



SCHEME OF STUDIES & EXAMINATIONS

Department: Aeronautical Engineering – 7th Semester

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1	AER-401B	COMPUTATION FLUID DYNAMICS	3	1		25	75	-	100	4	3
2	AER-403B	SPACE DYNAMICS	3	1		25	75	-	100	4	3
3	ME-403 B	REF & AIR CONDITIONING (AER, ME)	3	1		25	75	-	100	4	3
4	ME 405B	OPERATION RESEARCH (AER, ME)	3	1		25	75	-	100	4	3
5		OPEN ELECTIVE*	4	0		25	75	-	100	4	3
6	AER-405B	COMPUTATIONAL LAB	-	-	3	20		30	50	1.5	3
7	ME-411 B	R.A.C.LAB (AER, ME)	-	-	2	20		30	50	1	3
8	AER-407B	PROJECT	-	-	4	100	-	--	100	4	-
9	AER-409B	PROFESSIONAL TRAINING-II	-	-	2	50	-	-	50	2	-
Total			16	4	11	315	375	60	750	28.5	

* List of Open Electives

1	MEI 623B	ENTREPRENEURSHIP	6	BT401B	BIOINFORMATICS
2	BME451B	MEDICAL INSTRUMENTATION	7	AE417B	MODERN VEHICLE TECHNOLOGY
3	ECE305B	CONSUMER ELECTRONICS	8	CE451B	POLLUTION & CONTROL
4	EE451B	ENERGY AUDIT	9	CSE-411B	MANAGEMENT INFORMATION SYSTEM
5	EEE457B	ENERGY RESOURCES & TECHNOLOGY	10	IT-413B	CYBER SECURITY

Note:

- Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency & Ethics Syllabus.
- Students will be permitted to opt for any one elective run by the other department. However, the department shall offer those elective for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. The minimum strength of students should be 20 to run an elective course.
- Assessment of Professional Training-II, undergone at the end of VI semester, will be based on seminar, viva-voce, report and certificate of Professional Training obtained by the student from the industry, institute, research lab, training center etc
- The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
- Electronics gadgets including Cellular phones are not allowed in the examination
- Project coordinator will be assigned the project load of maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.



SYLLABUS: B Tech (Aero)

Department: Aeronautical Engineering– 7th Semester

Subject: Computational Fluid Dynamics (Theory)

Subject Code: AER 401B

Detailed Content

UNIT NO 1: Finite difference schemes:

- Topic No.1: Projection and truncation error
- Topic No.2: Stability, consistency, accuracy and convergence of numerical schemes
- Topic No.3: Time marching methods
- Topic No.4: FDM applied to linear advection - diffusion equation
- Topic No.5: MacCormack scheme and its application to Euler and N-S equations.
- Topic No.6: Equations of Fluid Dynamics and their classification
- Topic No.7: Boundary conditions.

UNIT NO.2 Basics of Finite Volume Method:

- Topic No.8: Equations in integral form
- Topic No.9: Numerical flux at cell faces
- Topic No.10: Upwind methods
- Topic No.11: Flux - vector splitting
- Topic No.12: Flux- difference splitting
- Topic No.13: Shock capturing methods

UNIT NO.3 Basics of Finite Element Method:

- Topic No.14: Isoparametric elements
- Topic No.15: Bilinear and tri-linear elements
- Topic No.16: Numerical Integration
- Topic No.17: Space function
- Topic No.18: Petrov- Galerkin method
- Topic No.19: Computation of turbulent flows
- Topic No.20: RANS
- Topic No.21: Turbulence modelling

UNIT NO.4 Grid generation:

- Topic No.22: Algebraic and pde based methods
- Topic No.23: O-, C-, H-type topologies
- Topic No.24: Unstructured meshes, Hybrid meshes
- Topic No.25: Large scale problems in CFD
- Topic No.26: Iterative solvers, Preconditioning techniques
- Topic No.27: Vector and parallel computing
- Topic No.28: Post- processing for visualisation.

Study Scheme				Evaluation Scheme			Total Marks
L	T	P	Credits	Internal Assessment	External Assessment (Examination)		
Max. Marks	Max. Marks	Exam Duration					
3	1	-	4	25	75	3 hours	100

Text Books:

1. T J R Hughes, The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Prentice Hall
2. O C Zienkiewicz and RL Taylor, The Finite Element Method, Vol I&II, McGraw Hill, Indian Ed.

Reference Books

1. John D Anderson Jr., Computational Fluid Dynamics: The Basics with Applications, McGraw Hill, Indian Edition
2. Charles Hirsch, Numerical Computation of Internal and External Flows, Wiley Series in Numerical Methods in Engineering, Indian



SYLLABUS: B Tech (Aero)

Department: Aeronautical Engineering– 7TH Semester

Subject: Space Dynamics (Theory)

Subject Code: AER 403B

Detailed Content

UNIT NO 1: Introduction To Space & Particle Dynamics:

- Topic No.1: Initial works in Germany for space travel. Russian and American campaigns in space
- Topic No.2: Profile of flight from earth to a destination in space and back
- Topic No.3: The space shuttle. PARTICLE DYNAMICS: Introduction
- Topic No.4: Newton's laws, velocity and acceleration, coordinates and rotation
- Topic No.5: the spherical pendulum. Energy for one particle
- Topic No.6: Angular momentum, energy for systems of particles, angular momentum, the N-body problem.

UNIT NO.2 The Two-Body Problem & The Earth Satellite Operations:

- Topic No.7: Introduction, the two body problem
- Topic No.8: Energy and angular momentum, Orbit equation, Kepler's laws
- Topic No.9: Orbit determination and satellite tracking.
- Topic No.10: THE EARTH SATELLITE OPERATIONS: The Hohmann transfer,
- Topic No.11: Inclination-change maneuver, Launch to rendezvous, Decay life time
- Topic No.12: Earth oblateness effect, Low thrust orbit transfer

UNIT NO.3 Rigid Body & Satellite Attitude Dynamics:

- Topic No.13: Introduction, choice of origin, Angular momentum and energy
- Topic No.14: Principal-body-axis frame, Particle axis theorem
- Topic No.15: Euler's equations, Orientational angle, The simple Top.
- Topic No.16: satellite attitude dynamics: Torque –Free-axisymmetri
- Topic No.17: Rigid body, The general torque free rigid body, semi-rigid space craft
- Topic No.18: Attitude control: Spinning and Non spinning space craft
- Topic No.19: The Yo-Yo mechanism, Gravity gradient satellite, The dual spin space craft

UNIT NO.4 Re-Entry Dynamics & Space Environment:

- Topic No.20: Introduction, ballistic re-entry, skip re-entry, double dip re-entry
- Topic No.21: Aero braking, lifting re-entry.
- Topic No.22: THE SPACE ENVIRONMENT: Introduction, The atmosphere
- Topic No.23: Light and space craft temperature
- Topic No.24: Charged particle motion
- Topic No.25: Magnetic mirrors
- Topic No.26: The van-atten Belts
- Topic No.27: Radiation effects
- Topic No.28: Meteors, Meteorites and impact
- Topic No.29: Our local neighborhood

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
3	1	-	4	25	75	3 hours	100

Text Books:

1. Elements of Gas Turbine Propulsion: J.D. Mattingly, McGraw Hill.
2. Gas Turbine Theory: Cohen, Rogers and Sarvanmatta, John Wiley.
3. Mechanics and Thermodynamics of Propulsion: P.G. Hill & Peterson, Addison- Wesley, 1970
4. Rocket Propulsion Elements: George P. Sutton, Oscar Biblarz, John Wiley & Sons.



SYLLABUS: B Tech (Aero)

Department: Aeronautical Engineering– 7th Semester

Subject: I Refrigeration And Air Conditioning

Subject CODE: CODE: ME 403B

Detailed Content

UNIT NO.1(a) Introduction:

- Topic no 1: Definition of refrigeration & air conditioning
- Topic no 2: Necessity; Methods of refrigeration;
- Topic no 3: Unit of refrigeration
- Topic no 4: Coefficient of performance (COP)
- Topic no 5: Fundamentals of air-conditioning system
- Topic no 6: Refrigerants- Definition, Classification, Nomenclature, Desirable properties
- Topic no 7: Secondary refrigerants
- Topic no 8: Eco-friendly refrigerants
- Topic no 9: Environmental issues of refrigeration & air conditioning industry

UNIT NO.1(b) Air Refrigeration System:

- Topic no 10: Carnot refrigeration cycle
- Topic no 11: Temperature limitations
- Topic no 12: Brayton refrigeration or the Bell Coleman air refrigeration cycle
- Topic no 13: Necessity of cooling the aero plane
- Topic no 14: Air craft refrigeration systems
- Topic no 15: Simple cooling and Simple evaporative types
- Topic no 16: Boot strap and Boot strap evaporative types
- Topic no 17: Regenerative type and Reduced Ambient type system

UNIT NO.2(a) Vapor Compression Refrigeration

- Topic no 18: Simple Vapor Compression (VC) Refrigeration systems
- Topic no 19: Limitations of Reversed Carnot cycle with vapor as the refrigerant
- Topic no 20: analysis of VCR cycle considering degrees of sub cooling and superheating
- Topic no 21: VCR cycle on p-v, t-s and p-h diagrams
- Topic no 22: Effects of operating conditions on COP
- Topic no 23: Liquid suction heat exchanger; actual VCR cycle
- Topic no 24: comparison of VC cycle with Air Refrigeration cycle, Problems

UNIT NO.2(b) Multistage Ref. Systems-

- Topic no 25: Necessity of compound compression
- Topic no 26: Compound VC cycle , Inter-cooling with liquid sub –cooling
- Topic no 27: Water inter cooler: Multistage compression with flash inter-cooling
- Topic no 28: Water inter-cooling, Systems with individual or multiple expansion valves
- Topic no 29: Individual compression system with individual or multiple expansion valves
- Topic no 30: Individual compression systems with individual or multiple expansion valves but with and
- Topic no 31: without intercoolers, Cascade refrigerating systems and its necessity
- Topic no 32: Selection of pairs of refrigerants for the system; concept of cascade temperature
- Topic no 33: Analysis, multistaging, applications, problems

UNIT NO.3(a) Psychrometry

- Topic no 34: Air Conditioning Processes, Properties of moist Air, Gibbs Dalton law, Sp. humidity
- Topic no 35: Dew point temperature, Degree of saturation, Relative humidity
- Topic no 36: Enthalpy, Humid specific heat, Wet bulb temperature. Psychrometric chart
- Topic no 37: Psychrometry of air-conditioning processes- Mixing Process & basic processes in air conditioning
- Topic no 38: Psychrometric processes in air-conditioning equipment like in air washer etc Problems.



UNIT NO.3(b) Air- Conditioning Load Calculations:

- Topic no 39: Outside and inside design conditions
- Topic no 40: Sources of heating load; Sources of cooling load
- Topic no 41: Heat transfer through structure, Solar radiation
- Topic no 42: Electrical applications, Infiltration and ventilation
- Topic no 43: Heat generation inside conditioned space; Comfort chart
- Topic no 44: Design of summer air-conditioning and Winter air conditioning systems, Problems.
- Topic no 45: Air Conditioning Systems with Controls & Accessories: Classifications
- Topic no 46: Layout of plants; Equipment selection; Air distribution system
- Topic no 47: Duct systems Design; Filters; Refrigerant piping.
- Topic no 48: Temperature, Pressure, Humidity sensors; Actuators and Safety controls, Accessories

UNIT NO.4(a) Other Refrigeration Systems

- Topic no 49: Vapor Absorption Refrigeration Systems – Basic Systems
- Topic no 50: COP of the System, Performance, Relative merits and demerits
- Topic no 51: Properties of aqua ammonia; Electrolux Refrigeration
- Topic no 52: Study of Lithium bromide water system. Steam Jet Refrigerating System- Introduction,
- Topic no 53: Analysis, Relative merits and demerits, Performance Applications; problems

UNIT NO.4(b) Refrigeration And Air Conditioning Equipments:

- Topic no 54: Type of compressors and their performance curves
- Topic no 55: Types of Condensers; types of expansion devices
- Topic no 56: Types of evaporators. Cooling and dehumidifying coils and cooling tower.
- Topic no 57: Electro Magnetic Flow meter. Hot-Wire Anemometer. Temperature Measurement: Electrical, Non electrical and Radiation Methods.

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
3	1	-	4	25	75	3 hours	100

TEXT BOOKS:

1. Refrigeration & Air conditioning –R.C. Jordan and G.B. Priester, Prentice Hall of India.
2. Refrigeration & Air conditioning –C.P. Arora, TMH, New Delhi.

REFERENCE BOOKS:

1. A course in Refrigeration & Air Conditioning – Arora & Domkundwar, Dhanpat Rai & Sons.
2. Refrigeration & Air conditioning –W.F. Stocker and J.W. Jones, TMH, New Delhi.
3. Refrigeration & Air conditioning- Manohar Prasad, Wiley Eastern limited, New Delhi.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.



SYLLABUS: B Tech (Aero)

Department: Aeronautical Engineering– 7th Semester

Subject: Operations Research

Subject Code: ME 405B

Detailed Content

UNIT NO1 Operations Research –An Overview, Linear Programming

- Topic no 1: Introduction, history, approach, techniques and tools
- Topic no 2: Applications of OR, phases and processes of OR study, limitations of OR
- Topic no 3: Introduction, Formulation, redundant constraints, Solution-Graphical and Simplex
- Topic no 4: Gauss-Jordan reduction process in simplex methods, BIG M methods computational problems

UNIT NO2 Transpotation Problem, Assignment Problem, Advanced Topics In OR

- Topic no 5: Introduction, , Basic feasible solution of a transpotation problem- North-West corner
- Topic no 6: Matrix minimum and Vogel's Approximation method
- Topic no 7: Methods for checking optimality of the solution- Stepping stone and MODI method
- Topic no 8: Unbalanced Transpotation problem Degenerate transpotation problem
- Topic no 9: Maximisation in Transpotation Problem, computational problems
- Topic no 10: Introduction, solution of an assignment problem- Hungarian Method
- Topic no 11: Unbalanced Assignment problem, computational problems
- Topic no 12: Duality, Primal- Dual relationship, Economic interpretation, Shadow price
- Topic no 13: Post optimality and sensivity analysis, problems

UNIT NO3 Waiting Line Models, Network Analysis In Project Planning (Pert And Cpm)

- Topic no 14: Introduction, Elements of a queuing system
- Topic no 15: Operating characteristics of a queuing system, queue parameters, M/M/1 queue, problems
- Topic no 16: Introduction, network diagram, event activity, critical path method, PERT
- Topic no 17: Cost analysis and Crashing the Network, Problems

UNIT NO 4 Simulation , Decision Theory

- Topic no 18: Introduction, advantages of simulation, limitations of simulation
- Topic no 19: Monte Carlo Simulation and its application in industries, Problems
- Topic no 20: Decision Process, SIMON model, types of decision making environment-certainty, risk
- Topic no 21: Uncertainty, decision making with utilities, problems

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week		Internal Assessment		External Assessment (Examination)			
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
3	1	-	4	25	75	3 hours	100

Text Books:

1. Quantitative Techniques by Vohra, TMH New Delhi
2. Operations Research Theory and applications by J.K.sharma, Macmillan

Reference Books:

1. Operations Research by Taha- PHI New Delhi

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.



SYLLABUS: B Tech (Aero)

Department: Aeronautical Engineering– 7th Semester

Subject: Pollution & Control (Theory)

Subject Code: CE 451B

Detailed Content

UNIT NO 1: Water Pollution:

- Topic No.29: Classification of water pollutants
- Topic No.30: Water characteristics
- Topic No.31: Effluent standards
- Topic No.32: Primary treatment, Secondary treatment
- Topic No.33: Aerobic (activated sludge, aerated lagoons, trickling filter, roughing filter rotating biological contactor)
- Topic No.34: Anaerobic (contact process, UASB).

UNIT NO.2 Air Pollution & Hydrocarbons:

- Topic No.35: Classification of air pollutants
- Topic No.36: Particulates: Physical characteristics
- Topic No.37: Mode of formation
- Topic No.38: Setting properties, Control measures.
- Topic No.39: HYDROCARBONS: Nature; sources, control
- Topic No.40: Carbon Monoxide: Source, harmful effects on human health
- Topic No.41: Control measures
- Topic No.42: Oxides of Sulphur and Nitrogen Sources
- Topic No.43: Effects on human health and plants, Control measure

UNIT NO.3 Solid Waste Management:

- Topic No.44: Types, sources and properties of solid waste
- Topic No.45: Methods of solid waste treatment and disposal
- Topic No.46: SOLID WASTE MANAGEMENT – Generation
- Topic No.47: Collection and techniques for ultimate disposal
- Topic No.48: Elementary discussion on resource and energy recovery

UNIT NO.4 Pollution Treatment:

- Topic No.49: Elementary treatment of nuclear pollution
- Topic No.50: Metal pollution
- Topic No.51: Noise pollution their effects & control.
- Topic No.52: Trace element: Mechanism of distribution
- Topic No.53: Essential and non essential elements
- Topic No.54: Trace of element in marine environment
- Topic No.55: Its ecological effects and biological effects.

Study Scheme				Evaluation Scheme			Total Marks
L	T	P	Credits	Internal Assessment	External Assessment (Examination)		
4	-	-	4	Max. Marks 25	Max. Marks 75	Exam Duration 3 hours	100

Suggested Books:

1. Environmental Engg.: by Howard s. Peavy & Others, MGH International.
2. Metacaf – EDDY – Waste-water engineering revised by George Teholonobus (TMH)
3. Environmental Chemistry by B.K. Sharma, Goel Publishing, Meerut.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.



SYLLABUS: B Tech (AERO)

Department: Aeronautical Engineering – 6th Semester

Subject: Computational Lab

Subject Code: AER-405B

Detailed Content

List of Experiments:

1. Point relaxation method for Laplace equation for the flow over airfoil
2. Successive Line Relaxation for the Laplace equation over airfoil
3. Structural grid generation over NACA 0012
4. Relaxation method for subsonic full potential equation for flow over airfoil with zero angle of attack
5. Lifting subsonic incompressible potential flow over airfoil
6. Two dimensional Panel method for subsonic incompressible flow over NACA 0012
7. Zoukowski transformation for subsonic incompressible flows

References:

1. Jack Moran, Theoretical and Computational Aerodynamics
2. Anderson, Computational Fluid Mechanics

Study Scheme				Evaluation Scheme			Total Marks
L	T	P	Credits	Internal Assessment Max. Marks	External Assessment (Examination) Max. Marks	Exam Duration	
		3	1.5	20	30	3 hours	50

Note:

1. Eight experiments are to be performed in the Semester.
2. At least six experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.



SYLLABUS: B Tech (AERO)

Department: Aeronautical Engineering – 7th Semester

Subject: Refrigeration & Air Conditioning Lab

Subject Code: ME 411B

Detailed Content

List of Experiments:

1. To study the Vapor Compression Refrigeration (VCR) System and determine its C.O.P. Draw the cycle on P-H and T-S diagrams.
2. To Study the Mechanical heat pump and find its C.O.P.
3. To study the cut- sectional models of Reciprocating, Rotary and Screw type refrigerant compressors.
4. To study the various controls used in Refrigerating & Air Conditioning systems.
5. To study the Ice- plant, its working cycle and determine its C.O.P and capacity.
6. To study the mixing process for different inlet conditions and plot them on Psychrometric charts and understand the concept of recirculation of air on re-circulated air-conditioning set up.
7. To study the basic air conditioning processes like heating, cooling, humidification, cooling and dehumidification and plot them on Psychrometric chart.
8. To determine the By-pass factor of cooling coil and plot them on Psychrometric charts for different inlet conditions.
9. To study the chilling plant and its working cycle.
10. To study the aqua- ammonia absorption system and find its COP.

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
		2	1	20	30	3 hours	

Note:

1. Ten experiments are to be performed in the Semester.
2. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.



SYLLABUS: B Tech (Aero)

Department: Aeronautical Engineering– 7th Semester

Subject: Project

Subject Code: AER 407B

Detailed Content

The project started in VII Semester will be completed in VIII Semester and will be evaluated through a panel of examiners consisting of the following:

Chairperson of Department : Chairperson
Project coordinator : Member
External expert : To be appointed by the University

The student will be required to submit two copies of his/her project report to the department for record (one copy each for the department and participating teacher).

Project coordinator will be assigned the project load of, maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

The format of the cover page and the organization of the body of the report for all the B. Tech. will be finalized and circulated by the Dean, Faculty of Engineering and Technology.

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
-	-	8	8	75	125	3Hrs	200



SYLLABUS: B Tech (Aero)

Department: Aeronautical Engineering– 7th Semester

Subject: Professional Training II

Subject Code: ME 415B

Detailed Content

- At the end of 6th semester each student would undergo four weeks Professional Training in an Industry/ Institute/ Professional / Organization/ Research Laboratory etc. with the prior approval of the Training and Placement Officer of the University and submit in the department a typed report along with a certificate from the organization.
- The typed report should be in a prescribed format.
- The report will be evaluated in the VII Semester by a Committee consisting of three teachers from different specialization to be constituted by the Chairperson of the department. The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization.
- The student will interact with the committee through presentation to demonstrate his/her learning.
- Teachers associated with evaluation work will be assigned 2 periods per week load.

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
-	-	2	2	50	-	-	50