(Pages : 3) **9708**

Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, January 2016
(2013 Scheme)
13.306 : HYDRAULIC MACHINES AND HEAT ENGINES
(E)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **2** marks.

1. Classify fluids according to Viscosity.
2. Distinguish between Steady flow and Uniform flow.
3. Explain the general layout of a hydroelectric power plant.
4. Differentiate between Impulse turbine and Reaction turbine.
5. What do you mean by specific speed of a turbine ?
6. What is the significance of air vessel in Reciprocating pump ?
7. Explain the concept of manometric efficiency in Centrifugal pump.
8. List any five classifications of IC engines.
9. Differentiate between Quality governing and Quantity governing.
10. Derive the air standard efficiency of Brayton (Jule) cycle. **(10×2=20 Marks)**

PART – B

Answer **one full** question from **each** Module. **Each** question carries **20** marks.

Module – I

11. a) Using Bernoullis principle derive the equation of discharge of a Venturimeter. **8**

    b) A cylinder of 30 cm diameter rotates concentrically inside a fixed cylinder of 31 cm diameter. Both the cylinders are 50 cm long. Determine the viscosity of the liquid which fill the space between the cylinder if a torque of 1 Nm is required to maintain a speed of 60 rpm. **12**

OR

12. a) Explain different type of losses that may occur in pipe flow. 8

b) A differential manometer is connected at two points A and B of two pipes. Pipe A contains a liquid of specific gravity 1.5 while the other contains water. The pressure at A and B are 1 kgf/cm^2 and 2 kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer. 12

Module – II

13. a) Explain the working of a centrifugal governor employed in turbine. 8

b) The following data is given for a Francis turbine. Net head 50 m, speed 600 rpm, shaft power 300 kW, overall efficiency is 84%, hydraulic efficiency is 93%, flow ratio 0.2, breadth ratio is 0.1, inner diameter of the runner is half the diameter of outer diameter. Thickness of the vanes occupy 5% circumferential area of runner. Velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine : i) Guide blade angle. ii) Runner vane angle at inlet and outlet. iii) Diameter of runner at inlet and outlet. 12

OR

14. a) With a neat sketch explain the working of a Kaplan turbine. 8

b) A 140 mm diameter jet of water impinges on the buckets of the Pelton wheel and jet is deflected through an angle of 165°. Head available at the nozzle is 400 m. Coefficient of velocity is 0.97 and speed ratio is 0.46. Reduction in relative velocity while passing through the bucket is 15%. Find the power developed. 12

Module – III

15. a) Discuss the effect of acceleration on Indicator diagram of a reciprocating pump. 8

b) A double acting reciprocating pump has a piston of diameter 250 mm and piston rod of diameter 50 mm which is on one side only. Stroke length is 350 mm and speed of crank is 60 rpm. The suction and delivery heads are 4.5 m and 18 m respectively. Determine the discharge capacity of the pump and the power required to operate the pump. 12

OR

16. a) Discuss the performance characteristics curves of a centrifugal pump. 8

b) A centrifugal pump has the following characteristics : Outer diameter of the impeller 800 mm, width of the impeller vanes at outlet 100 mm, angle of impeller vanes at outlet is 40°. The impeller runs at 550 rpm and delivers 0.98 cm^3/s water under an effective head of 35 m. A 500 kW motor is used to drive the pump. Determine the manometric, mechanical and overall efficiencies of the pump. Assume water enters the impeller vanes radially at inlet. 12

Module – IV

17. a) Explain retardation test for IC engines. 8

b) The following details were noted in a test on a 4 cylinder 4 stroke engine. Bore = 100 mm, Stroke = 120 mm, Speed of engine = 1600 rpm, Fuel consumption = 0.2 kg/min, Difference in weights on either side of brake pulley = 40 kg, Circumference of the brake pulley = 300 cm, Calorific value of fuel = 44000 kJ/kg, Mechanical efficiency = 80%. Calculate (i) Brake thermal efficiency. (ii) Indicated thermal efficiency. (iii) Specific fuel consumption. 12

OR

18. a) Derive the expression for optimum pressure ratio for maximum work output for a gas turbine. 8

b) Air enters the compressor at a pressure of 1 bar and a temperature of 30°C. Pressure of air after compression is 4 bar. The isentropic efficiency of the compressor and turbine are 0.8 and 0.85 respectively. The air fuel ratio is 80 : 1. If the flow rate of air is 3 kg/s, find the power developed and thermal efficiency of the cycle. Assume calorific value of fuel as 42000 kJ/kg and C_p = 1 kJ/kgK and γ = 1.4 for both air and gas. 12
