|                        |     | Paper / Subject Code: 41222 / Fluid Mechanics  | 4                |
|------------------------|-----|--|------------------|
|                        |     | (c Scheme) R 2019 "Mechanics   |                  |
|                        |     | sem 1 (CScheme) K-2019 "Mechanical"  | Dec 2022         |
| 9                      | E   | Sem (C Scheme) R 2019 "Mechanics  puration: 3hrs  [Max Marks:80]  Question No 1 is Compulsory.  (1) Attempt any three questions out of the remaining five.  (2) All questions carry equal marks.  All questions carry equal marks.   |                  |
| ر<br>ا <sub>12</sub> م | 12  | ion No 1 is Compulsory.  |                  |
| 12/20                  | ,   | Question No 1 is Compulsory.  (1) Attempt any three questions out of the remaining five. (2) Attempt any equal marks.  |                  |
| ا                      | .:  | (1) Questions any three questions out of the remaining five. (2) Attempt any three questions out of the remaining five. (3) All questions carry equal marks. (3) Assume suitable data, if required and state it clearly.   |                  |
| N.L                    |     | a) All questions carry equired and acceptance  |                  |
|                        |     | (2) All questions carry equal marks. (3) All questions suitable data, if required and state it clearly. (4) Assume suitable data, if required and state it clearly.  |                  |
|                        |     | (A) Par  |                  |
|                        |     | Attempt any FOUR Attempt any FOUR Attempt any FOUR   | [20]             |
|                        |     | Attempt any FOOR  Attempt any FOOR  Explain Newtonian and non-Newtonian Fluids  Explain velocity potential function and stream function  | [5]              |
| 1                      | a   | Explain velocity potential function and stream function.  Explain velocity potential function and stream function.  Explain velocity potential function and stream function.   | [5]              |
|                        | b   | Explain velocity potential function and stream function.  Explain velocity potential function and stream function.  What are the Applications of Bernoulli's equation in Orifice meter, Venturi  What are the Applications of Bernoulli's equation in Orifice meter, Venturi   | [5]              |
|                        | С   | What are the Applications of Bernoulli's equation in Orifice meter, Venturi What are the Applications of Bernoulli's equation in Orifice meter, Venturi meter, Rotameter and Pitot tube meter, Payrolds number. Explain critical Reynolds number for flat plate and pipe   | ,                |
|                        |     | meter, Rotameter and Pitol tube meter, Reynolds number. Explain critical Reynolds number for flat plate and pipe pefine Reynolds number.   | [5]              |
|                        | d   | conduit.   | rs1 ~            |
|                        |     | conduit.  Explain various Major and Minor losses for flow through pipe  Explain Streamlined and bluff bodies   | [5] S            |
|                        | е   | Explain Streamlined and bluff bodies Explain Streamlined and bluff bodies  | 1/3              |
|                        | f   | EAPTH OF THE STATE | [10]             |
|                        |     | The flow field is given by $V = xyi + 2yzj - (yz+z^2)k$  | ([10]            |
| 2                      | a   | The flow field is given by $V = Xyi + 2yzj - (yz+z^2) k$<br>i) Show that it represents a possible 3-D steady incompressible continuous flow<br>i) Show a protettional or irrotational? If rotational determine at the point (2,4,6)  | 17               |
|                        |     | in Is this flow Iolational of Including Information in Iolation Including In | . 3 <sup>4</sup> |
|                        |     | ii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) ii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) ii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) iii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) iii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) iii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) iii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) iii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) iii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) iii) Is this flow rotational or irrotational? If rotational determine at the point (2, 3, 4) iii) Is this flow rotational or irrotational or | [10]             |
|                        | ı.  | Derive an expression for the production of the p | Ç.               |
|                        | D   | immersed surface.  | į                |
|                        |     |  | [10]             |
| ,                      | a   | What is venturimeter? Derive expression of discharge through venturimeter.  What is venturimeter? Derive expression of discharge through venturimeter.  The pipe is bent by 120°. The pipe bend is 0.14 m³. The pressure at the case of the bend is 0.14 m³. The pressure at the case of the bend is 0.14 m³.  | [10]             |
| 3                      | h   | aco lit/sec of water is nowing in pipe.  |                  |
|                        | Ň   | measures 360 mm x 240 mm and volume of the bend is 0.14 m. The present the entrance is 73 KN/m <sup>2</sup> and the exit is 2.4m above the entrance. Find the  |                  |
|                        |     | the entrance 18-73 Kivin and the direction and magnitude of resultant force.   |                  |
|                        |     | direction and magnitude of resources of the direction and direct | [10]             |
| 4                      |     | Specific of 0.9 poise is filled with horizontal plates 10 mm apair. It   | [10]             |
| 4                      | a   | A liquid of viscosity of 0.9 poise is filled with horizontal plates 10 mm apart. If the upper plate is moving at 1 m/s with respect to the lower plate which is the upper plate is moving at 1 m/s with respect to the lower plate which is the upper plate is moving at 1 m/s with respect to the lower plate which is  |                  |
|                        |     |  |                  |
|                        |     |  |                  |
| 2,5                    |     |  | [10]             |
|                        | 1   | iii) The shear stress on appearation in rectangular Cartesian co-ordinate system and Derive Euler's equation of motion in rectangular Cartesian co-ordinate system and Derive Euler's equation for liquid. State assumptions made in the from this derive Bernoulli's Equation   |                  |
|                        | (   |  |                  |
|                        |     | derivation of Bernoulli's Equation   | r10]             |
| (                      |     |  | [10]             |
| Ş.                     | ; ; | Derive the Hagen-poiseuille Equation.  b Water is flowing through a pipe having diameter 600 mm and 400 mm at the bottom end is the water is flowing through respectively. The intensity of pressure at the bottom end is  | [10]             |
|                        | 1   | b Water is flowing through a pipe having diameter 600 mm and 400 m |                  |
|                        |     |  |                  |
|                        | W)  | b Water is flowing through a pipe in the bottom and upper end respectively. The intensity of pressure at the bottom and upper end respectively. The intensity of pressure at the bottom end is bottom and upper end is 100 kN/m <sup>2</sup> . Determine the difference 350 kN/m <sup>2</sup> and the pressure at upper end is 100 kN/m <sup>2</sup> to the rate of flow through the pipe is 60 litre/sec.   |                  |
| 3                      |     | 350 kN/m <sup>2</sup> and the pressure at upper end is 100 kl/m <sup>2</sup> and the pressure at upper end is 100 kl/m <sup>2</sup> in datum head if the rate of flow through the pipe is 60 litre/sec.  |                  |
| Y                      |     |  |                  |
|                        |     |  |                  |
|                        |     | V V V  |                  |

## Paper / Subject Code: 41222 / Fluid Mechanics

- Two reservoirs with a difference in elevation of 15m are connected by the three pipes in series. The pipes are 300 m long of diameter 30 cm, 150 m long of 20cm diameter and 200 m long of 25 cm diameter respectively. The friction factors for three pipes are 0.018, 0.020 and 0.019 respectively and which account for friction and all losses. Determine the flow rate in lit/sec. The loss of coefficient for sudden contraction for dia.30 cm to 20 cm is equal to 0.24.
  - b Using the laminar boundary velocity distribution:  $\frac{u}{u} = \frac{3}{2} \left( \frac{y}{\delta} \right) \frac{1}{2} \left( \frac{y}{\delta} \right)^3$  [10]
    - (i) Determine boundary layer thickness in terms of Re
    - (ii)Check if boundary layer separation occurs