GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Aeronautical
Subject Code: BE04001041
Subject Name: Avionics

w.e.f.Academi Year:	2025-26
Semester:	4
Category of the Course:	Professional Core Course

Prerequisite:	Fundamentals of Aeronautical engineering
Rationale:	This subject will help students about understanding Aviation electronics systems of military and civil aviation aircrafts with respect to applications in commercial or defense related operations.

Course Outcomes:

Sr. No.	CO statement	Marks% weightage
CO-1	Explain need and architecture of avionics systems.	15
CO-2	Demonstrate understanding of navigation and approach systems.	25
CO-3	Analyze the principles and applications of radar and space avionics systems.	25
CO-4	Interpret electronic flight instruments and management systems.	20
CO-5	Apply knowledge of ELT and communication systems.	15

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	Total no of hours per semester		ESE (E)	PA / CA (M)	PA/ CA (I)	PBL (I)	ESE (V)	
45	0	30	15	90	3	70	30	20	30	50	200

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Avionics:** Need for avionics in civil and military aircraft and space systems, Integrated avionics and weapon systems, Typical avionics subsystems, design and technologies, Introduction of Avionics Architecture, Flight deck design with respect to Avionics.	4
2	**Introduction to Navigation and Approach System:** DVOR, Errors in Direction Finding, Distance Measuring Equipment (DME) Integration with VOR and NDB, Working of navigation Aid for aircraft, Identification friend or foe (IFF), Ground Controlled Approach(GCA),Head up Display(HUD), Hands on Throttle And Stick(HOTAS), Inertial guidance system, Inertial navigation system, , Fly by Wire flight controls, Night vision goggles,	16
3	**Radar and Space Avionics System:** Primary ground radar, Secondary surveillance radar (SSR), Transponder, Radar display & data processing systems, Radar altimeter , Radar Ground Proximity Warning System (GPWS), Enhanced Ground Proximity Warning System (EGPWS), Doppler radar, Airborne Weather Radar (AWR), Traffic Collision Avoidance System (TCAS), Global Positioning System, Satellite Communication System, Indian Regional Navigation Satellite System (IRNSS), Airborne (Early) Warning and Control System (AWACS)	14
4	**Navigation Instruments:** Electronic Flight Instrument system(EFIS), Flight, director system, Flight Management system, Black Box-Flight Data and cockpit voice Recorder, Autopilot Flight director system	6
5	**Emergency Locator Transmitter(ELT):** Types of ELT, Maintenance and testing of ELT, ELT mounting requirements, Typical ELT, HF range and propagation, SSB-DSB modulation, Selective Calling System(SELCAL), HF radio equipment.	5
	TOTAL	45

Suggested Specification table with Marks(Theory): (ForB.E.only)

Distribution of Theory Marks					
RLevel	ULevel	ALevel	NLevel	ELevel	CLevel
40	**40**	**10**	**10**	**00**	**00**

R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Aircraft communication and navigation systems by Mike Tooley and David Wyatte, A Butterworth-Heinemann Title (15 August 2007) Publication.
2. Digital Avionics Systems, by C R Spitzer, CRC press Publication.
3. The Avionics Handbook, by Ed. Cary R. Spitzer, Boca Raton, CRC Press LLC. 2001.
4. Principles of Avionics by Albert Helfrick , Avionics communications Inc. Leesburg, VA, USA.
5. Military Avionics by Ian Moir & Allan Seabridge, John Wiley & Sons, Ltd.
6. Avionics Systems by D H Middleton, Longman Scientific & Technical, 1989.
7. Manual of Avionics by Brian Kendal, Blackwell Science Ltd.

List of Experiments:

Sr. No.	Title
1	To study operation of modulation and demodulation for amplitude and frequency.
2	To study binary to decimal code and different logic gate.
3	To understand and perform 4-bit binary Full adder and Subtractor.
4	To perform function of Annunciator Panel.
5	To study and perform 16 line to 1 line multiplexer.
6	To study and perform 1 line to 16 line Demultiplexer.
7	To study and perform 4 line to 16 line decoder.
8	To study and perform Digital to Analog converter.
9	To study satellite communication system.
10	To study Function of GPS (Global Positioning System) and EGPWS (Enhanced GroundProximity Warning System).

Major Equipment: Annunciator Panel, 4-bit binary full adder and subtractor, Modulation and Demodulation kit, Multiplexer, Demultiplexer, Decoder, Digital to Analog converter

List of Open Source Software/learning website: https://nptel.ac.in/course.php

- **List of suggested activities for Problem Based Learning:**

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.

2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numericals based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
4.	Problem solving/Coding using C, C++, Python, SCILAB, MATLAB, MS-EXCEL or any other relevant software	5 small coding based assignment of 2h each. Total = 10h	Based on the coding solution submitted.
5.	Self learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
6.	Complex problem solving	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8	Discussion on research paper based on relevant subject	5 research paper = 20 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions
12	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
13.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
14.	Application/Software development	Duration = 10 h	Depending on the complexity of the Application/Software

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