Seat No.: _____  Enrolment No. 

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VI(NEW) – EXAMINATION – SUMMER 2019**

**Subject Code:2160602** **Date:14/05/2019**

**Subject Name:Applied Fluid Mechanics**

**Time:10:30 AM TO 01:00 PM** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

| | | | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | Explain the terms: Hydraulic gradient line and Total energy line. | **03** |
| | **(b)** | Derive an expression for the loss of head due to sudden enlargement of a pipe. | **04** |
| | **(c)** | Prove that the velocity distribution for viscous flow between two parallel plates when both plates are fixed across a section is parabolic in nature. | **07** |
| **Q.2** | **(a)** | Explain the terms: Pipes in parallel and Equivalent pipe. | **03** |
| | **(b)** | Derive an expression for the loss of head due to friction in pipe. | **04** |
| | **(c)** | Explain the term hydraulic jump. Derive an expression for the depth of hydraulic jump in terms of the upstream Froude number. | **07** |
| | | **OR** | |
| | **(c)** | Draw specific energy curve. Also derive expressions for critical depth and critical velocity. | **07** |
| **Q.3** | **(a)** | Explain laminar boundary layer. | **03** |
| | **(b)** | Derive an expression for the momentum thickness (ɵ) of boundary layer flow. | **04** |
| | **(c)** | Explain Froude model law. Obtain scale ratio for time, acceleration and discharge for the Froude model law. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Define: Inertia force, Viscous force and Gravity force. | **03** |
| | **(b)** | Explain the Buckingham's π-theorem in dimensional analysis. | **04** |
| | **(c)** | Explain boundary layer separation. Also discuss the effect of pressure gradient on boundary layer separation. | **07** |
| **Q.4** | **(a)** | What is priming? Why it is necessary. | **03** |
| | **(b)** | Draw a layout of hydroelectric plant and explain different components of hydroelectric plant. | **04** |
| | **(c)** | A Francis turbine of 1.2 metre runner diameter working under a head of 5 metres at a speed of 200 rpm develops 70 kW when the rate of flow of water is 2 $m^3$ /s. If the head on the turbine is increased to 17 metre, determine the new speed, discharge and power. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Explain the efficiencies of turbine. | **03** |
| | **(b)** | Explain the principal and working of a centrifugal pump with a neat sketch. | **04** |
| | **(c)** | A centrifugal pump delivers water against a net head of 15 m and a design speed of 1000 rpm. The vanes are curved back to an angle of $30^{\circ}$ with the periphery. The impeller diameter is 250 mm and outlet width 50 mm. determine the discharge of the pump if manometric efficiency is 95%. | **07** |
| **Q.5** | **(a)** | Explain the terms: affux, back water curve, unsteady flow. | **03** |

| | | | |
|---|---|---|---|
| | **(b)** | Differentiate between: (1) uniform flow and non-uniform flow (2) laminar flow and turbulent flow | **04** |
| | **(c)** | A trapezoidal channel has side slopes of 3 horizontal to 4 vertical and slope of its bed is 1 in 2000. Determine the optimum dimensions of the channel if it is to carry water at 0.7 $m^3/s$. Take Chezy's constant as 60. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Explain the terms: open channel flow, steady flow, critical flow. | **03** |
| | **(b)** | Show that for trapezoidal channel of most economical section (1) half of top width = length of one of the slopping side (2) hydraulic mean depth = $\frac{1}{2}$ depth of flow. | **04** |
| | **(c)** | The discharge of water through a rectangular channel of width 7.5 m is 20 $m^3/s$ when depth of flow of water is 1.5 m. Calculate: (1) specific energy of the flowing water (2) critical depth and critical velocity (3) value of minimum specific energy. | **07** |

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