

# Faculty of Engineering

## End Semester Examination May 2025

### AU3CO27 / AU3CO47 / ME3CO46 Fluid Mechanics & Machinery

<b>Programme</b>	:	B.Tech.	<b>Branch/Specialisation</b>	:	AU/ME
<b>Duration</b>	:	3 hours	<b>Maximum Marks</b>	:	60

**Note:** All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Section 1 (Answer all question(s))				Marks	CO	BL
<b>Q1.</b> Newton's law of viscosity relates:				1	1	1
<input type="radio"/> Stress and strain in a fluid						
<input checked="" type="radio"/> Shear stress and rate of angular deformation in a fluid						
<b>Q2.</b> The centre of buoyancy is:				1	1	1
<input type="radio"/> Centre of gravity of the body						
<input type="radio"/> Point of intersection of the buoyant force and centre line of the body						
<b>Q3.</b> The path traced by a single particle of smoke issuing from a cigarette is a:				1	2	3
<input type="radio"/> Streamline						
<input checked="" type="radio"/> Path line						
<b>Q4.</b> The Bernoulli's equation refers to conservation of :				1	2	1
<input type="radio"/> Mass						
<input type="radio"/> Force						
<b>Q5.</b> The jet ratio of a Pelton wheel lies between:				1	3	1
<input checked="" type="radio"/> 11-14						
<input type="radio"/> 2-5						
<b>Q6.</b> High specific speed (300 to 1000) and low heads (below 30m) indicate that the turbine is:				1	3	2
<input type="radio"/> Pelton wheel						
<input type="radio"/> Francis						
<b>Q7.</b> The specific speed of centrifugal pump is given by:				1	4	2
<input checked="" type="radio"/> $\frac{N\sqrt{Q}}{H^{3/4}}$						
<input type="radio"/> $\frac{N\sqrt{Q}}{H^{5/4}}$						
<b>Q8.</b> When starting a centrifugal pump the delivery valve is kept:				1	4	1
<input type="radio"/> Fully open						
<input type="radio"/> Half open						

**Q9.** Euler's dimensionless number relates:

1 5 2

- Inertia and gravity force
- Pressure and inertia force

- Viscous and inertia force
- Buoyant and viscous force

**Q10.** Dimensional analysis is useful in:

1 5 1

- Checking the correctness of physical equation
- Determine the dimensionless groups from the given variable

- Determine the number of variables involved in a particular phenomenon
- The exact formulation of a physical phenomenon

### Section 2 (Answer all question(s))

**Marks CO BL**

**Q11.** State and explain the Newton's law of viscosity.

2 1 1

<b>Rubric</b>	<b>Marks</b>
1 marks for correct statement of Newtons law of viscosity.	1
1 marks for correct explanation of Newtons law of viscosity.	1

**Q12.** Define the following fluid properties-

3 1 1

- (i) Density
- (ii) Weight density
- (iii) Specific gravity

<b>Rubric</b>	<b>Marks</b>
1 marks for correct definition of density.	1
1 marks for correct definition of weight density.	1
1 marks for correct definition of specific gravity.	1

**Q13. (a)** A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm, both cylinders are 25 cm high the space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 Nm is required to rotate the inner cylinder at 100 rpm determine the viscosity of the fluid?

5 1 2

<b>Rubric</b>	<b>Marks</b>
1 marks for given data	1
2 marks for correct formula.	2
2 marks for correct answer	2

**(OR)**

**(b)** If a density of liquid is  $840 \text{ kg/m}^3$  kinematic viscosity is 1.7 st. Find its specific weight, specific gravity, specific volume and coefficient of viscosity.

<b>Rubric</b>	<b>Marks</b>
1 marks for given data	1
2 marks for correct formula.	2
2 marks for correct answer	2

### Section 3 (Answer all question(s))

**Marks CO BL**

**Q14.** Differentiate the steady and unsteady flow.

2 2 4

Rubric	Marks
1 marks for steady flow	1
1 marks for unsteady flow	1

**Q15. (a)** Define the equation of continuity obtain an expression for continuity equation for a three-dimensional.

8 2 1

Rubric	Marks
2 marks for correct statement.	2
2 marks for correct assumption.	2
3 marks for correct derivation.	3
1 marks for correct expression.	1

**(OR)**

**(b)** State Bernoulli's theorem and derive the expression using Euler equation of motion along a streamline.

Rubric	Marks
2 marks for correct statement	2
2 marks for correct assumption.	2
3 marks for correct derivation.	3
1 marks for correct expression.	1

#### Section 4 (Answer all question(s))

**Marks CO BL**

3 3 1

**Q16.** Define and classify the turbines.

Rubric	Marks
1 marks for correct definition	1
2 marks for correct classification.	2

**Q17. (a)** Define and explain hydraulic efficiency, mechanical efficiency and overall efficiency of a turbine.

7 3 1

Rubric	Marks
4 marks for correct definition	4
3 marks for each correct expression.	3

**(OR)**

**(b)** Define draft tube and its application. Describe with neat scratch different types of draft tubes.

Rubric	Marks
1 marks for correct definition.	1
2 marks for correct application.	2
2 marks for diagram.	2
2 marks for correct classification.	2

### Section 5 (Answer all question(s))

Marks CO BL

**Q18.** What is the priming of pumps? Why it is necessary?

4 4 1

Rubric	Marks
2 marks for correct definition.	2
2 marks for correct explanation.	2

**Q19. (a)** The diameter of centrifugal pump which is discharge  $0.03 \text{ m}^3/\text{s}$  of water against a total head of 20 m is 0.40 m the running at 1500 rpm. Find the head discharge and ratio of power of geometrically similar pump of diameter 0.25 m, when it is running at 3000 rpm.

6 4 1

Rubric	Marks
1 marks for given data.	1
2 marks for correct expression.	2
3 marks for correct answer.	3

(OR)

**(b)** A single stage centrifugal pump with impeller diameter of 30 cm rotates at 2000 rpm and lift 3  $\text{m}^3$  of water per second to a height of 30 m with an efficiency of 75%. Find the number of stage and diameter of each impeller of a similar multistage pump to lift 5  $\text{m}^3$  of water for second to a height of 200 meters when rotating at 1500 rpm.

Rubric	Marks
1 marks for given data.	1
2 marks for correct expression.	2
3 marks for correct answer.	3

### Section 6 (Answer any 2 question(s))

Marks CO BL

**Q20.** State Buckingham's  $\pi$  - theorem. Why this theorem is considered superior over the Rayleigh's method for dimensional analysis?

5 5 1

Rubric	Marks
2 marks for correct statement.	2
3 marks for explanation	3

**Q21.** What do you mean by repeating variables? How the repeating variables are select for dimensional analysis?

5 5 1

Rubric	Marks
2 marks for correct definition.	2
3 marks for correct explanation.	3

**Q22.** Define any two the following dimensional less number and mention the significance in fluid problems:

5 5 1

- (I) Reynolds's number
- (ii) Froude's number
- (iii) Mach number

Rubric	Marks
2.5 marks for each correct definition.(total 5 marks for 2 definition)	5

\*\*\*\*\*