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



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

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| **Code :** | **14AE3007** | **Duration :** | **3 hrs** |
| **Sub. Name :** | **ADVANCED 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. | Describe the performance difference of the air breathing engine and rocket engine. | CO1 | 8 |
| b. | With a neat sketch explain the working of closed cycle arrangement state the advantages and disadvantages of closed cycle system over open cycle system. | CO1 | 12 |
| (OR) | | | | |
| 2. |  | The following data apply to gas turbine set employing a regenerator  Isentropic efficiency of compressor each stage= 82%  Isentropic efficiency of the turbine = 85%  Mechanical transmission efficiency =99%  Pressure ratio = 7:1  Maximum cycle temperature = 1000 K  Combustion efficiency = 97%  Calorific value of the fuel = 43.1 MJ/kg  Air mass flow = 20 kg/s  Regenerative effectiveness = 75%  Regenerative gas side pressure loss =0.1 bar  Ambient temp & Pressure = 327 K, 1 bar  Calculate the output, specific fuel consumption and overall thermal efficiency. Assume that pressure losses in the airside of the regenerator and combustion chamber are accounted for the compressor efficiency. Compare the results obtained with the same plant without regenerator and with regenerator but without pressure loss and also comment on the results. Neglect the effect of the fuel mass addition in the heat balance in the combustion chamber but include in the turbine calculation. | CO2 | 20 |
| 3. | a. | State the losses in axial flow compressor. | CO1 | 6 |
|  | b. | Explain the phenomenon of surging and stalling of the compressor. | CO1 | 14 |
| (OR) | | | | |
| 4. | a. | With a neat sketch explain the combustion chamber geometry bringing out the various zones that play a part in the process of combustion. | CO2 | 10 |
|  | b. | Mention the various practical problems in the operation of a combustion chamber. | CO2 | 10 |
| 5. |  | The first stage of an axial compressor is designed on free vortex principles, with no inlet guide vanes. The rotational speed is 6000 rev/min and the stagnation temperature rise is 20 K. The hib tip ratio is 0.60, the work done factor is 0.93 and the isentropic efficiency of the stage is 0.89. Assuming an inlet velocity of 140 m/s and ambient conditions of 1.01 bar and 288 K calculate   1. The tip radius and corresponding rotor air angles β1 and β2, if the Mach number relative to the tip is limited to 0.95 2. The mass flow entering the stage 3. The stagnation pressure ratio and power input. 4. The rotor air angles at the root section.   Take R = 0.287 kJ/kg K, Cp = 1.005 kJ/kg K and γ = 1.4. | CO1 | 20 |
| (OR) | | | | |
| 6. |  | Draw the thermodynamic cycle of the ramjet engine and derive the equation of a ramjet engine. | CO1 | 20 |
| 7. | a. | What is meant by an operating line? | CO2 | 5 |
|  | b. | Explain by means of a numerical example how to determine the operating line. | CO2 | 15 |
| (OR) | | | | |
| 8. | a. | With a neat sketch explain the variation of pressure and velocity through a two stage pressure compounded impulse turbine. | CO2 | 10 |
|  | b. | Draw a schematic diagram of a chemical rocket and its corresponding T – s diagram. | CO1 | 10 |
|  | | **Compulsory**: |  |  |
| 9. |  | Explain the following performance coefficients. |  |  |
|  | a. | Nozzle coefficient. | CO2 | 4 |
|  | b. | Cross thrust coefficient. | CO2 | 4 |
|  | c. | Flow coefficient. | CO2 | 4 |
|  | d. | Velocity coefficient. | CO2 | 4 |
|  | e. | Angularity coefficient. | CO2 | 4 |

ALL THE BEST