

Printed Pages – 5

Roll No. : .....

**337652(37)**

APR-MAY 2022

**B. E. (Sixth Semester) Examination 2020**

**(New Scheme)**

**(Mechanical Engg. Br.)**

**ENERGY SYSTEMS**

***Time Allowed : Three hours***

***Maximum Marks : 80***

***Minimum Pass Marks : 28***

***Note : Part (a) of each unit is compulsory and attempt any two from part (b), (c) and (d) each unit.***

**Unit - I**

1. (a) What is Propulsive Efficiency? 2
- (b) Explain Ramjet engine with schematic diagram and give its advantage and disadvantages also. 7

337652(37)

PTO

- (c) The diameter of the propeller of an aircraft is 3 m. It flies at a speed of 800 kmph at an altitude of 5000 m. For a flight of jet speed ratio of 0.75 determine :
- (i) The flow rate of air through the propeller.
  - (ii) Thrust produced
  - (iii) Specific thrust
  - (iv) Specific impulse
  - (v) The thrust power
- Let air density at altitude of 5000 m is  $0.525 \text{ kg/m}^3$ . 7
- (d) An aircraft flies at 1000 kmph. One of its turbojet engines takes in 40 kg/s of air and expands the gases to the ambient pressure. The air-fuel ratio is 50 and the lower calorific value of the fuel is 43 MJ/kg. For maximum thrust power determine :
- (i) Jet velocity
  - (ii) Thrust
  - (iii) Specific thrust
  - (iv) Thrust power
  - (v) Propulsive efficiency
  - (vi) Thermal and overall efficiency
  - (vii) TSFC

Unit - II

2. (a) In rocket engine what is thrust and how it will be product. 2
- (b) In rocket engine prove that  $\eta_0 = \eta_p \eta_{th}$   
 $\eta_0$  = over all efficiency,  $\eta_p$  = propulsion efficiency  
 $\eta_{th}$  = thermal efficiency. 7
- (c) Prove that for vertical flight of a rocket :
- $$z = f(I_s, \xi, t_p)$$
- where  $z$  = altitude,  $I_s$  = specific impulse,  $\xi$  = propellant mass fraction,  $t_p$  = Burn out time. 7
- (d) Explain liquid propellant rocket with advantage and disadvantage. 7

Unit - III

3. (a) What is non conventional source of energy? 2
- (b) Describe the principle of photovoltaic energy conversion. 7
- (c) Explain flat plate solar collector with function of main components. 7

- (d) Explain the following terms : 7
- (i) Hour angle
  - (ii) Declination angle
  - (iii) Solar azimuth angle
  - (iv) Latitude angle

Unit - IV

4. (a) What is the basic principles of wind energy conversion? 2
- (b) Prove that horizontal axis propeller type wind turbine. Maximum power is given by : 7

$$P_{\max} = \frac{8}{27} \rho A V_1^2$$

where  $v_1$  = incoming wind velocity

A = Area

$\rho$  = density of air

- (c) How biomass conversion takes place? 7
- (d) Write short notes on : 7
- (i) biogas plant
  - (ii) Basic component of wind energy system

Unit - V

5. (a) What is wave energy conversion? 2
- (b) Explain the various methods of utilization of tidal energy. 7
- (c) Explain construction and working of MHD generator. 7
- (d) Write short notes on :
- (i) Fuel cell 7
  - (ii) Ocean thermal energy