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

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**End Semester Examination – Nov/Dec – 2018**

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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. | Derive the thrust equation for a simple turbo jet engine and explain its operation. | CO2 | 10 |
| b. | With neat sketch explain the working principle of turbo fan engine. | CO1 | 10 |
| (OR) | | | | |
| 2 |  | The following data apply to a turbojet aircraft flying at an altitude of 10 km where the ambient conditions are 0.265 bar and 223.3 K. Speed of aircraft : 299.5m/s  Pressure ratio of compress: 8:1  Combustion chamber pressure loss : 4% compressor delivery  Turbine inlet temperature :1200 K  Intake duct efficiency : 93%  Isentropic efficiency of compressor : 87%  Isentropic efficiency of turbine : 90%  Mechanical efficiency of transmission : 99%  Nozzle efficiency : 95%  Combustion chamber efficiency : 98%  Theoretical fuel / air ratio : 0.0194  Find the specific thrust and specific fuel consumption in kg/Nh of thrust. Take Cpa= 1.005 kJ/kg K, γ=1.4, Cpg=1.147 kJ/kg K and γ= 1.33 | CO2 | 20 |
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| 3. |  | Air at a temperature of 200 K enters a ten stage axial flow compressor at the rate of 3 kg/s. the pressure ratio is 6.5 and the isentropic efficiency is 90%, the compression process being adiabatic. The compressor has symmetric blades. The axial velocity of 110 m/s is uniform across stage and the mean blade speed of each stage is 180 m/s.  Determine the direction of the air at entry to and exit from the rotor and the stator blades and also the power given to the air. Assume Cp=1.005 kJ/kg k and specific heat ratio is 1.4. | CO2 | 20 |
| (OR) | | | | |
| 4. | a. | Differentiate between axial flow compressor and centrifugal compressor and compare their velocity triangles. | CO1 | 10 |
| b. | Describe the working of a centrifugal compressor with a neat sketch. Draw the T-S diagram and velocity triangles. | CO1 | 10 |
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| 5. |  | In a single stage impulse turbine the nozzle discharges the fluid on the blades at an angle of 60 ° to the axial direction and the fluid leaves the blade with an absolute velocity of 310 m/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 angles and power produced per kg/s of the fluid. | CO2 | 20 |
| (OR) | | | | |
| 6. | a. | Differentiate between impulse stage and reaction stage turbines. | CO1 | 5 |
| b. | Describe the working of an axial flow turbine stage with a neat sketch. Draw the T-S diagram and velocity triangles. | CO1 | 15 |
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| 7. | a. | List the functions of an aircraft engine nozzle. | CO1 | 5 |
| b. | Illustrate the working principle of combustion chamber also explain the purpose of different zones in the combustor. | CO2 | 15 |
| (OR) | | | | |
| 8 | a. | Briefly explain the supersonic inlets. | CO1 | 10 |
| b. | Briefly explain operational principle of the subsonic inlet with flow pattern. | CO1 | 10 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Describe the general matching procedure of a turbojet engine. | CO2 | 15 |
| b. | List down the performance characteristics of Gas turbine engine with typical data. | CO2 | 5 |