Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**Supplementary Examination – June – 2017**

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| **Code :** | **14AE2017** | **Duration :** | **3hrs** |
| **Sub. Name :** | **AIRCRAFT PROPULSION** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

**(Standard Atmosphere Table & Gas Table are permitted)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Derive the thrust equation for turbofan engine with a fan exhaust. | CO1 | 10 |
| b. | A turbojet operates at 6100 m and moves at Mach 0.75. The nozzle exit pressure is 135.87 kPa, the exit velocity is 598.9 m/s, and the exit density is 0.513 kg/m3. The developed thrust is 4080 N, and the fuel flow rate is 1.43 kg/s.   1. Find the ingested air mass flow rate 2. If the exit nozzle is round, what is nozzle exit diameter?  |  |  |  |  | | --- | --- | --- | --- | | Altitude  Z, m | Pressure  P, kPa | Density, kg/m3 | Speed of Sound a, m/s | | 6100 | 46.553 | 0.65265 | 315.99 | | CO2 | 10 |
| (OR) | | | | |
| 2. | a. | Briefly explain the Brayton cycle with intercooling, reheating, and regeneration. | CO1 | 10 |
| b. | Air enters the compressor of a gas-turbine engine at 300 K and 100 kPa, where it is compressed to 700 kPa and 580 K. Heat is transferred to air in the amount of 950 kJ/kg before it enters the turbine. For a turbine efficiency of 86 percent, determine (i) the fraction of the turbine work output used to drive the compressor and (ii) the thermal efficiency. Assume variable specific heats for air. | CO2 | 10 |
| 3. |  | Briefly explain the elementary theory of axial compressors with sketches and Derive the work input and pressure rise equation. | CO1 | 20 |
| (OR) | | | | |
| 4. |  | Briefly explain the elementary theory of axial flow turbine with sketches and Derive the pressure ratio, temperature drop cooefficient, degree of reaction equation. | CO1 | 20 |
| 5. |  | Estimate the power required to drive a single-stage compressor. Flow angle at rotor inlet and stator inlet are 40o and 60o, respectively. Rotor blade angle is 60o, Mean radius = 30 cm, the overall adiabatic efficiency of the stage is 90 percentage. The hub-tip radius ratio is 0.8, high enough so that conditions at the mean radius are good average of the condition from root to tip. The axial velocity component at design flow rate is uniformly 125 m/s, and the inlet air is at 1 atm and 20oC. | CO2 | 20 |
| (OR) | | | | |
| 6. | a. | What are the differences between radial turbine and axial turbine. | CO1 | 5 |
|  | b. | Briefly explain the working principle of centrifugal compressors with sketches and Derive the workdone and pressure rise equation. | CO1 | 15 |
| 7. |  | Explain the types of combustion chamber for gas turbine engine with neat sketches and the factors affecting the combustion chamber performance. | CO1 | 20 |
| (OR) | | | | |
| 8. | a. | Derive the subsonic inlet relation between area ratio A­­max / A i and external deceleration ratio ui/ ua . | CO1 | 10 |
|  | b. | Briefly explain operational principle of the supersonic inlet with typical modes of inlet operations. | CO1 | 10 |
|  | | **Compulsory**: |  |  |
| 9. | a. | What is the need for matching of compressor and turbine? Write down the matching procedure for turbofan engine with suitable sketches. | CO1 | 15 |
|  | b. | Explain the operational principle of convergent nozzle and C-D nozzle used in gas turbine engine. | CO1 | 5 |

ALL THE BEST