*R20 Regulation* *Subject code: 3P3AE*

# TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

**B.Tech III Semester Supplementary Examinations, June 2026**

## FLUID MECHANICS

**(CE)**

***Maximum Marks: 70*** Date: 20.06.2026 Duration: 3 hours

**Note:** **1.This question paper contains two parts A and B.**
**2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.**
**3. Part B consists of 5 Units. Answer any one full question from each unit.**
**4. Each question carries 10 marks and may have a, b, c, d as sub questions.**

Part-A

| All the following questions carry equal marks (10X2M=20 Marks) | | Marks | CO | BTL |
|---|---|---|---|---|
| 1 | How does viscosity of fluid vary with temperature? | 2M | 1 | L1 |
| 2 | What is the difference between U-tube differential manometer and inverted U-tube differential manometer? | 2M | 1 | L1 |
| 3 | Write the conditions of equilibrium of floating body with neat sketches. | 2M | 2 | L1 |
| 4 | Define the terms a) velocity potential function b) stream function. | 2M | 2 | L1 |
| 5 | State Bernoulli's theorem and mention assumptions underlying it. | 2M | 3 | L1 |
| 6 | List out the advantages of triangular notch over rectangular notch. | 2M | 3 | L1 |
| 7 | Distinguish between laminar and turbulent flow in pipes. | 2M | 4 | L1 |
| 8 | What do you understand by terms: major energy loss and minor energy losses in pipes? | 2M | 4 | L1 |
| 9 | Derive an expression for the displacement thickness. | 2M | 5 | L1 |
| 10 | Define laminar boundary layer. | 2M | 5 | L1 |

Part-B

| Answer All the following questions. (5X10M=50Marks) | | Marks | CO | BTL |
|---|---|---|---|---|
| 11 | Define manometer. How they are classified with a neat sketch? | 10M | 1 | L2 |
| | OR | | | |
| 12 | Derive an expression for the total force and depth of center of pressure from free surface of a liquid of vertical plane surface submerged in liquid. | 10M | 1 | L2 |
| 13 | a) Define buoyancy and metacentre.<br>b) A wooden log of 0.8m diameter and 6m length is floating in a river water. Find the depth of wooden log in water when specific gravity of wooden log is 0.7 | 5M<br>5M | 2 | L2 |
| | OR | | | |
| 14 | Derive the condition for irrotational flow, prove that, for potential flow, both the stream function and velocity potential function satisfy the Laplace equation. | 10M | 2 | L2 |
| 15 | A vertical pipe conveying oil of specific gravity 0.8, two pressure gauges have | 10M | 3 | L2 |

| | | | | |
|---|---|---|---|---|
| | been installed at A and B where diameters are 16 cm and 8 cm respectively. A is 2m above B. The pressure gauge readings have shown that the pressure at B is greater than at A by 0.981 N/cm$^2$. Neglecting all losses calculate the flow rate. If the gauges at A and B are replaced by tubes filled with the same liquid and connected to a U-tube containing mercury, calculate the difference of level of mercury in the two limbs of U-tube. | | | |
| | OR | | | |
| 16 | State momentum equation. How will u apply momentum equation for determining the forces exerted by a flowing liquid on pipe bend? | 10M | 3 | L2 |
| 17 | Derive an expression for loss of head due to i) sudden contraction and ii) sudden enlargement of pipes. | 10M | 4 | L2 |
| | OR | | | |
| 18 | a) Define hydraulic gradient line and total energy line.<br>b) Three pipes of lengths 800m, 600m and 300m and of diameters 400mm, 300mm and 200mm respectively are connected in series. The end of the compound pipe is connected to the two tanks, whose water surface levels are maintained at a difference of 15m determine the rate of flow of water through the pipes if f=0.005. What will be diameter of the single pipe of length 1700m and f=0.005, which replaces the three pipes? | 5M<br>5M | 4 | L2 |
| 19 | Define Boundary layer thickness, Displacement thickness, momentum thickness and Energy thickness. | 10M | 5 | L2 |
| | OR | | | |
| 20 | Find the ratios of displacement thickness to momentum thickness and momentum thickness to energy thickness for velocity distribution in the boundary layer given by $u/U=2(y/\delta)-(y/\delta)$. Where u=Velocity in the boundary layer at the distance y, U=Free-stream velocity, $\delta$=Boundary layer thickness | 10M | 5 | L2 |