

AIRCRAFT MAINTENANCE AVIONICS (INSTRUMENT, AUTOPILOT, RADIO, RADAR) BASIC COURSE

COURSE OBJECTIVES:

To provide the electrical engineer the basic knowledge of the A/c Systems & prepare them to have the A/C Type rating

WHO SHOULD ATTEND:

Newly hired Electrical (avionics) (Instrument, Autopilot, Radio, Radar) engineers and high school certificates technicians with good command of English.

DURATION:

6 months.

COURSE CONTENTS

A. Instruments

1- Temperature indicating systems:

- a. Oil temperature-indicating system.
- b. Engine temperature system:
 - 1) EGT indicating system.
 - 2) EGT thermocouple resistor adjustment/props.

2- Engine tachometer systems.

3- Engine pressure ratio indicating system.

4- Fuel flow-indicating systems.

5- Aircraft instruments:

- a. Flight instrument- Pitot Static Systems.
- b. Flight recorder system.
- c. Airborne vibration monitoring system.
- d. Pressurization control system.
- e. Aircraft systems and equipment.
 - 1) Oxygen systems.

2) Aircraft magnetic compass.

B. Autopilot

1- Principles of flight.

2- Introduction to avionics systems.

3- Classification of autopilot system.

4- Introduction and signal processing:

- a. Introduction to autopilots.
- b. Servomechanisms as used in autopilots.
- c. Autopilot sensing methods.
- d. Practical attitude sensing methods.
- e. Aerodynamics.
- f. Axis control.
- g. Outer loop control.
- h. Engagement and interlocks.
- i. Command signal processing.
- j. Inductive sensing methods.
- k. Autopilot practical servomotors.
- l. Control surface actuators.
- m. Torque limiting and protection circuits.
- n. Trim indication and synchronization.

5- Pitch channel:

- a. Typical pitch channel and command inputs.
- b. Version generation and true pitch rate.
- c. Automatic trim and control of gravity trimming.
- d. Mach trims.
- e. Turbulence mode.

- f. Altitude hold mode.
- g. Preselect altitude mode.
- h. Vertical speed mode.
- i. Direct lift control.
- j. Angel of attack and stall warning.
- k. Automatic mode over-rides

6- Roll channel:

- a. Roll channel functional diagram.
- b. Rudder-aileron cross feed.
- c. Aileron integrator.
- d. Preselect heading mode.
- e. Radio systems.
- f. Radio coupling modes.
- g. Autopilot monitoring.

7-Yaw channel and yaw damper:

- a. Autopilot yaw damper-rudder channel.
- b. Rudder channel commuting.

8- Automatic landing.

9- Auto throttle.

- a. Introduction.
- b. Mode select and modes.
- c. Block diagram.
- d. Indications.
- e. Annunciation.
- f. Inter locks and disconnects.

c. Radio

1- Basic electricity and electronic course:

- a. Electricity current.
- b. Resistance and Ohm's law.
- c. Resistor construction
- d. Magnetic circuit.
- e. Electromagnetic induction.
- f. Inductive circuit.
- g. Construction of inductors.
- h. DC generators.
- i. DC motors.
- j. Electrostatics.
- k. Capacitors.
- l. Capacitate circuits.
- m. AC theory.
- n. Series AC circuits.
- o. Parallel AC circuits.
- p. Poly phase AC system.
- q. Ammeters and voltmeters.
- r. Test instrument.
- s. Measurement of power.
- t. Coupled circuit.
- u. Iron cored Trans for met.
- v. Tran's conductors.
- w. Thermionic emission and the diode valve.
- x. The triode valve.
- y. Multi-Grid and Multi-Unit valves
- z. Gas filled valves.

- aa. Photo-electronic devices.
- bb. Semi-conductor devices.
- cc. Electromechanical power supplies.
- dd. Mechanically- derived power supplies.
- ee. Electronic power supplies.

2- Communications:

a. Fundamental concepts of FM:

- 1) FM and AM compared.
- 2) FM terminology.
- 3) The FM waves.
- 4) Secondary definition.

b. The production of FM.

- 1) AM generators.
- 2) Simple FM generator.
- 3) FM by reactance-tube modulation.
- 4) Frequency multiplication.
- 5) Frequency multipliers.
- 6) Frequency stabilization.

c. From PM to FM:

- 1) Advantage of phase modulation.
- 2) The meaning of carrier phase-shift.
- 3) Fundamental phase modulator.
- 4) Effect upon PM of audio modulation frequency.
- 5) Cancellation of the frequency factor.
- 6) PM transmitters.
- 7) Side bands in FM.

d. the propagation and reception of FM:

- 1) The ground waves.
- 2) The sky wave.
- 3) Line of sight transmissions.
- 4) The FM antenna.
- 5) Transmission lines.
- 6) Reduction of interference.
- 7) Narrow band FM.
- 8) The FM receiver.
- 9) R-F and converter consideration.
- 10) The IF and limiter requirements.
- 11) The demodulator.
- 12) Audio system in FM receiver.

e. Forerunners of modern FM detectors:

- 1) The function of the FM detector.
- 2) The slope detector.
- 3) Double-tuned discriminator.
- 4) The S-curve.

f. FM limiters:

- 1) The need for amplitude limiting.
- 2) Limiter requirements.
- 3) Plate circuit limiters.
- 4) Grid circuit limiters.
- 5) Limiting through control of gain.
- 6) A practical limiter circuit.
- 7) The use of two-coupled limiter.
- 8) Limiter adjustment and test.

g. The modern FM discriminator:

- 1) Circuitry.
- 2) Vector analysis of discrimination action.
- 3) A simplified discriminator.
- 4) The need for a new type of FM detector.
- 5) Discriminator alignment and test.

h. The ratio detector:

- 1) Principle of operation.
- 2) Automatic volume control for F M receivers.
- 3) Modern ratio detectors.
- 4) Ratio detector alignment and test.

i. Logic circuits:

- 1) Introduction to digital techniques.
- 2) Numbering systems.
- 3) Logic functions and Boolean equations.
- 4) Logic circuits.
- 5) Counters and registers.
- 6) Conversion circuits.

D. RADAR

1- Introduction to radar:

- a. Pulse modulated radar.
- b. Basic requirements of pulse-modulated radar system.
- c. Factors effecting of performance of pulse modulated radars.
- d. Some examples of the user of pulsed radar.
- e. Basic outline of CW radar.

2- Radar circuit:

- a. Square waves.

- b. Square waves applied to CR circuits.
- c. Square waves applied to LR and LC circuits.
- d. Limiting circuits.
- e. Clamping circuits.
- f. Free-running (a stable) multi vibrators.
- g. Mono-stable bi-stable multi vibrators.
- h. Other square waves generators.
- i. Ringing and blocking oscillators.
- j. Electronic switching circuits.
- k. Frequency-dividing and counting circuits.
- l. Time base principles.
- m. Miller time base circuits.
- n. Other radar time base generator.
- o. Strobe pulse circuits.
- p. Para phase amplifiers.

3- UHF radar:

- a. UHF radar.
- b. UHF radar aerial systems.

4- Centimetric radar:

- a. Resonant cavities.
- b. Klystrons.
- c. Traveling wave tubes.
- d. Magnetrons.
- e. Wave guides.
- f. Wave-guide components.
- g. TR switching and frequency changing.
- h. Centimetric aerials.

- i. Microwave semiconductor devices.
- j. Masers.

5- Pulsed radar transmitters:

- a. Outline of pulsed radar transmitters.
- b. Modulators.
- c. Transmitter power supplies.

6- Radar receivers:

- a. Basic requirements of radar receiver.
- b. Stages in a radar receiver.
- c. Reduction of clutter.
- d. Interference and jamming.

7- CW radar:

- a. CW ground radar.
- b. FM CW radar altimeters.
- c. Airborne Doppler principles.
- d. Moving target indication (radar).