JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in AERONAUTICAL ENGINEERING

III YEAR LABS SYLLABUS (R18)
Applicable From 2018-19 Admitted Batch

COMPUTER AIDED AIRCRAFT ENGINEERING DRAWING

B.Tech. III Year AE I Sem.	**L**	**T/P/D**	**C**
	0	**0/2/0**	**1**

Pre-Requisites: Engineering Graphics

Course Objectives:

- Understand the concepts and various tools used in design module
- Understand the design of typical structural components.
- Understand the design of typical aircraft components.
- Understand the design of three view diagram of a typical aircraft.

Course Outcomes:

- Exposure to computer aided design and drafting software
- Learn part design and assembly by design tool

LIST OF EXPERIMENTS

Week-I: SKETCHER; Interface, Sketch Tools, View Tool bar, Profile Tool bar, Operation Tool bar, Tools, Constrain tool bar, Transformation Tool bar, User Selection Filter, Standards, Visualizations.
Week-2: PART DESIGN; Sketch Based Features, Dress up Features, Transformation Features, Reference Elements, Measure, Thickness, Boolean Operations.
Week-3: SHEET METAL DESIGN; Walls, Cutting and Stamping, Bending, Rolled Walls,
Week-4: SURFACE DESIGN; Surfacer, Operations, Wireframe, Replication.
Week-5: ASSEMBLY; Product Structure Tools, Constrains.
Week-6: GD&T ; Introduction to Geometric Dimensioning and Tolerance, Weld Symbols, GD&T Symbols, Types of Tolerances, Types of views, Roughness Symbols.
Week-7: DRAFTING; Views, Annotations, Sheet Background.
Week-8: DESIGN OF AIRCRAFT WING; Design of any two types of Aircraft structures
Week-9: DESIGN OF FUSELAGE; Design of fuselage with internal components
Week-10: DESIGN OF NOSE CONE; Design of Nose cone structures
Week-11: DESIGN OF LANDING GEAR; Design of Main landing gear and nose landing gear

Reference Books:

1. http://www.ehu.eus/asignaturasKO/DibujoInd/Manuales/R12_manual_catia_v5.pdf
2. http://www.engr.psu.edu/xinli/edsgn497k/TeaPotAssignment.pdf
3. http://file1.engineering.com/pdf/PartDesign.pdf

FLIGHT CONTROL LAB

B.Tech. III Year AE I Sem.	**L**	**T/P/D**	**C**
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Pre-Requisites: Aircraft Performance & Stability

Course Objectives:

- Understand the basics simulation of unaccelerated and accelerated level flight for climb and descend
- Analyse the take-off and landing performance and ground roll for different modes of aircraft.
- Identify the basic controls and manoeuvre of in complex flight Path

Course Outcomes:

- Exposure to flight simulation
- Exposure to MATLAB

LIST OF EXPERIMENTS

Week-1: SIMULATION OF UNACCELERATED AND ACCELERATED LEVEL FLIGHT

1. Simulation of steady flight

Week-2: SIMULATION OF UNACCELERATED AND ACCELERATED CLIMB

1. Simulation of steady climb

Week-3: SIMULATION OF UNACCELERATED AND ACCELERATED DESCENT

1. Simulation of steady descent

Week-4: SIMULATION OF TAKE-OFF PERFORMANCE

1 Estimation of takeoff velocity

Week-5: SIMULATION OF LANDING PERFORMANCE

1. Estimation of ground roll distance
2. Estimation of total landing distance

Week-6: SIMULATION OF CONVENTIONAL FLIGHT PATH

1. Perform the given mission profiles

Week-7: STABILIZATION OF LONGITUDINAL PERTURBED AIRCRAFT

1. Perform the operation from disturbed flight to trim flight

Week-8: STABILIZATION OF LATERAL PERTURBED AIRCRAFT

1. Simulate lateral directional modes.

Week-9: SIMULATION OF SPIN RECOVERY

1. Perform the operation of spin recovery

Week-10: SIMULATION OF COORDINATED LEVEL TURN

1. Perform the level turn at given turn rate.
2. Perform the level turn at given turn radius.

Week-11: SIMULATION OF BARREL ROLL MANOEUVRE

1. Perform the barrel roll manoeuvre

REFERENCE BOOKS:

Peter John Davison. "A summary of studies conducted on the effect of motion in flight simulator pilot training".

Beard, Steven; et al. "Space Shuttle Landing and Rollout Training at the Vertical Motion Simulator" (PDF). AIAA. Retrieved 5 February 2014.

WEB REFERENCE:

1. https://ch.mathworks.com/help/aeroblks/flight-simulator-interfaces.html

AIRCRAFT PROPULSION LAB

B.Tech. III Year AE I Sem.	L	T/P/D	C
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Pre-Requisites: Aircraft Propulsion, Thermodynamics

Course Objectives:

- To familiarise the students to the working of jet engines and its different working conditions

Course Outcomes

- To understand how to do the heat transfer analysis over the surface of the aircraft structure, the working of different jet engines

LIST OF EXPERIMENTS

Week-1: Study of jet engines
Week-2: Study of free convective heat transfer over a flat plate
Week-3: Study of forced convective heat transfer over a flat plate
Week-4: Ignition studies of solid and liquid propellants
Week-5: Operation of a ramjet engine
Week-6: Study of free jet
Week-7: Study of wall jet
Week-8: Study of hybrid propulsion system
Week-9: Preparation of fuel grain for hybrid rocket
Week-10: Burning rate measurement of solid propellants in a strand burner

AEROSPACE PROPULSION LAB

B.Tech. III Year AE II Sem.

L	T/P/D	C
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Pre-Requisites:

- Thermodynamics
- Aircraft propulsion

Course Objectives:

1. Understand the basics of propulsion, working principles of reciprocating engines, performance estimation based on rotation angles, and components of engine and their functions
2. Knowledge about the operation of valves, ports and their functioning in four stroke and two stroke engines.
3. Calculation of percentage of carbon residue and flash and fire point temperatures of a Lubricating Oil.
4. Understand the basic characteristics and range of performance of axial flow gas turbine. Perform parametric jet engine performance analysis and turbo machinery and basic combustion calculations.

Course Outcomes:

- Working principle of IC engine, compressor
- Turbine efficiency

LIST OF EXPERIMENTS

Week-1 ENGINE DISASSEMBLY AND ASSEMBLY

1. To understand the working mechanism and identifying various components to build an IC engine.
2. Brief description about Components of engine and their functions.

Week-2 FLASH POINT AND FIRE POINT TEST

1. Determination of flash point and fire point for a sample using pen sky martin‘s test.

Week-3 DETERMINATION OF DYNAMIC VISCOSITY OF A GIVEN SAMPLE USING REDWOOD VISCOMETER

1. Determine kinematic viscosity and dynamic viscosity of given sample using a viscometer.
2. Order fluctuating temperature is measured in terms of viscosity

Week-4 MECHANICAL EFFICIENCY OF AXIAL COMPRESSOR

1. Calculation of the Mechanical efficiency of axial compressor- power required, power Available, Compression Ratio.

Week-5 GAS TURBINE PARAMETERS CALCULATION

1. Calculation of work, power and Thrust requirement in gas turbine- combustion power input, work heat relationship.

Week-6 GAS TURBINE EFFICIENCY AND PERFORMANCE DIAGRAMS

1. Elucidate T-S, H-S diagrams for the gas turbine and compare efficiencies of non-ideal engine components.

Week-7 GAS TURBINE EFFICIENCY CALCULATIONS

1. Calculation of thermal, propulsive and overall efficiency of turbo jet cycle.

Week-8 WORK OUTPUT OF AXIAL TURBINE

1. Calculation of total work output of axial turbine- out put work necessary, Available output.

Week-9 NOZZLE PERFORMANCE

1. Calculation of various nozzle performance with airflow

Week-10 CALORIFIC VALUE OF DIFFERENT FUELS

1. Calculation of calorific value of different fuels and materials using digital bomb calorimeter and optimizing astute fuels

Week-11 FREE AND FORCED CONVECTION

1. Estimation of convection coefficient of air using forced jet or free convection apparatus

Week-12 PROPELLER TEST RIG

1. Calculation of propeller efficiency and thrust availability using propeller test rig at various blade pitch angles.

REFERENCE BOOKS:

1. https://www.cast-safety.org/pdf/3_engine_fundamentals.pdf
2. https://en.wikipedia.org/wiki/Reciprocating_engine

CFD LAB

B.Tech. III Year AE II Sem.

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Pre-Requisites:

- Computer Aided Aircraft Engineering Drawing
- Computational Aerodynamics

Course Objectives:

- Experience in computing aerodynamic problems and understanding flow physics over the objects.
- Knowledge in estimating flow analysis for different mach numbers.
- Determining the aerodynamic forces like mainly lift and drag.
- Analyze the errors and cause of errors in computational analysis.

Course Outcomes:

- Numerical Simulation of Aerodynamic problem
- Hands on experience on various solving technique with boundary conditions

LIST OF EXPERIMENTS

Week-1: INTRODUCTION
Introduction to computational aerodynamics, the major theories, approaches and methodologies used in computational aerodynamics. Applications of computational aerodynamics for classical aerodynamic‘s problems.

Week-2: INTRODUCTION TO GAMBIT
Introduction to gambit, geometry creation, suitable meshing types and boundary conditions.

Week-3: INTRODUCTION TO FLUENT
Introduction to fluent, boundary conditions, solver conditions and post processing results.

Week-4: FLOW OVER A FLAT PLATE
Flow over a flat plate at low Reynolds numbers, observe the boundary layer phenomena, no slip condition and velocity profile inside the boundary layer.

Week-5: FLOW THROUGH PIPE
Flow through pipe at different Reynolds numbers; observe the velocity changes for laminar and turbulent flows.

Week-6: FLOW OVER A CIRCULAR CYLINDER
Flow over a circular cylinder at different Reynolds numbers, observe the properties at separation region and wake region.

Week-7: FLOW OVER A CAMBERED AEROFOIL
Flow over a cambered aerofoil at different velocities, observe flow properties and compare the computation results with experimental results (consider the model from aerodynamics laboratory).

Week-8: FLOW OVER A SYMMETRIC AEROFOIL
Flow over a symmetric aerofoil at different velocities, observe flow properties and compare the computation results with experimental results (consider the model from aerodynamics laboratory).

Week-9: FLOW OVER WEDGE

Flow over wedge body at supersonic mach number; observe the shock wave phenomena and change of properties across the shock wave.

Week-10: FLOW OVER A CONE

Flow over a cone at supersonic mach number; observe the shock waves and 3D relieving effect.

Week-11: CODE DEVELOPMENT

Solution for the following equations using finite difference method

I. One dimensional wave equation using explicit method of lax.

II. One dimensional heat conduction equation using explicit method.

Week-12: CODE DEVELOPMENT

Generation of the following grids

I. Algebraic grids.

II. Elliptic grids.

REFERENCE BOOKS:

1. Anderson, J.D., Jr., Computational Fluid Dynamics The Basics with Applications, McGraw-Hill Inc, 1st Edition 1998.
2. Hoffmann, K. A. and Chiang, S. T., ―Computational Fluid Dynamics for Engineers‖, 4th Edition, Engineering Education Systems (2000).
3. Hirsch, C., ―Numerical Computation of Internal and External Flows: The Fundamentals of Computational Fluid Dynamics‖, Vol. I, 2nd Edition., Butterworth-Heinemann (2007).
4. JAF. Thompson, Bharat K. Soni, Nigel P. Weatherill ―Grid generation‖, 1st Edition 2000.

ADVANCED COMMUNICATION SKILLS LAB

B.Tech. III Year AE II Sem. **L T/P/D C**
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1. INTRODUCTION:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

4. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

5. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

REFERENCES:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.