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Question Paper Code: 59702

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Elective

Mechanical Engineering

15UME902- GAS DYNAMICS AND JET PROPULSION

(Regulation 2015)

(Approved Gas Tables and Steam tables permitted)

Duration: 1.15 hrs

Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

- In transonic flow Mach number is CO1- R
(a) $0.8 < M < 1.2$ (b) $0.8 > M < 1.2$ (c) $0.8 < M < 1.5$ (d) $0.9 < M < 1.2$
- Identify the Mach number Formula CO1- R
(c = fluid velocity, a = velocity of sound)
(a) $M = c/a$ (b) $M = a/c$ (c) $M = c * a$ (d) $M = a - c$
- Rayleigh line flow is a flow in constant area duct CO2- R
(a) With friction but without heat transfer (b) Without friction but with heat transfer
(c) With both friction and heat transfer (d) Without either friction or heat transfer
- For Rayleigh flow which one is correct. CO2- R
(a) $T_{01} = T_{02}$ (b) $P_{01} = P_{02}$ (c) $P_1^* = P_2^*$ (d) None of these
- For oblique shock, the downstream Mach number CO3- R
(a) Is always more than unity (b) Is always less than unity
(c) May be less or more than unity (d) Can never be unity
- Across a Normal shock CO3- R
(a) the entropy remains constant (b) the pressure and temperature rise
(c) the velocity and pressure decrease (d) the density and temperature decrease

7. A turbo-prop is preferred to turbo-jet because CO4- R
 (a) It can fly at high elevations (b) It has high propulsive efficiency at high speeds
 (c) It can fly at super sonic speeds (d) It has high power for take off
8. Which one is Air breathing Engines. CO4- R
 (a) Rocket Engine (b) Turbojet Engine
 (c) Ramjet Engine (d) Both B & C
9. A rocket engine uses _____ for the combustion of its fuel. CO5- R
 (a) Its own oxygen (b) Compressed atmospheric air
 (c) Surrounding air (d) None of these
10. A rocket engine uses _____ for the combustion of its fuel. CO5- R
 (a) its own oxygen (b) compressed atmospheric air
 (c) surrounding air (d) none of these

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. An air jet at 400 K has sonic velocity. Determine the following CO1- App (8)
 1. Velocity of sound at stagnation condition
 2. Maximum velocity of jet
 3. Stagnation enthalpy
 4. Crocco number
12. The pressure, temperature & Mach number of the gas at exit are 2bar, 1200°C and 0.7 respectively. The ratio of stagnation temperature at exit to entry is 3.85. Calculate (i) Mach number, pressure and temperature of the gas entry (ii) the heat supplied per kg of gas (iii) the maximum heat supplied. Take $\gamma = 1.3$,
 $C_p = 1.22 \text{ KJ/ kg K}$. CO2- App (8)
13. A jet air at 270K and 0.7bar has an initial mach number of 1.9. If it passes through a normal shock wave. Determine the following for downstream of the shock wave Mach number and properties. CO3- App (8)
14. Describe the principle of operation of a turbojet engine with neat sketch and state its advantages and disadvantages. CO4- U (8)
15. Explain with neat sketch the working of Liquid propellant rocket engine with merits and demerits. CO5 U (8)

