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Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, January 2015
(2008 Scheme)
08 303 : HYDRAULIC MACHINES AND HEAT ENGINES (E)

Time : 3 Hours Max. Marks : 100

Instructions : *Answer **all** questions from Part – **A** and **any one** question from **each** of the Module of Part – **B**. Include neat sketches **wherever** necessary.*

PART – A

Answer **all** questions.

1. Distinguish between dynamic viscosity and kinamatic viscosity of a fluid. Give their values for water.

2. At a certain location in the flow field pressure equals 50 m of water column. Obtain equivalent pressure head in terms of
   i) Kerosene of specific gravity 0.8
   ii) Carbon tetra chloride of specific gravity 1.5

3. Discuss the assumptions under lying Bernaullis equation. Apply the Bernaullis equation between the suction and delivery pipes of a centrifugal pump, considering loss also.

4. What is Reynold's number ? Describe the upper and lower critical Reynold's number.

5. What is governing of a turbine ? How it accomplished for Impulse and reaction water turbines ?

6. What is meant by cavitation ? How and where does it occur in Hydraulic machines ?

7. Discuss the influence of exit blade angle on the performance of centrifugal pump.

8. Give a brief account of providing air vessels on the suction and delivery sides of a reciprocating pump.

P.T.O.

9. Define the following with respect to I.C. engines.
   i) Swept volume
   ii) Compression ratio
   iii) Piston speed
   iv) Brake power.

10. What do you mean by compounding of steam turbine ? Name various methods of compounding steam turbine. **(10×4=40 Marks)**

PART – B

Module – 1

11. a) Describe an orifice meter and derive an expression for measuring actual discharge of fluid through a pipe line with this device.

    b) A pipe line carrying oil of specific gravity 0.87 changes in diameter from 200 mm at a position A to 500 mm at another position B which is 4 metres at a higher level. If the pressures at A and B are 1 bar and 0.6 bar respectively and the discharge is 0.2 m^3/sec. Determine the loss of head and the direction of flow.

12. a) Derive Darcy-Weisbach and Chezy's equations for finding loss of head due to friction in a pipe.

    b) Lubricating oil of specific gravity 0.85 and dynamic viscosity 0.1 N-sec/m^2 is pumped through a 3 cm diameter pipe. If pressure drop per metre length of pipe is 15 KPa. Determine
       i) The mass flow rate on kg/min
       ii) The shear stress at the pipe wall
       iii) The Reynold's number of the flow.

Module – 2

13. a) Obtain an expression for the workdone per second by water on the runner of an Inward radial flow reaction turbine.

b) A pelton wheel generates 8000 kw under a net head of 130 m at a speed of 200 r.p.m. Assuming the Co-efficient of velocity for the nozzle 0.98 hydraulic efficiency 87% speed ratio 0.46 and jet diameter to wheel diameter ratio is $\frac{1}{9}$. Determine

i) Discharge required

ii) Diameter of the wheel

iii) Diameter of jet and number of jets required

iv) Specific speed.

Take mechanical efficiency is 75%.

14. a) Define specific speed of a centrifugal pump obtain an expression for specific speed. What is its significance ?

b) A single acting reciprocating pump has a piston of diameter 100 mm and stroke length 200 mm. The length and diameter of the suction pipe are 6.5 m and 50 mm. respectively. If the suction left of the pump is 3.2 m. and separation occurs when the pressure in the pump falls below 2.5 m of water absolute and take atmospheric pressure as 10.37 m of water . Find the maximum speed at which pump can be run without separation in the suction pipe.

Module – 3

15. a) Explain retardation test for finding friction power of an I.C. engine.

    b) A single cylinder four-stroke diesel engine running at 1800 r.p.m. has a bore of 85 mm. and a stroke of 110 mm. It takes 0.56 kg of air per minute and develops a brake power output of 6 kw. While the air fuel ratio is 20 : 1. The calorific value of the fuel used is 42550 kJ/ kg and ambient air density is 1.18 kg/m^3. Calculate

        i) The volumetric efficiency

        ii) Brake specific fuel consumption.

16. a) Explain with a schematic diagram, the working of a closed cycle gas turbine with inter cooling and Reheating. What is the condition for perfect inter cooling ?

    b) Find the required air fuel ratio in a gas turbine whose turbine and compressor efficiencies are 85% and 80% respectively. Maximum cycle temperature is 875°C. The working fluid can be taken as air for Cp = 1.0 kJ/kg°k. r = 1.4. The air enters the compressor at 1 bar and 27°C. The pressure ratio is 4. The fuel used has calorific value of 42000 kJ/kg. There is a loss of 10% of calorific value in the combustion chamber. **(20×3=60 Marks)**
