KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Marks scored:

Level : B. Tech.
Year : II

Course : MEEG 206
Semester: I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No. :

Date : APR 10 2017

SECTION "A"
[20 Q. × 1 = 20 marks]

Tick the most appropriate answer.

1. Poise is unit of
[ ] dynamic viscosity [ ] kinematic viscosity [ ] vapour pressure [ ] surface tension

2. Property of a fluid by which molecules of different kinds of fluid are attracted to each other is called
[ ] adhesion [ ] cohesion [ ] surface tension [ ] viscosity

3. Which one is not the unit of pressure
[ ] Pascal [ ] mm of Hg [ ] stokes [ ] inches of water

4. Pressure gauge measures
[ ] absolute pressure [ ] gauge pressure
[ ] local atmospheric pressure [ ] standard atmospheric pressure

5. A U-tube manometer measures
[ ] absolute pressure at a point [ ] local atmospheric pressure
[ ] difference in total energy between two points [ ] difference in pressure between two points

6. Continuity equation is related to conservation of
[ ] mass [ ] energy [ ] momentum [ ] pressure

7. A line formed by tracing path of a particular fluid particle in a flowfield is called
[ ] streamline [ ] pathline [ ] streakline [ ] timeline

8. The flow field represented by the velocity vector $V = axi + by^2j + czk$
[ ] three-dimensional and steady [ ] two-dimensional and steady
[ ] three-dimensional and unsteady [ ] two-dimensional and unsteady

9. Bernoulli's equation is based on the principle of conservation of
[ ] flow [ ] mass [ ] momentum [ ] energy

10. Venturimeter is used to measure
[ ] pressure [ ] discharge [ ] rotation [ ] momentum

11. According to Bernoulli's theorem, for no change in elevation if pressure increases velocity
[ ] increases [ ] decreases [ ] remains same [ ] depends

12. Which flow measurement device has highest value for coefficient of discharge
[ ] venturimeter [ ] nozzle meter [ ] orifice meter [ ] rotameter

13. During the opening of a valve in a pipeline, the flow is
[ ] steady [ ] unsteady [ ] uniform [ ] laminar

14. Major loss in pipe is related to diameter by _____proportional relation
[ ] directly [ ] linearly [ ] inversely [ ] randomly

15. For pipes, laminar flow occurs when Reynolds number is
[ ] less than 2000 [ ] between 2000 and 4000
[ ] more than 4000 [ ] equal to 4000

16. The dimensions of force are
[ ] $[M^1L^{-1}T^{-1}]$ [ ] $[M^1L^1T^{-2}]$ [ ] $[M^1L^1T^{-1}]$ [ ] $[M^{-1}L^1T^1]$

17. Which of the following is a dimensionless parameter
[ ] dynamic viscosity [ ] friction factor
[ ] kinematic viscosity [ ] Energy

18. For sonic flow, the Mach number is
[ ] greater than 1 [ ] equal to 1 [ ] greater than 2 [ ] less than 1

19. A reversibleand adiabatic process is also called
[ ] isentropic process [ ] isenthalpic process
[ ] isobaric process [ ] all of the above

20. An aircraft moves at 1300 km/h in an atmosphere where the temperature is -30 ^{0}C. If k = 1.4 and R = 287 J/kg K, the Mach number of the plane is
[ ] 0.86 [ ] 1.16 [ ] 1.1 [ ] 2.2

KATHMANDU UNIVERSITY
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APR 10 2017

Level : B. Tech.
Year : II
Time : 2 hrs. 30 mins.

Course : MEEG 206
Semester: I
F. M. : 55

SECTION "B"
[5 Q. × 11 = 55 marks]

Attempt *ALL* questions. Assume suitable data if necessary.

Q.N.1

a. What is cavitation? Explain why cavitation occurs in pumps and turbines. [3]
b. A 1.9 mm diameter tube is inserted into an unknown liquid whose density is 960 kg/m^3, and it is observed that the liquid rise 5 mm in the tube, making a contact angle of 15^0. Determine the surface tension of liquid. [5]
c. Determine the atmospheric pressure at a location where the barometric reading is 740 mm Hg and the gravitational acceleration is 9.81 m/s^2. Assume the density of mercury is 13,570 kg/m^3. [3]

Q.N.2

a. Differentiate between pathlines and streaklines with proper sketch. [2]
b. Derive an expression for variation of pressure with depth of liquid. [4]
c. For a two dimensional potential flow, the velocity potential is given by $\varphi = x(2y-1)$. Determine the velocity at the point P (4, 5). Determine also the value of stream function ψ at the point P. [5]

Q.N.3

a. Derive an expression for discharge (Q) through obstruction devices based on pressure difference (P_1-P_2), density (ρ) and diameter ratio (β), discharge coefficient (C_d) and Area (A):

$$Q = C_d A \sqrt{\frac{2(P_1 - P_2)}{\rho(1-\beta^4)}}.$$ [6]

b. A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water. $C_d = 0.98$ and $\rho_{mercury} = 13600$ kg /m^3. [5]

Q.N.4

a. Differentiate between skin friction drag and pressure drag. [2]
b. Explain the turbulent velocity profile of fluid flow inside a circular pipe with proper sketch. How is it different from laminar velocity profile? [4]
c. Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity 3 m/s. Take $C_f = \frac{0.079}{Re^{1/4}}$ and $\gamma = 0.01$ stokes [5]

Q.N.5

a. What is converging-diverging nozzle? Explain why it is necessary for supersonic flow. [2]
b. List rules of choosing repeating variables in Buckingham-π theorem. [4]
c. Air flows adiabatically through a duct. At point 1 the velocity is 240 m/s with $T_1 = 320$ K and $p_1 = 170$ kPa. Compute stagnation temperature T_o and stagnation pressure p_o. What is the stagnation pressure at point 2 further downstream where $V_2 = 290$ m/s and $p_2 = 135$ kPa. [5]