

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI(NEW) EXAMINATION – WINTER 2022****Subject Code:2160602****Date:14-12-2022****Subject Name:Applied Fluid Mechanics****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q1** (a) Give three examples of open channel flows from real life situation **3**
 (b) Draw layout plan for a hydro electric power plant and state the function of each component **4**
 (c) (i) Draw a sketch showing development of boundary layer over a flat plate. (ii) Identify the importance of developing and fully developed turbulent flow **7**
- Q2** (a) Give demerits of distorted models. **3**
 (b) Give two examples of dimensionally non homogeneous equations explain how their use is justified. **4**
 (c) Calculate the speed of rotation and the torque produced by a windmill of 5 meter diameter in a wind speed of 30 km/hour from the performance of a 1/10 scale geometrical model in a wind tunnel with 10 m/s of free stream and model speed of rotation 1200 rpm. The model produced a torque of 2.5 Nm **7**
- OR**
- (c) A 1:50 model of hydro electric power station tail race is proposed to be built. If the design bypass flow is 600 cumecs and maximum discharge is 800 cumecs calculate the corresponding discharges in the model using relevant similarity laws. **7**
- Q3** (a) Write the Manning's and Chezy's equation and develop a relationship between Manning's "n" and Chezy's "C". **3**
 (b) Draw surface profile when a steep slope meets a steeper slope down stream; for a given discharge and channel parameters **4**
 (c) A sluice gate is located on a mild slope; sufficient length of the slope is available on the downstream side of the gate. Outline the procedure to find the location of the hydraulic jump and draw a sketch of the system to show the location of the jump. **7**
- OR**
- Q3** (a) Define normal depth and normal slope for a uniform steady flow. **3**
 (b) Draw M1, M2 and M3 type profiles in the hydraulic structures they actually occur. **4**
 (c) Define conveyance of a channel, show that the conveyance of a channel for given area of cross section is maximum, for minimum perimeter, and hence develop the condition for most efficient rectangular section. **7**
- Q4** (a) Draw sketches of pumps in series and indicate under what conditions pumps will be connected in series **3**
 (b) Define specific turbine and indicate how this concept is useful in studying the performance of different types of turbines. **4**
 (c) Draw the following performance characteristics curve (i) head v/s, fluid discharge (ii) Power input v/s discharge (iii) overall efficiency v/s discharge. **7**

Explain the reason for the variation of head v/s discharge for change in speed of rotation.

OR

- Q4** (a) Illustrate the head discharge curves for two pumps connected in parallel and also draw the resultant head discharge curves curve due to the combined effect of the two pumps **3**
- (b) Explain the importance of unit quantities **4**
- (c) A centrifugal pump having an impeller of 30 cm diameter was tested in a laboratory and gave the best efficiency when running at 900 rpm and delivering 1.8 cumecs against a head of 15.2 meters. If an exactly similar design of pump is needed to deliver twice the discharge against a head of 18.3 meters find the diameter of the impeller and the speed at which it should be run. **7**
- Q5** (a) Write the differential form of the Navier Stokes equation in the “X” direction and explain each term. State the predominant forces when the Navier Stokes equation can be used. **3**
- (b) Show hydraulic gradient line and total energy for open channel and pipe flow. **4**
- (c) Determine the power in (i) kilowatt and (ii) horse power required to pump water through a pipe 500 meter long, 10 cm diameter, coefficient of friction of pipe material is 0.03. Take the difference of level between the suction and delivery end of the pipe as 60 meter, the head loss due to friction is found to be 20 metres Neglect minor losses and losses in the pump. **7**

OR

- Q5** (a) Using the momentum principle calculate the force experienced by a flat stationary plate when a jet of water strikes the centre of the plate at U m/s at the centre normal to the plate and exits parallel to plate in both directions . **3**
- (b) Develop an expression for loss of head due to sudden enlargement in pipes. **4**
- (c) Water is discharged continuously from a reservoir maintaining a constant head of 5 meters above the exit of a straight pipe 200 meter long 15 cm in diameter Estimate the rate of flow if the coefficient of friction is 0.01. Express the head in terms of power of flow. **7**
