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**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

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

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

**End Semester Examination – Nov/Dec – 2016**

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| **Code :** | **09AE211** | **Duration :** | **3 hrs** |
| **Sub. Name :** | **ADVANCED PROPULSION SYSTEM** | **Max. marks :** | **100** |

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| **Q. No.** | **Questions** | **Marks** |
| **PART-A(10X1=10 MARKS)** | | |
| 1. | What are the different types of aircraft engines? | (1) |
| 2. | Define total impulse | (1) |
| 3. | What is the fuel used in monopropellant rocket? | (1) |
| 4. | Why the area ratio of nozzle is increased with increase in stages of the rocket? | (1) |
| 5. | Unburned propellant remaining (or lost--that is, expelled through the nozzle) at the time of web burnout is called as \_\_\_\_\_\_\_\_\_\_. | (1) |
| 6. | The specific impulse of Nuclear rocket is higher than solid and less than liquid propellant rocket engine ( True/False) | (1) |
| 7. | \_\_\_\_\_\_\_\_\_\_Motor burn time during which thrust, pressure, and burning surface area remain approximately constant typically within about +15%. | (1) |
| 8. | Why liquid rocket engine requires cooling? | (1) |
| 9. | What are the advantages of using ion thrusters? | (1) |
| 10. | What are solar sails? | (1) |

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| **PART B(5 X 3= 15 MARKS)** | | |
| 11 | State the difference between rocket motor and aircraft engine. | (3) |
| 12 | What are the advantages and disadvantages of Integral Ram rockets? | (3) |
| 13 | Explain the working of dumped cooling with a neat sketch | (3) |
| 14 | Write a note on case bonded grains. | (3) |
| 15 | What are the different types of electric thrusters? | (3) |

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| **PART C(5 X 15= 75 MARKS)** | | | |
| 16. | a. | What are the limiting factors in a gas turbine design? | (5) |
| b. | Gas at 6 bar and 310˚C expands to 3.5 bar in an impulse turbine stage. The nozzle angle is 65˚ 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 70kW. Take Cp=1150 J/kg-K | (10) |
| (OR) | | | |
| 17. | a. | What are the various methods of blade cooling? | (5) |
| b. | Briefly explain the matching procedure of turbine and compressor? | (10) |
| 18. |  | Explain the working principle of a scramjet engine with a neat sketch. | (15) |
| (OR) | | | |
| 19. | a.  b.  c. | Write short note on  Sub critical intake.  Critical intake.  Super critical intake. | (5)  (5)  (5) |
| 20. |  | Design a nozzle for an ideal rocket that has to operate at 25 km altitude and gives 5000 N thrust at a chamber pressure of 2.068 MPa and chamber temperature of 2800 K. Assuming that K=1.30 and R=355.4 J/kg-K, determine the throat area, exit area, throat velocity, and exit temperature. | (15) |
| (OR) | | | |
| 21. |  | Explain the variation of pressure, temperature, area ratio, specific volume, Mach Number and velocity across a C-D nozzle with a neat sketch | (15) |
| 22. | a. | What is the various propellant grain design consideration? | (5) |
| b. | Explain the working principle of solid rocket motor with a neat sketch | (10) |
| (OR) | | | |
| 23. |  | What are the different criteria for selection of a liquid propellant rocket engine? | (15) |
| 24. | a. | What is the concept involved in Ion propulsion? | (5) |
| b. | Explain with the help of a diagram how an Ion engine works. | (10) |
| (OR) | | | |
| 25. |  | What is a Solar thermal rocket? Explain its working with a neat sketch. | (15) |

ALL THE BEST