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



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **17AE2021** | **Duration :** | **3hrs** |
| **Sub. Name :** | **AIRCRAFT PROPULSION** | **Max. Marks :** | **100** |

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

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. |  | In a gas turbine plant the air enters the compressor at 1 bar and 300 K. The pressure ratio is 5. The temperature at the turbine inlet is 1200 K. The mass rate of flow is 12 kg/s.  Sketch the cycle on p-V and T-s planes and indicate the area representing the best supply, heat rejection and work of the cycle. Determine,   1. Compressor and turbine work 2. Net work developed 3. The ratio of turbine work to compressor work and 4. The thermal efficiency   Take Cp = 1.005 kJ/kg K. | CO1 | 20 |
| **(OR)** | | | | |
| 2. |  | In a gas turbine the compressor taken in air at a temperature of 27 degree and compressed it to five times the initial pressure with an isentropic efficiency of 85%. The air is then passed through a regenerator heated by the turbine exhaust before reaching the combustion chamber. The effectiveness of the regenerator is 80%. The maximum temperature after constant pressure combustion is 677°C and the efficiency of the turbine is 80%. Neglecting all losses except mentioned and assuming the working fluid throughout the cycle to have the characteristics of air   1. Sketch the cycle on the T-S diagram. 2. Calculate the efficiency of the cycle.   Take γa = 1.4 & γg = 1.33 | CO2 | 20 |
|  |  |  |  |  |
| 3. | a. | Define spillage drag. | CO3 | 2 |
| b. | Mention the problems associated with spillage drag. | CO3 | 4 |
| c. | Illustrate in detail about subsonic intake performance. | CO3 | 14 |
| **(OR)** | | | | |
| 4. |  | Explain the following techniques:   1. Thrust vectoring 2. Thrust reversal 3. Noise control. | CO3 | 7  7  6 |
|  |  |  |  |  |
| 5. |  | A centrifugal compressor has a pressure ratio of 4:1 with an isentropic efficiency of 80% when running at 15000 rpm and inducing air at 293 K. Curved vanes at inlet gives the air a prewhirl of 25°C to the axial direction at all radii and the mean dia of eye is 250 mm. The absolute air velocity at inlet is 150 m/s. Impeller tip dia is 600 mm. Calculate the slip factor. | CO4 | 20 |
| **(OR)** | | | | |
| 6. | a. | Mention the basic requirement of a compressor for aircraft engine. | CO4 | 2 |
| b. | List out the difference between centrifugal compressor and axial compressor. | CO4 | 4 |
| c | With neat sketch explain the working of a axial compressor. | CO4 | 14 |
|  |  |  |  |  |
| 7. | a. | State the various factors those effect the combustion chamber performance. | CO5 | 10 |
| b | Explain the process of combustion in a gas turbine combustion chamber | CO5 | 10 |
| **(OR)** | | | | |
| 8. |  | Gas at 6.5 bar and 310°C expands to 3 bar in an impulse turbine stage. The nozzle angle is 75°C with reference to the exit direction. The rotor blades have equal inlet and outlet angles, and the stage operates with the optimum blade speed ratio. Assuming that the isentropic efficiency of the nozzle is 0.9, and that the velocity at entry to the stage is negligible, deduce the blade angle used and the mass flow required for this stage to produce 80 kW. Take Cp = 1.15 kJ/kg K. Mention the cause of under performance if any. | CO6 | 20 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Mention the difference between impulse and reaction turbine. | CO4 | 6 |
| b. | Explain what is meant by velocity compounding of a multistage impulse turbine with necessary diagram. | CO4 | 14 |