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



**End Semester Examination – Nov/Dec – 2017**

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| **Code :** | **14AE2017** | **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. | a. | State the compressor and turbine work output of turbojet engine. | CO1 | 6 |
| b. | In a gas turbine plant air enters the compressor at 1 bar and 7˚C. It is compressed to 4 bar with an isentropic efficiency of 82%. The maximum temperature at the inlet to the turbine is 800˚C. The isentropic efficiency of the turbine is 85%. The calorific value of the fuel used is 43.1 MJ/kg. The heat losses are 15% of the calorific value. Calculated the following: (i) Thermal efficiency (ii) Air/Fuel ratio (iii) Specific fuel consumption in kg/kW/hr. Assume =1.005 kJ/kg, γa=1.4, Cpg=1.147 kJ/kg, γa=1.4. | CO1 | 14 |
| (OR) | | | | |
| 2. |  | The following data apply to a twin-spool turbofan engine, with fan driven by the LP turbine and the compressor driven by the HP turbine. Separate cold and hot nozzles are used.  Overall pressure ratio : 25  Fan pressure ratio : 1.65  Bypass ratio : 5.0  Turbine inlet temperature : 1550 K  Isentropic efficiency of compressor : 87%  Isentropic efficiency of turbine : 92%  Isentropic efficiency of Nozzle : 97%  Mechanical efficiency of spool : 87%  Combustion chamber Pressure loss : 1.50 bar  Total air mass flow : 215 kg/s  It is required to find the thrust and SFC of 2500 kg/hr under sea level conditions where the ambient conditions may be taken as 1 bar and 288 K. | CO2 | 20 |
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| 3. | a. | Briefly explain the flow through a compressor and bring out the details of various losses in an axial low compressor. | CO2 | 14 |
|  | b. | Derive the Expression to calculate the pressure ratio in a stage. | CO2 | 6 |
| (OR) | | | | |
| 4. | a. | What are the three types of blade shapes possible and how they are classified in the compressor? | CO1 | 6 |
|  | b. | What is meant by volute? Explain the purpose of volute casing? | CO1 | 6 |
|  | c. | With neat sketch explain the essential parts and working principle of centrifugal compressor. | CO1 | 8 |
|  |  |  |  |  |
| 5. |  | With neat sketch explain the combustion chamber geometry bringing out the various zones that play a part in the process of combustion. | CO1 | 20 |
| (OR) | | | | |
| 6. |  | A single sided centrifugal compressor is to deliver 14 kg of air per second when operating at a pressure ratio of 4:1 and a speed of 13,000 rpm. The total head inlet conditions may be taken as 288 K and 1.033 kg/cm2. Assuming slip factor as 0.9, a power input factor of 1.04 an isentropic efficiency of 80%, estimate the overall diameter of the impeller. If the Mach number is not to exceed unity at the impeller tip and 40% of the losses are assumed to occur in the impeller, find the minimum possible depth of the diffuser. | CO2 | 20 |
|  |  |  |  |  |
| 7. |  | In a single-stage turbine the nozzle discharges the fluid on to the blades at an angle of 65° to the axial direction and the fluid leaves the blades with an absolute velocity of 300m/s at an angle of 30° to the axial direction. If the blades have equal inlet and outlet angles and there is no axial thrust, estimate the blade angle, power produced per kg/s of the fluid and the blades efficiency. | CO2 | 20 |
| (OR) | | | | |
| 8. | a. | With a neat sketch explain a single stage velocity triangle and derive an expression for the work output. | CO2 | 10 |
|  | b. | Explain the principle of operation of a turbine and what are the primary parts of a turbine? | CO2 | 10 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. | a. | Briefly explain the supersonic inlets. | CO1 | 8 |
|  | b. | Write short notes on   1. engine back pressure control, 2. exhaust nozzle area ratio, and 3. thrust reversing. | CO1 | 12 |

ALL THE BEST