Total No. of Printed Pages:02

SUBJECT CODE NO: E-253
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E.(Mech) Examination Nov/Dec 2017
Fluid Mechanics & Machinery
(REVISED)-I

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B
i. Attempt any three questions from each section.
ii. Assume suitable data, if necessary.
iii. Draw a neat labeled sketch wherever necessary.

SECTION-A

Q.1 a) A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm. both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12 Nm is required to rotate the inner cylinder at 100 rpm, determine the viscosity of the fluid. 06

b) A rectangular plate 0.6 m wide and 1.2 m deep is submerged in an oil bath of specific gravity 0.8. The maximum and minimum depths of the plate are 1.6m and 0.75m from the free surface. Calculate the hydrostatic force on one face of the plate and the depth of Centre of pressure. 07

Q.2 250 liters per second of water is flowing in a pipe having a diameter of 30cm. if the pipe is bent by 135°, find the magnitude and direction of resultant force on the bend. The pressure of water flowing in the pipe is 400kPa. 13

Q.3 Show that the power P developed in a water turbine can be expressed as: 13

$$P = \rho N^3 D^5 \emptyset[\frac{D}{B}, \frac{\rho D^2 N}{\mu}, \frac{ND}{\sqrt{gH}}, \frac{H}{D}]$$

Where D and B are the diameter and width of the runner, N is the speed in revolutions per minute, H is the operating head, μ *and* ρ are respectively the coefficient of dynamic viscosity and mass density of the liquid.

Q.4 a) Show by Rayleigh's method of dimensional analysis that the resistance F to the motion of a sphere of diameter D moving with a uniform velocity V through a real fluid of density ρ and viscosity μ is given by 07

$$F = \rho D^2 V^2 f(\frac{\mu}{VD_\rho})$$

b) A stone weighs 400 kN in air and when immersed in water it weighs 225N. Calculate the volume of the stone and its relative density. 06

Q.5 Write short note on any two of the following questions. 14

a) Need for CFD
b) Types of fluid
c) Assumptions of Bernoulli's equation.

SECTION-B

Q.6 a) A nozzle of 5cm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find the force on the plate, the work done and efficiency of jet. 07

b) With the help of neat sketch explain the principle, working of Francis turbine. 06

Q.7 a) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of floe is constant. Determine the work done by the impeller per unit weight of water. 09

b) Define 04

1) suction head
2) Delivery head
3) Manometric head
4) Static head on centrifugal pump

Q.8 a) The hub diameter of a Kaplan turbine working under a head of 12m, is 0.35 times the diameter of the runner. The turbine is running at 100 rpm. If the vane angle of the extreme edge of the runner at outlet is 15 ° and flow ratio is 0.6. The velocity of whirl at outlet is given as zero. Find : 08

1) Diameter of the runner
2) Diameter of the boss
3) Discharge through the runner.

b) Explain the construction and working of Hydraulic press. 05

Q.9 a) Differentiate between Pelton, Francis and Kaplan turbine. 03

b) Define 06

1) Cavitation
2) Net positive suction head (NPSH)
3) Priming

c) Explain the significance of Draft tube. 04

Q.10 Write short notes on any two of the following questions. 14

a. Hydraulic crane
b. Effect of number of vanes on impeller
c. Performance characteristics of hydraulic turbine.