



MEDICAPS
UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

AU3CO27 / AU3CO47 / ME3CO46 Fluid Mechanics & Machinery

Programme	: B.Tech.	Branch/Specialisation	: AU/ME
Duration	: 3 hours	Maximum Marks	: 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

- | | | | | |
|---|---|----------|----------|----------|
| Q1. 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 | <input type="radio"/> Pressure, velocity and viscosity of a gas
<input type="radio"/> Yield stress, viscosity and rate of angular deformation | | | |
| Q2. 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 | <input checked="" type="radio"/> Centre of the displaced fluid volume
<input type="radio"/> Point of intersection of the buoyant force and the gravitational force | | | |
| Q3. 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 | <input type="radio"/> Flow line
<input type="radio"/> Streak line | | | |
| Q4. The Bernoulli's equation refers to conservation of : | | 1 | 2 | 1 |
| <input type="radio"/> Mass
<input type="radio"/> Force | <input type="radio"/> Momentum
<input checked="" type="radio"/> Energy | | | |
| Q5. The jet ratio of a Pelton wheel lies between: | | 1 | 3 | 1 |
| <input checked="" type="radio"/> 11-14
<input type="radio"/> 2-5 | <input type="radio"/> 6-10
<input type="radio"/> 20-25 | | | |
| Q6. 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 | <input checked="" type="radio"/> Kaplan
<input type="radio"/> Propellor | | | |
| Q7. 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"/> $\frac{N\sqrt{Q}}{H^{5/4}}$ | <input type="radio"/> $\frac{N\sqrt{P}}{H^{5/4}}$
<input type="radio"/> $\frac{N\sqrt{H}}{Q^{3/4}}$ | | | |
| Q8. When starting a centrifugal pump the delivery valve is kept: | | 1 | 4 | 1 |
| <input type="radio"/> Fully open
<input type="radio"/> Half open | <input checked="" type="radio"/> Fully close
<input type="radio"/> Less than half open | | | |

Q9. Euler's dimensionless number relates:

1 5 2

- ☐ Inertia and gravity force
 ☐ Viscous and inertia force
☒ Pressure and inertia force
 ☐ Buoyant and viscous force

Q10. Dimensional analysis is useful in:

1 5 1

- ☐ Checking the correctness of physical equation
 ☐ Determine the number of variables involved in a particular phenomenon
☒ Determine the dimensionless groups from the given variable
 ☐ 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

Rubric	Marks
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

Rubric	Marks
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

Rubric	Marks
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 kg/m³ kinematic viscosity is 1.7 st. Find its specific weight, specific gravity, specific volume and coefficient of viscosity.

Rubric	Marks
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

Q16. Define and classify the turbines.

3 3 1

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 sketch 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 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 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 π - 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
