AVIONICS

ENAS 301

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:
The objective of this course is to enable the students to understand the needs of avionics for both civil and military aircraft, introduce various digital electronic principles and working operations of digital circuit, integrate the digital electronics with cockpit equipment, understand the various principles in flight desk and cockpit panels and study the communication and navigation equipment.

1 Introduction (5 hours)

1.1 Need for avionics
1.2 Components overview
1.3 Systems that interact with the pilot
1.4 Fly-by-wire, flight management and autopilot systems
1.5 Sensors systems
1.6 Task automation systems
1.7 Overview of aircraft stability and control

2 Cockpit Displays and Human-Machine Interface (8 hours)

2.1 Functions of the cockpit systems
2.2 Primary flight display
2.3 Analog display systems in the cockpit
2.4 Flight control instruments (Side-stick, yoke, throttle, pedal)
2.5 Analog controls
2.6 Fly-by-wire system

3 Basic Navigation Systems (4 hours)

3.1 Principle of navigation system
3.2 Types of navigation systems- Position fixing and dead-reckon
3.3 Air data systems
3.4 Working principle of
  3.4.1 Vertical speed indicator (VSI)
  3.4.2 Altimeter
  3.4.3 Air speed indicator

4 Fly-By-Wire System, Autopilot and Flight Management (6 hours)

- 4.1 Fly-by-system architecture and data handling
- 4.2 Failure safety and triplex/quadruplex redundancies
- 4.3 Flight management and housekeeping
- 4.4 Data fusion

5 Communication and Navigation Systems-I (14 hours)

- 5.1 Machinery fundamentals of
  - 5.1.1 Radio wave propagation
  - 5.1.2 Antennas and transmission lines
  - 5.1.3 Communication
  - 5.1.4 Receiver and transmitter
- 5.2 Working principle of following systems
  - 5.2.1 VHF communication
  - 5.2.2 HF communication
  - 5.2.3 Audio systems
  - 5.2.4 Emergency locator transmitter (ELT)
  - 5.2.5 Cockpit voice recorder (CVR)
  - 5.2.6 Very high frequency omnidirectional range (VOR)
  - 5.2.7 Automatic direction finding (ADF)
  - 5.2.8 Instrument landing system (ILS)
  - 5.2.9 Distance measuring equipment (DME)

6 Communication and Navigation Systems-II (8 hours)

- 6.1 Working principle of following systems
  - 6.1.1 Very low frequency and hyperbolic navigation (VLF/ omega)
  - 6.1.2 Doppler navigation
  - 6.1.3 Area navigation, RNAV system
  - 6.1.4 FMS (Flight management system)
  - 6.1.5 GPS (Global positioning system)
  - 6.1.6 GNSS satellite system
  - 6.1.7 Inertial navigation system
  - 6.1.8 ATC transponder, secondary surveillance radar
  - 6.1.9 Traffic alert and collisions avoidance system (TCAS)
  - 6.1.10 Weather avoidance radar
  - 6.1.11 Radio altimeter
  - 6.1.12 ARINC communication and reporting

Tutorial (15 hours)

1. Descriptions of AFM
2. Components of AIP Nepal
3. Reading from cockpit instruments

Practical **(22.5 hours)**

1. Perform tests of basic flight controls
2. Use autopilot to perform altitude hold and vertical speed settings
3. Practice with Garmin G1000
4. Use of NDB and VOR
5. Refer to lab manual for software instructions and further exercises

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	5	12
2	8	12
3 and 4	10	12
5	14	12
6	8	12
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Collinson, R. P. (2012). Introduction to avionics (Vol. 11). Springer Science & Business Media.
2. Collinson, R. P. (2023). Introduction to avionics systems. Springer Nature.
3. Spitzer, C. R. (2018). Avionics: Development and implementation. CRC Press.
4. Newport, J. R. (2024). Avionic systems design. Taylor & Francis.