	1	2	1	2
CO5	3	-	3	2	3	-	-	-	1	2	1	2	1	2
AVG	3	-	3	2	2.8	-	-	-	1	2	1	2	1.2	2

SEMESTER-IV

16MA4107-Numerical Methods

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	2

CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	2
AVG	3	3	2	2	-	-	-	-	-	-	-	2	3	2
16AE4201-Aerodynamics														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO3	3	2	2	2	2	-	-	-	-	-	-	2	3	2
CO4	3	2	2	2	2	-	-	-	-	-	-	2	3	2
CO5	2	2	-	-	-	-	-	-	-	-	-	1	2	1
AVG	2.8	2	2	2	2	-	-	-	-	-	-	1.4	2.8	1.8
16AE4202-Mechanics of Machines														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	2	1	-	1	-	-	-	-	-	-	-	2	1
CO3	3	2	-	1	-	-	-	-	-	-	-	-	2	1
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CO5	3	2	-	1	-	-	-	-	-	-	-	-	2	2
AVG	3	2	1	1	1	-	-	-	-	-	-	-	2.2	1.4
16AE4203-Gas Turbine Propulsion														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-	3	-
CO3	3	2	1	2	-	-	1	-	-	-	-	2	3	2
CO4	3	2	1	3	-	-	-	-	-	-	-	-	3	2
CO5	3	2	2	3	-	-	-	-	-	-	-	2	3	2
AVG	3	2	1.25	2.4	-	-	1	-	-	-	-	2	3	2
16AE4204-Aircraft Strength of Materials														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	2	3	2
CO2	3	2	1	-	-	-	-	-	-	-	-	2	3	2
CO3	3	2	1	-	-	-	-	-	-	-	-	2	3	2
CO4	3	2	1	-	-	-	-	-	-	-	-	2	3	2

CO5	3	2	1	-	-	-	-	-	-	-	-	2	3	2
AVG	3	2	1	-	-	-	-	-	-	-	-	2	3	2
16EI4231-Control Engineering														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	2	3	-	-	-	-	-	-	1	2	1
CO2	3	-	3	2	3	-	-	-	-	-	-	1	-	1
CO3	3	3	3	2	3	-	-	-	-	-	-	1	2	1
CO4	3	3	3	2	3	-	-	-	-	-	-	1	2	1
CO5	3	3	3	2	3	-	-	-	-	-	-	1	2	2
AVG	3	3	3	2	3	-	-	-	-	-	-	1	2	1.2
16AE4001-Aerodynamics Laboratory														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	2	2	-	-	3	1
CO2	3	2	2	2	2	-	-	-	2	2	1	2	3	2
CO3	3	2	2	2	2	-	-	-	2	2	1	2	3	2
CO4	3	2	2	2	2	-	-	-	2	2	1	2	3	2
CO5	3	-	-	-	-	-	-	-	2	2	-	2	3	2
AVG	3	2	2	2	2	-	-	-	2	2	1	2	3	1.8
16AE4002-Aircraft Strength of Materials Laboratory														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	1	-	-	2	-	-	1	2	3
CO2	3	2	1	-	-	1	-	-	2	-	-	1	2	3
CO3	3	2	1	-	-	1	-	-	2	-	-	2	2	3
CO4	3	2	1	-	-	1	-	-	2	-	-	1	2	3
CO5	3	2	1	-	-	1	-	-	2	-	-	1	2	3
AVG	3	2	1	-	-	1	-	-	2	-	-	1.2	2	3
SEMESTER-V														
16AE5201-Aircraft Performance														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	2	3	1
CO2	3	2	2	-	-	1	-	-	1	-	1	2	3	2
CO3	3	2	1	2	-	-	-	-	1	-	1	2	3	2
CO4	3	2	1	2	-	2	1	-	1	-	1	2	3	2
CO5	3	2	2	2	-	2	1	-	1	-	1	2	2	2
AVG	3	1.8	1.5	2	-	1.67	1	-	1	-	1	2	2.8	1.8
16AE5202-High Speed Aerodynamics														

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	1
CO2	3	3	2	2	2	-	-	-	-	-	-	-	3	1
CO3	3	3	-	2	2	-	-	-	-	-	-	-	3	1
CO4	3	3	3	2	2	-	-	-	-	-	-	-	3	-
CO5	3	-	2	-	2	-	-	-	-	1	-	2	3	3
AVG	3	3	2.33	2	2	-	-	-	-	1	-	2	3	1.5
16AE5203-Aircraft Structures														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	2	-	-	-	-	-	-	2	3	2
CO2	3	3	2	-	2	-	-	-	-	-	-	2	3	2
CO3	3	3	2	-	2	-	-	-	-	-	-	2	3	2
CO4	3	3	2	-	2	-	-	-	-	-	-	2	3	2
CO5	3	3	2	-	2	2	-	-	-	-	-	2	3	2
AVG	3	3	2	-	2	2	-	-	-	-	-	2	3	2
16AE5204-Advanced Propulsion														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	3	2
CO3	3	3	2	2	-	-	2	-	-	-	-	2	3	2
CO4	3	3	2	2	-	-	2	-	-	-	-	2	3	2
CO5	3	-	-	-	-	-	2	-	-	-	-	2	3	2
AVG	3	3	2.25	2	-	-	2	-	-	-	-	2	3	2
16AE5205-Aircraft General Engineering Maintenance and practice														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	-	-	-	-	-	2	2	3	3
CO2	3	3	2	3	3	-	-	-	-	-	2	2	3	3
CO3	2	3	2	-	3	-	-	-	-	-	2	2	3	2
CO4	2	2	2	3	3	-	-	-	-	-	2	3	3	3
CO5	2	2	2	-	3	-	-	-	-	-	2	3	3	2
AVG	2.4	2.4	2	2.67	3	-	-	-	-	-	2	2.4	3	2.6
16AE5001-Aircraft Structures Laboratory														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	-	-	-	-	2	-	-	2	3	3
CO2	3	-	2	-	-	-	-	-	2	-	-	2	3	3
CO3	3	-	2	-	2	-	-	-	2	-	-	2	3	3
CO4	3	-	2	-	-	-	-	-	2	-	-	2	3	3
CO5	3	-	2	-	-	-	-	-	2	-	-	2	3	3
AVG	3	-	2	-	2	-	-	-	2	-	-	2	3	3
16AE5002-Propulsion Laboratory														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	2	-	2	3	2

CO2	3	3	-	2	2	-	-	-	-	2	-	2	3	3
CO3	3	3	-	2	-	-	-	-	-	2	-	2	3	3
CO4	3	2	-		-	-	-	-	-	2	-	2	3	3
CO5	3	3	-	2	-	-	-	-	-	2	-	2	3	3
AVG	3	2.75	-	2	2	-	-	-	-	2	-	2	3	2.8
SEMESTER-VI														
16AE6201-Aircraft stability and control														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	1	-	1	2	1
CO2	3	2	2	2	-	1	1	-	-	1	-	2	3	2
CO3	3	2	2	2	-	1	1	-	-	1	-	2	3	2
CO4	3	2	2	2	-	1	1	-	-	1	-	2	3	2
CO5	3	3	2	2	-	1	1	1	-	1	-	2	3	2
AVG	2.8	2	1.8	1.8	-	1	1	1	-	1	-	1.8	2.8	1.8
16AE6202-Finite Element Methods in Engineering														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	1	-	-	-	-	1	-	-	1	2	3
CO2	2	2	2	3	1	-	1	-	-	-	-	2	1	3
CO3	3	1	1	2	2	1	2	-	-	-	-	2	2	3
CO4	1	2	3	2	-	-	-	-	-	-	-	1	2	1
CO5	1	1	2	3	-	-	1	-	-	-	-	2	1	2
AVG	2	1.6	2	2.2	1.5	1	1.33	-	1	-	-	1.6	1.6	2.4
16AE6203-Composite Materials and Structures														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO3	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO4	3		2	2	2	-	-	-	-	-	-	1	1	1
CO5	3	2	2	2	-	-	-	-	-	-	-	1	3	2
AVG	3	2	2	2	2	-	-	-	-	-	-	1	2.6	1.8
16AE6001-Aircraft Design Project														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	1	2	3	2	2	2	3	3
CO2	3	3	3	3	2	-	1	1	3	2	2	2	3	3
CO3	3	3	3	3	3	1	-	1	3	2	2	2	3	3
CO4	3	3	3	3	2	-	2	1	3	2	2	2	3	3
CO5	3	2	3	3	3	2	-	2	3	2	2	2	3	3
AVG	3	2.8	3	3	2.6	1.33	1.33	1.4	3	2	2	2	3	3
16AE6002-Computer Aided Simulation Laboratory														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	-	-	-	-	-	-	-	-	-	1	1
CO2	2	2	2	2	2	-	-	-	-	-	-	-	2	2

CO3	3	2	3	3	3	-	-	-	-	-	-	2	3	3
CO4	3	2	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	1	-	-	-	1	2	3	3
AVG	2.4	2.2	2.6	2.75	2.75	-	1	-	-	-	1	2	2.4	2.4
16AE6003-Aircraft Systems Laboratory														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	-	3	-	-	2	2	-	2	3	1
CO2	3	2	2	2	-	-	-	-	2	2	-	-	3	2
CO3	3	3	3	2	-	-	-	-	2	2	-	-	3	3
CO4	3	2	2	3	-	2	-	-	2	3	-	2	3	1
CO5	3	2	2	3	-	3	-	-	2	2	-	2	3	2
AVG	3	2.2	2.2	2.6	-	2.67	-	-	2	2.2	-	2	3	1.8
16AE6801-Mini Project														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	3	3	3	3	2	3	3
CO2	3	3	3	3	3	2	2	3	3	3	3	2	3	3
CO3	3	3	3	3	3	2	2	3	3	3	3	2	3	3
CO4	3	3	3	3	3	2	2	3	3	3	3	2	3	3
CO5	3	3	3	3	3	2	2	3	3	3	3	2	3	3
AVG	3	3	3	3	3	2	2	3	3	3	3	2	3	3

PROFESSIONAL ELECTIVES

16AE5301-Aircraft materials and processes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-	-	-	-	3	3
CO2	3	-	-	3	-	-	-	-	-	-	-	-	3	3
CO3	3	-	-	3	-	3	-	-	-	-	-	-	3	3
CO4	3	-	-	3	-	-	-	-	-	-	-	-	3	3
CO5	3	-	-	3	-	-	-	-	-	-	-	-	3	3
AVG	3	-	-	3	-	3	-	-	-	-	-	-	3	3
16AE5302- Heat Transfer														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	2	-	-	-	-	2	3	1
CO2	3	3	2	3	-	-	2	-	-	-	-	2	3	1
CO3	3	3	2	3	-	-	2	-	-	-	-	2	3	1
CO4	3	3	2	3	-	-	2	-	-	-	-	2	3	1
CO5	3	3	2	3	-	-	2	-	-	-	-	2	3	1
AVG	3	3	2	3	-	-	2	-	-	-	-	2	3	1
16AE5303-Boundary layer Theory														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2.2	1.2	1	-	-	-	-	-	-	-	-	3	2.2

CO2	3	3	2	2	2	-	-	-	-	1	-	2	-	3
CO3	3	3	1	2	1	-	-	-	-	1	-	2	-	3
C04	3	2	2	1	2	1	1	-	-	-	1	1	2	2
C05	3	2	1	-	1	-	-	2	-	-	1	1	2	1
AVG	3	3	2	1	2	1	-	2	1	1	2	2	2	2
16AE5304-Principles of Management														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	3	-	3	-	-	-
CO2	2	-	-	-	-	-	-	3	3	-	3	-	-	-
CO3	2	-	-	-	-	-	-	-	3	-	3	-	-	-
C04	2	-	-	-	-	-	-	-	3	-	3	-	-	-
C05	2	-	-	-	-	-	2	-	3	-	3	-	-	-
AVG	2	-	-	-	-	-	2	3	3	-	3	-	-	-
16AE6301 -Theory of Elasticity														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	2
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	-	3	2
AVG	3	2.8	2.8	2	-	-	-	-	-	-	-	-	3	2
16AE6302- Introduction to Cryogenics														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	-	3	2
CO2	3	2	1	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	2	1	-	-	-	-	-	-	-	-	3	3
C04	3	2	1	-	-	-	-	-	-	-	-	-	3	2
C05	3	2	1	-	-	-	-	-	-	-	-	-	3	2
AVG	3	2.2	1.2	1	-	-	-	-	-	-	-	-	3	2.2
16AE6303 - Wind Tunnel Techniques														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	3	-	3	3
CO2	3	3	3	3	-	-	-	-	-	-	3	-	3	3
CO3	3	3	3	3	-	-	-	-	-	-	3	-	3	3
CO4	3	3	1	3	-	-	-	-	-	-	1	-	3	2
CO5	3	3	1	2	-	-	-	-	-	-	1	-	3	2
AVG	3	3	2.2	2.8	-	-	-	-	-	-	2.2	-	3	2.6
16AE6304 - Aero Engine Maintenance and Repair														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	-	-	-	-	2	1	-	3	3	1
CO2	3	3	1	3	2	-	-	-	2	-	-	-	3	2
CO3	3	1	1	-	-	-	-	-	-	-	-	-	3	1

CO4	3	3	2	1	-	-	-	-	-	1	-	-	3	1
CO5	3	1	1	2	-	-	-	-	2	-	-	-	3	2
AVG	3	1.8	1.4	2	2	-	-	-	2	1	-	3	3	1.4

OPEN ELECTIVE

16AE6401-Introduction to Flight														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
C04	3	-	-	-	-	-	-	-	-	-	-	-	2	-
C05	3	-	-	-	-	-	-	-	-	-	-	-	2	-
AVG	2.6	-	-	-	-	-	-	-	-	-	-	-	1.8	-

Chairman - BoS
AERO - HiCET

Chairman

Dean (Academics)
HiCET