SE-SEM-IV - Civil

FM-II

21/5/15

QP Code : **3962**

(OLD COURSE)

(3 Hours) [Total Marks : 100

N.B.:- 1) Question No 1 is compulsory.
2) Solve any four questions from remaining questions.
3) Assume suitable data wherever necessary and mention it clearly.

Q.1 Attempt any four of the following questions. 20

a) What are the important characteristics of laminar flow? Give examples where such flow is encountered.

b) Derive Dupit's equation.

c) Calculate the pressure gradient along flow, the average velocity and the discharge for an oil of viscosity 0.02 Ns/m^2 flowing between two stationary parallel plates 1m wide maintained 10 mm apart. The velocity midway between the plates is 1.8 m/s.

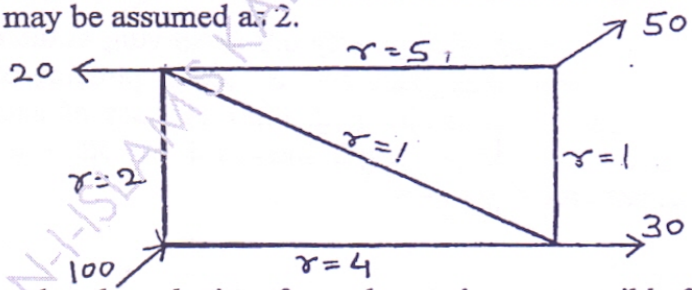
d) Explain Moody diagram.

e) Explain HGL and TEL.

f) An aeroplane is moving at a supersonic speed is not heard by a stationary observer until the place has passed him. Comment on the validity of this statement.

Q.2 a) A siphon of diameter 200 mm connects two reservoirs whose water surface level differs by 40 m. The total length of pipe is 8010 m. The pipe crosses a ridge. The summit of ridge is 8m above the level of water in the upper reservoir. Determine the mean depth of the pipe below the summit of the ridge if the absolute pressure head at the summit of siphon is not to fall below 2.8m of water. Take f = 0.006 and the atm. pressure head 10.3 m of water. The length of siphon from the upper reservoir to the summit 500 m. Find the discharge also. 10

b) For a pipe network shown in figure determine the flow in each pipe. The value of n may be assumed as 2. 10



Q.3 a) i) Prove that the velocity of sound wave in compressible fluid is given by, $C=\sqrt{K/\rho}$ where K= bulk modulus of fluid and ρ= density of fluid 05

ii) A pipe of 100 mm diameter carrying water. The velocities of a the pipe centre are found to be 2.7 m/s and 2.4 m/s resp. Find the wall shearing stress. 05

b) The difference in the water surface levels in the two tanks, which are connected by three pipes in series of lengths 300, 170 and 210 m and of diameter 300, 200 and 400 mm resp. is 14m. Determine the rate of flow of water if coefficients of friction are 0.005, 0.0052 and 0.0048 resp. considering moor losses and neglecting minor losses. 10

[TURN OVER

Q.4 a) Prove the relationship for one dimensional compressible flow, 10

$$\frac{dA}{A} = \frac{dP}{\rho V^2}\left[1 - M^2\right]$$

b) i) A valve is provided at the end of cast iron pipe of diameter 150 mm and of thk. 10 mm. The water is flowing through the pipe which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of the valve is 196.2 N/cm^2. Take K for water as 19.62 x 10^4 N/cm^2 and E for cast iron pipe as 11.772 x 10^6 N/cm^2. 06

ii) A projectile is travelling in air having pressure and temp. as 8.829 N/cm^2 and -2 °C. If the Mach angle is 40 °C, find the velocity of projectile. Take for air R =287 J/kg K and k = 1.4. 04

Q.5 a) Derive an expression for universal velocity distribution equation for turbulent flow. 08

b) A smooth pipe of diameter 350 mm and length 800 m carries water at the rate of 0.04 m^3/s. Determine the head lost due to friction, wall shear stress, centre line velocity and thk. of laminar sub layer. Take the kinematic viscosity of water as 0.018 strokes. 12

Q.6 a) A fluid of viscosity 0.7 Ns/m^2 and sp. gravity 1.3 is flowing through a circular pipe of dia. 100 mm. The max. Shear stress at the pipe wall is given as 196.2 N/m^2. Find 1) pressure gradient 2) the avg. velocity 3) Reynolds number of flow. 10

b) Find the max. power transmitted by a jet of water discharging freely out of nozzle fitted to a pipe 300 m long and 100 mm diameter with co-efficient of friction as 0.01. The available head at nozzle is 90 m. 10

Q.7 a) In a 100 mm diameter pipeline an oil of sp.gravity 0.9 is flowing at the rate of 0.0125 m^3/s. A sudden expansion takes place into a second pipeline of such diameter that maximum pressure rise is obtained. Find 1) Loss of energy in sudden expansion 2) Differential gauge length indicated by oil – mercury manometer connected between the two pipes. 10

b) Write short notes on (any two) 10

i) Hydrodynamically smooth and rough boundary
ii) Water hammer effect with control measures
iii) Kinetic energy correction factor and momentum correction factor
iv) Mach number and it's significance
