

MODEL QUESTION PAPER

WITH ANSWERS OF MULTIPLE-CHOICE QUESTIONS

For

B. Sc. (Hons.) Semester-5

Subject: Mathematics

Paper: CCMATH512

By

Dr. Md. Moiz Ashraf

Head, P.G. Department of Mathematics,

Karim City College, Jamshedpur

Group-A
(Compulsory)

Each part of question carries 2 marks.

1. Choose the correct answer
- (i) The uniform pressure on a plane area which will give same resultant thrust as the actual one is called ...
 - (a) uniform pressure.
 - (b) mean pressure.
 - (c) uniform thrust.
 - (d) mean thrust.
 - (ii) On any plane surface in contact with fluid sum of all normal thrust exerted by the fluid on different elements of the surface is called ...
 - (a) average thrust.
 - (b) mean pressure.
 - (c) uniform pressure.
 - (d) resultant thrust.
 - (iii) At one side of a plane surface immersed in a heavy homogeneous liquid, the product of surface area and pressure at centre of gravity is equal to...
 - (a) average thrust.
 - (b) mean pressure.
 - (c) uniform pressure.
 - (d) resultant thrust.
 - (iv) In fluid dynamics, the method in which we study mathematically, the history each fluid particle is...
 - (a) Lagrangian method.
 - (b) Eulerian method.
 - (c) Bernouli's method.
 - (d) none of these.
 - (v) The continuity equation is based on the principle of...
 - (a) conservation of mass
 - (b) conservation of momentum
 - (c) conservation of energy
 - (d) conservation of force

- (vi) Frobenius method is not applicable to find a series solution about a point $x = x_0$ if the point $x = x_0$ is ...
- (a) ordinary point.
 - (b) regular singular point.
 - (c) irregular singular point.
 - (d) not an integral point.
- (vii) $P_n(-1) = \dots$
- (a) 1
 - (b) -1
 - (c) 0
 - (d) $(-1)^n$
- (viii) $\sum_{n=0}^{\infty} z^n P_n(x) = \dots$
- (a) $(1 - 2xz + z^2)^{-1}$
 - (b) $(1 - 2xz + z^2)^{-2}$
 - (c) $(1 - 2xz + z^2)^{\frac{1}{2}}$
 - (d) $(1 - 2xz + z^2)^{-\frac{1}{2}}$
- (ix) $\int_{-1}^1 [P_n(x)]^2 dx = \dots$
- (a) 0
 - (b) $\frac{n}{2n+1}$
 - (c) $\frac{1}{2n+1}$
 - (d) $\frac{2}{2n+1}$
- (x) The hypergeometric function $F(\alpha; \alpha; x) = \dots$
- (a) 1
 - (b) $\sin x$
 - (c) e^x
 - (d) $\tan^{-1} x$

Group-B

Answer any four questions.

Each question carries 5 marks.

2. Prove that increase of pressure at any point of an incompressible fluid at rest in a closed vessel under action of system of external forces is transmitted equally to all parts of liquid.

3. Prove that the depth of centre of pressure always exceeds that of centre of gravity of a plane area immersed in a fluid.
4. Discuss the two methods for studying fluid motion mathematically.
5. Derive the equation of continuity in cartesian coordinates.
6. Solve in series:

$$9x(1-x)y'' - 12y' + 4y = 0,$$
7. Derive the recurrence relation:

$$nP_n = (2n-1)xP_{n-1} - (n-1)P_{n-2}, \text{ for } n \geq 2$$
8. Derive the recurrence relation:

$$\frac{d}{dx}\{x^{-n}J_n(x)\} = -x^{-n}J_{n+1}(x),$$
9. Prove that:

$$F(\alpha; \beta; x) = \frac{1}{B(\alpha, \beta - \alpha)} \int_0^1 (1-t)^{\beta-\alpha-1} t^{\alpha-1} e^{xt} dt$$

Group-C

Answer any two questions

Each question carries 15 marks.

10. A regular hexagon is immersed in water with one side in the surface. Find the Centre of Pressure of upper half.
11. Derive Euler's dynamical equation of motion of an inviscid fluid.
12. Write the Legendre's differential equation and find its solution.
13. Prove that:

$$\int_0^a x J_n(\lambda_i x) J_n(\lambda_j x) dx = \begin{cases} 0, & \text{if } i \neq j \\ \frac{a^2}{2} J_{n+1}^2(\lambda_i a), & \text{if } i = j \end{cases}$$

ANSWER TO OBJECTIVE TYPE QUESTION:

- (i) b
- (ii) d
- (iii) d
- (iv) a
- (v) a
- (vi) c
- (vii) d
- (viii) d
- (ix) d
- (x) c