

MAM School of Engineering
Short & Long Questions

Department of Aeronautical Engineering

AE-1252 Aircraft systems and Instrumentation

Short Questions

1) Name any four modern control systems?

- Fly by wire (computer):- May be Analog computer or digital computer
- Fly by optics (light):-
- Power by size (user electro-hydraulic actuators)
- Intelligent flight control system

2) What do you mean by active control technology? Give at least three examples?

Active control technology helps to improve the handling of aircraft and to reduce the time lag or control delays by increasing the no. of computers, etc., in the aircraft (i.e. redundancy). This advance concept is applicable to following e.g..

Examples are:-

- Fly by wire
- Control configured vehicles
- Automatic flight control system.

3) Name any four communication system?

HF (High Frequency) communication for long range

- VHF (Very High Frequency) communication for short range
- Sat Com (Satellite Communication)
- ACARS/AIRCOM

4) Name any four navigation system?

- VHF Direction Finder (VDF)
- NDB
- ADF
- GPS

5) What is INS used for?

Ins (Inertial Navigation System) is a sophisticated system for continuously calculating the aircraft track, ground speed and then convert this information into other useful data.

6) Differentiate between instrument landing system and Microwave landing system?

- In MLS, the A/C can approach from different directions, rather than having to fly to a position on the extended centerline of the runway in use.
- MLS guidance is more accurate than ILS.
- MLS increases the no. of A/C that can approach at same time.

7) What do you mean by VOR & CCV?

VOR means (Very High Frequency Omni range)

(Ref. to your notes as text book)

CCV means (Control configured Vehicle)

(Ref. to your care study)

8) What is ADF & NDB?

- ADF means automatic direction finder

(See notes or Text book)

- NDB mean non directional beacons

(See notes or text book)

9) What is SELCAL & Sat Con?

SEL CAL – (selective calling)

See notes

10) Differentiate between electric trim and manual trim?

Electric trim is usually used to reposition stabilizer. Manual trim is used to override the elective trim.

11) What is difference between speed brakes and spoilers?

Speed brakes are used for reducing the speed of A/C by increasing the drag.

They also act as spoilers to spoil the lift

Spoilers are used to spoil the lift for descending or landing.

12) Name any four control system components?

- Bell crank

- Walking beam

- Sector & Quadrant

- Torque tube

13) What is stabilators, ruddervators and flaperons?

STABILATOR = STABILIZER + ELEVATOR

(MOVABLE)

RUDDERVATORS = RUDDERS +ELEVATORS

FLAPERONS = FLAP + AILERONS

14) What is aileron differential control system?

Movement of control stick moves one ailerons up greater than the other down words.

15) What is the use of yaw dampers in rudder control system?

Yaw damper systems operate continuously in flight to improve the airplane's directional stability and turn coordination. Dampers actuators are powered hydraulically.

16) What are the merits and demerits of analog and digital fly by wire flight control system?

See notes

17) Differentiate between fly by wire and conventional system?

See notes

18) How are cable tensions measured?

Tensometer

19) Name some advantages of fly by wire control systems?

- Weight saving
- Improved handling
- Fuel saving
- Reduced maintenance

20) Classify at least three engine control systems?

- FADEC (Full Authority Digital Electronic/Engine control)
- ECU (Electronic Engine Control)

ECU can be manually overridden by FADEC can not (For details see notes)

21) What do you mean by heat exchanger?

A heat exchanger is any device by which heat is transferred from one independent system to another independent system.

(See notes for details)

22) What is thermal relief valve?

A thermal relief valve is similar to a regular system relief valve but such valves are installed in parts of the hydraulic system where fluid pressure is trapped and may need to be relieved because of the increase caused by higher temperatures.

(Refer notes of power pack for details)

23) Differentiate between single-acting and double acting actuating cylinder?

A single acting actuator is normally used as a locking device the lock being engaged by spring pressure and released by hydraulic pressure.

The double acting actuator is used in most aircraft systems eg landing gear.

24) Differentiate between open and closed hydraulic system?

An open system is one having fluid flow but no appreciable pressure in the system whenever the actuating mechanisms are idle. Its simple but only one service can be operated by this system at a time.

(For diagram see notes)

A closed system is one that directs fluid flow to the main system manifold and builds up pressure in that portion of the system the leads to all the selector valves. Its bit complicated but more than one service can be operated by this system at a time.

25) Classify air pressure sources?

- Super charger
- Turbo charger
- Engine bleed air
- Independent cabin compressors

26) What is a moisture control?

The great reduction in temperature causes the moisture in the air to condense and thin moisture is removed by means of a water repeater.

(For details see notes)

27) Differentiate between springs oleo struts and air oleo struts?

In spring oleo struts, the spring supports the A/C weight on the ground and during taxiing and oleo strut absorbs the shock of landing.

In air oleo struts, the air supports the A/C weight on the ground and absorbs shocks during taxiing and oleo strut absorbs the shock of landing.

28) What is trunnion?

The trunnion is the portion of landing gear assembly attached to the airframe. The trunnion is supported at its ends by bearing assemblies which allows the gear to pivot during retraction and extension.

29) Explain the difference between drag strut and side strut?

Draglink or drag strut is designed to stabilize the landing gear assembly longitudinally. Side link or side assembly laterally.

30) Classify the types of retraction system?

- Mechanical retraction system
- Electrical retraction system
- Hydraulic retraction system

31) What is bungee cylinder used in landing gear? What is artificial bungee?

The bungee cylinder: are mechanically linked to side brace links. They are hydraulically actuated & help in retraction of landing gears.

Artificial bungee: gives feel factor to the pilot (for details see notes)

32) Differentiate between sequence and deboost value?

See notes or solved Q paper of Anna University.

33) What is ply rating?

Ply rating is an index of tire strength. The term is used to identify a given tire with its maximum recommended load. The higher the rating, the greater the load a tire will carry.

34) Differentiate between expander – shoe brake and expands – tube brake?

Expander shoe brake: Relation of brake drum adds braking energy to the brake shoes and makes them operate more effectively & with less effort by the pilot. They are also known as servo brakes.

Expander tube brake: The pressure of hydraulic fluid in the tube forces the blocks radially outward against the brake drum.

35) Differentiate between single disk brake and multiple disk brake?

Single disk brakes are used in smaller aircraft single disk may be conducted with an many separate pistons and linings as needed for the airplane. Each piston is equipped with separate sets of linings, which bear against the brake disk when the brake is applied multiple disk brakes are used in large aircraft. Braking action is produced by hydraulic pressures forcing the pistons against the pressure plate, which, in turn, forces the disk together and creates friction between the rotating and stationary disks.

36) Differentiate between segmented retractor disk brake and carbon composite brakes?

Segmented retractor disk brakes are heavy duty brakes designed for use with high pressure hydraulic systems using power brake control valves or power boost master cylinders. Braking action results from several sets of stationary linings making contact with rotating segments

Carbon composite brakes: In this the disks are made of carbon. Its long-life, light weight compared to steel brakes and more reliable.

37) Classify A/C brake system & Landing gear?

A/C Brake systems are: Landing gear

- Independent brake system - Non absorbing landing gear
- Power boost system - Shock absorbing landing gear
- Power brake system - Fixed gear
- Multi power brake actuating system - Retractable landing gear.

38) What is a master cylinder?

The master cylinder is the energizing unit. There is one for each main landing gear wheel. It is a foot operated single action reciprocating pump, the purpose of which is to build up hydraulic fluid pressure in the brake system.

(for diagram see notes)

39) What do you mean by anti skid system?

Anti skid systems are used to prevent loss of airplane control on the ground caused by skidding of the wheels. The system consists of electronic controller, transducers, servo valves, indicating light & switch.

(See block diagram from notes)

40) What are the advantages of pneumatic system over hydraulic system & vice versa?

(See notes as Anna University solved Q paper)

41) What is surge fuel tank?

Surge fuel tanks are normally empty and are designed to contain fuel overflow & prevent fuel spillage particularly when fueling the aircraft.

(For diagram see notes)

42) What do you mean by 'wet wing'?

An integral fuel tank is a tank that is part of the basic structure of the aircraft. When an integral type of tank is used in a wing, the aircraft is said to have a "wet wing"

43) What is vapor lock?

Vapor lock is a condition of fuel starvation that can occur in a reciprocating engine fuel system in which the fuel in the fuel line is heated enough to cause it to vaporize, forming a bubble of fuel vapor in the line blocking fuel from flowing to the engine.

44) a) Classify fuel system? b) Why do we need primers?

a) Fuel systems are

- Gravity feed fuel system

- Pressure feed fuel system

b) Non fuel injected reciprocating A/C engines must often be primed before starting because carburetor is not functioning properly until the engine is running

(For diagram see notes)

45) What is fuel cross feed system?

On most multiengine aircraft, the fuel manifolds are connected in such a manner that any fuel tank may supply fuel to any engine, any tank can transfer fuel to other tanks for balancing.

(for diagram see notes)

46) What is fuel jettison or dumping system?

In this system fuel from the tanks is continuously from using tip to using tip, with each end terminating at a fixed fuel jettison nozzle. The nozzle valve is an electrically operated valve controlled from the cockpit. After fuel passes through the nozzle valve, it flows into the jettison nozzle to be discharged into the air. The jettison nozzle valve is discharged into the air.

(for diagram see notes)

47) What is the difference between defueling and jettison?

Defueling means draining the fuel out of the tanks when A/C is on ground.

Jettison means dumping the fuel out of the tank when A/C is in air. Fuel is dumped at the time of emergency landing.

48) What is the purpose of fuel boost over ride & scavenge pump in fuel system?

The central using tank boost pumps will override the main-tank boost pump to supply fuel through the manifold to the engines. That's why it's known as fuel-boost override pump. Scavenge pump helps to prevent water from accumulating in the tanks' low points. Thus it avoids corrosion problems.

49) How will you select the starting system of the A/C?
(See chapter 5 Engine starting system in A/F & power plant for details)

50) Enumerate the lubricating systems used for jet engine?
- Dry sump Lubrication: utilize an external tank mounted on the engine or some where in A/C structures near the engine.
- Wet sump Lubrication: stores the lubricating oil in the engine proper.

51) Differentiate between fuel system of piston and jet engines?
(See notes for details)

52) How does scavenge system work in lubrication?
The scavenging system scavenges the main bearing compartments and circulates the scavenged oil to the oil coolers and back to the tank.

53) What is breather pressurizing system?
The breather pressurizing system ensures a proper oil spray pattern from the main bearing oil jets and furnishes a pressure head to the scavenge system. Breather maintains an oil system pressure. It prevents over pressurizing.

54. Clarify turbine engine ignition system?
- Capacitor type ignition system (jet)
- Electronic ignition system (jet)
- Battery ignition system P
- Magnetic system (High tension)
- Magnetic system (Low tension)

55. Clarify gas turbine engines starting system?
- Direct cranking electrical system
- Starter generator systems
- APU (Pneumatic) systems (see page 274 for details)

56. Clarify reciprocating engine starting system?
- Cartridge starter
- Hand inertia starter
- Electric inertia starter
- Come inertia starter
- Direct cranking starter

57. What is ignition exciter?
(See notes)

58. Draw a neat diagram of typical electronic ignition system?
Fig 4.77 page 233 at power plant hand book.

59. Differentiate between high tension ignition system & low tension ignition system?

Magneto Ignition system operates on the principles of electro magnetic induction. They can be high tension & low tension ignition system.

- High tension magnetic Ignition system High voltages are induced either by rotating the transformer windings between poles of permanent magnet or by rotating the magnet between fixed transformer windings carried by rotating soft iron bars between fixed permanent magnets and transformer windings.

- Low tension magneto Ignition system these systems were developed far earlier having large number of better than high tension. In this, the low voltage impulses from the magneto primary are directly supplied to the distributor. The low tension magnet are suited on and off similar to the high tension magneto. (See figure 4-16 & 4-17 for low tension magnets) [In your text book A/F & power plant]

60. Draw a neat diagram of hydro mechanical fuel control?

See notes can see page 157 of power plant hand book.

61. What do you mean by environmental system?

Environmental systems are these aircraft systems used to make the interior environment of the aircraft comfortable and/or habitable for human beings.

62. What is bleed air?

When a compressor compresses air pressure the directed to the engine combustion chamber, it gets heated up. This heat compressed air is called bleed air, which can be driven to a cabin heating system.

63. What are A/C cooling system or air conditioning systems?

Aircraft cooling systems are used to reduce the temperature inside the aircraft for crew and passenger comfort. The two basic methods of reducing the temperature are the vapor cycle machine and the air cycle machine.

64. What is air cycle and vapor cycle machines?

Air cycle machine:- The turbine, compressor unit by which air is cooled is called air cycle machine (ACM) The ACM uses compression and expansion of air to lower the temperature of cabin air.

Vapor cycle machine: - Uses refrigerant instead of air The vapor cycle machine in a closed system uses the evaporation and condensation of Freon to remove heat from the cabin interior

65. What do you mean by purging the system?

In vapor cycle refrigeration system, purging means releasing the refrigerant.

In fuel system, purging means draining the fuel from tank by introducing inert gas as CO₂ or N₂ to the tank.

In oxygen system, purging means releasing oxygen from the system.

66. What is shirt sleeve environment?

In order to make the cabin environment comfortable for the air craft occupants, the cabin must normally be pressurized to maintain the cabin air pressure at the level reached at no higher than 800 ft. This enables the crew and passengers to function without the uses of supplemental oxygen and, with adjustments of the cabin air temperature, allows them to be in a "shirt sleeve" environment.

67. Differentiate between super charger and turbo charger?

A supercharger is an engine drive air pump; mechanically drive for engine, which compresses air for use by the engine in the combustion process.

A turbocharger is used in a similar manner as a system charger except that the turbo charger is driven by exhaust gases from the engine, which driver an air compressed to supply an air charge to the engine.

68. What is out flow valve, safety or relief valve, and negative pressure relief valve?

– Out flow valve are discharge valve

- Pressure relief valve x used at high altitude to reduce the over pressure.

- Vacuum Relief valves so negative or relief valves are used at low altitude or ground in car the pressure in cabin is less than outside pressure

69. What is a cooling pack?

Cooling packs consist of primary heat exchanger, secondary heat exchanger and air – cycle machine (turbine & Compressor). They are used to cool the air

70. What is boot strap arrangement?

71. Differentiate between hypoxia and anoxia

Hypoxia ÷ A lack of oxygen causes a person to experience a condition called hypoxia. Symptoms are headaches, dizziness etc.

Anoxia ÷ when permanent physical damage results from lack of oxygen, the condition is anoxia.

72. Classify oxygen system?

– Continuous flow oxygen system.

- Diluter Demand system

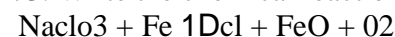
- Pressure Demand system

- Stored gas system

- Chemical oxygen Generator or solid state generator system

- liquid oxygen system(LOX)

73. Write the chemical reaction in chemical oxygen or solid state generators?



(Fuel)

(See Fig. From Notes)

74. What are auxiliary systems?

Systems not essential to the actual operation of the Aircraft are called auxiliary System.

75. What ways can ice be detected?

- Visual detection
- Electronic instrument

76. What is de-icing?

De-icing means removing ice that has already formed.

77. What is thermal anti-icing?

Thermal anti-icing heated air flowing through passages in the leading edge of wings, Stabilizers and engine cowlings to prevent the formation of ice.

78. What is wind shield ice control?

- By heating the wind shield
- By spraying a fluid on the windshield, to remove ice and prevent the formation of any more ice

79. What is gasper system?

The individual air- distributive system, also called the gasper system, routes only the cold air from the air conditioning packs to individually regulated outlets in the control and passenger cabins.

80. Name any three valves used in pressurization system components?

- Out flow valve
- Positive pressure relief valve
- Negative pressure relief valve

81. What is static balancing?

To eliminate the effect of cross wind or side slip the static pressure is duplicated and is known as static balancing.

82. Evaluate "TAS"?

- CAS= IAS+PEC
- EAS= CAS+CEC
- TAS= EAS+OEC (See notes for details)

83. How is mach no. is inversely related to temperature (See notes for details)

84. What is the principle behind vertical speed indicator?

85. What is difference between SAT and TAT?

86. SAT(Static air temperature) –This is the temp the air at the surface of the aircraft would be at if there were no compression effects due to air craft is movement TAT (Total air temperature) in the temp. Of the air when it has been brought completely to rest, as in the pitot tube.

87. The turn and bank indicator uses which of these :-Free gyro /tied gyro/ Earth gyro/ rate gyro.

88. How is gyro powered?
Electrically & Pneumatically.

89. Name any three electronic display systems?
–Electronic height Instrument system (EFIS)
- EICAS (Engine indicating and crew alerting system)
-ECAM. (Electronic centralized air self monitoring)
(For details see notes)

90. Draw a block diagram of typical FMS
(Flight management system)
FMS is a “Pilot – interactive navigational computing and display systems designed to assist in flying an air craft with the maximum economy and safety to a previously planned route defined both laterally and vertically.

91) What is TCAS?
Traffic collision Avoidance system

92) Show block diagram of flight data recorder?

93) Show block diagram of cockpit voice recorder?

94) What is BITE?
BITE means Build In Test Equipment. BITE is a fault management and diagnosis’s built into airborne systems to support the maintenance process.

95) What do you mean by AIDS & ACARS?
ACARS Aircraft Communication Addressing and reporting system (see notes for detail)
AIDS: Air craft integrated data system is an A/C system that allows the airlines to record and /or monitor all available parameter which are on the aircraft buses.

96) What are the units of fuel consumption gauge?
Fuel flow is:
- Volumetric i. e gallons or liters per hour
- Mass flow i.e. pounder (lb) or kilogram per hour.

97) How can we measure RPM of engine?

- By Electronic Tachometer
- By electrical Tachometer
- By Magnetic Tachometer

98) What is multipurpose display?

The multipurpose display is used for monitoring and revising the flight plan.

99) Explain the principle of Magnetic compass?

It works on the principle that a freely suspended magnet will align itself with the earth's magnetic field such that one end will point toward the north magnetic pole.

100) What is the purpose of artificial horizon?

Artificial horizon (also known as attitude indicator) is used to provide the pilot with an indication of the aircraft attitude in both pitch and roll.

101) How can you pass in exam?

Revise series text 1 series text 2; model Exam; Anna University paper I & II; and then 100 questions meet. If you leave any one of these you then you fail.

If you want to score then read notes

- Airplane handbook nFAA
- Dower plant handbook, FAA

Part B;

- 1) What are the functions of push pull and flexible push pull red system? Explain with neat diagram?
- 2) Explain how fully powered flight control system and power boated flight control system work?
- 3) Explain the merits (advantage) and demerits (disadvantage) of analog and digital fly by wire flight control system?
- 4) Explain the working and the advantage of auto pilot system?
- 5) Explain INS, ILS, MLS, VOR, ADF, NDBR selcal communication with neat diagram?
- 6) Explain the working of any two Engine control system with neat sketcher?
- 7) Explain sequence valve, Debooster valve, retractor valve, shutt off valve Cressfeed value?
- 8) Explain with neat diagram the working of typical hydraulic far B-727 cross feed valve?
- 9) Explain shimmy dampers in rose gears Air-oleo spring oleo shock struts in main landing gears?
- 10) Clan its airbrakes? Describe Expander tube brake system explain its working?
- 11) Differentiate between fuel system of piston and jet engine?
- 12) Explain lubrication system used for piston and jet engine? Also explain electronic engine control?
- 13) Explain the starting system for the A/C? List out the gar turbine engine starters explain with neat diagram?
- 14) Describe the fuel system for B 747 A/C with neat diagram?
- 15) Explain high & low voltage capacitor type ignition system.
- 16) Explain with neat sketcher the air cycle cooling system and vapor –cycle cooling system of an A/C

17) Explain icing do-icing and anti -icing? Discuss pneumatic de-icing system?

18) What are cooling pales? Explain?

19) Explain the working of different fire detection and smoke detection techniques used in A/C with neat sketches?

20) Classify different type of oxygen system? Explain solid state oxygen systems? Write down its advantages?

21) Explain the following with neat diagram:

- Accelerometer
- Capacitance type fuel level indicator
- Flight data recorder
- Thermocouple

22) Explain the working of following with neat diagram:

- Electrical tachometer
- Altimeter
- Airspeed indicators
- Mach meter

23) Explain with neat diagram

- Gyroscopic instrument
- Resistance type temperature measuring system
- Magnetic tachometer
- EHS & EAS relation

24) Explain the functional

- Multi function display (MCDU)
- EFIS
- EADI & EHSI
- EICAS & ECAM

25) Explain with neat diagram

- Bank indication (Turn & back indicator display)
- Heading indicates
- Attitude indicates
- Turn coordinator