



B.E DEGREE EXAMINATIONS: NOV 2015

(Regulation 2009)

Seventh Semester

AERONAUTICAL ENGINEERING

AER133: Gas Turbine Technology

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. ____ is defined as a group of compressor stages rotating at the same speed
 - a) Free compressor
 - b) Free turbine
 - c) Spool
 - d) Power turbine
2. In 1791____, an Englishman was the first to patent a design that used the thermodynamic cycle of the modern gas turbine.
 - a) Isaac Newton
 - b) Giovanni Branca
 - c) John Barber
 - d) Leonardo Da vinci
3. The metal is pushed through a die to form various cross sectional shapes is called____
 - a) Forging
 - b) Extrusion
 - c) Machining
 - d) Casting
4. Creep always ____ with temperature.
 - a) Remains constant
 - b) Decreases
 - c) Increases
 - d) Zero
5. FADEC contains ____ channels
 - a) 2
 - b) 3
 - c) 4
 - d) 0
6. The ____ system is designed to remove fuel from the engines fuel manifolds and fuel nozzles and burn them in the combustion chamber during the engine shutdown cycle.
 - a) Fuel purging
 - b) Dry cranking
 - c) Light off
 - d) Thermal soakage
7. Humidity measurement can be done using
 - a) Capacitance sensors method
 - b) Wet and dry bulb thermometer method
 - c) Chilled mirror method
 - d) All of these

8. Any interruption of the fuel supply can result in _____
 - a) Flame stable
 - b) Flameout
 - c) Turbulence
 - d) Heat
9. To measure density of a fuel sample a _____ is used
 - a) Hydrometer
 - b) Densitometer
 - c) Manometer
 - d) Barometer
10. Snakes are resistance thermometers many meters long sometimes used to measure _____
 - a) Average inlet temperature
 - b) Total temperature
 - c) Turbine temperature
 - d) Exhaust temperature

PART B (10 x 2 = 20 Marks)

11. Define Propulsive efficiency.
12. Mention the types of thrust reversers.
13. What is yield strength?
14. Write a short note on powder metallurgy.
15. A turbofan engine has a bypass ratio of 5 and a total mass flow of 120kg/s. calculate the mass flow rate through the bypass duct.
16. Mention the factors which erode compressor surge margin
17. Differentiate under expanded and over expanded nozzles.
18. What is ram pressure recovery of inlet duct.
19. Lists the factors considered for design of engine test beds.
20. What is a CUSUM plot?

PART C (5 x 14 = 70 Marks)

21. a) i) Discuss the different ways to suppress the sound in an aircraft engine (6)
 ii) Explain with neat diagram the afterburner method of thrust augmentation. (8)
 (OR)
 b) i) Briefly describe the operation of supersonic inlets. (7)
 ii) Explain exhaust system with a neat diagram. (7)
22. a) i) Explain any four methods of casting. (7)
 ii) Explain High temperature strength and heat ranges of alloys. (7)
 (OR)
 b) i) With a block diagram briefly describe the FADEC interface with engine (9)

ii) Describe the heat ranges of metals used in aircraft construction. (5)

23. a) Conduct a design point calculation for a single spool turbojet at ISA, 11,000m, 0.8 Mach number with the following cycle parameters.

Mass flow = 100kg/s

Pressure ratio = 25:1

SOT = 1400K

compressor polytropic efficiency = 88%

Turbine polytropic efficiency = 89%

Kerosene fuel with LHV = 43,100kJ/kg

Mechanical efficiency = 99.5%

Intake pressure loss = 0.5%

Compressor exit diffuser pressure loss = 2%

Combustor pressure loss = 3%

Jet pipe pressure loss = 1%

Propelling nozzle $C_D, C_x = 0.97, 0.99$

Assume required data.

(OR)

b) i) Explain design and off design performance. (8)

ii) Write short notes on Starting process and wind milling of engines. (6)

24. a) How the testing and performance evaluation is carries out in compressor. Explain inlet distortion in the compressor.

(OR)

b) How the testing and performance evaluation is carries out in combustion showing combustion MAP and pressure loss for the same.

25. a) i) Detail the steps in test bed cross calibration. (5)

ii) Explain any four types of engine tests. (9)

(OR)

b) Write short notes on the following.

(i) Uncertainty analysis

(ii) Test data analysis

(iii) Data acquisition system.
