



FEDERAL PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATION – 2025
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT

Roll Number

APPLIED MATHEMATICS

TIME ALLOWED: THREE HOURS	PART-I (MCQS)	MAXIMUM MARKS = 20
PART-I(MCQS): MAXIMUM 30 MINUTES	PART-II	MAXIMUM MARKS = 80
NOTE: (i) First attempted Part-I (MCQS) on the separate OMR Answer Book which shall be taken back after 30 minutes. (ii) Overwriting/cutting of the options/answers will not be given credit. (iii) There is no negative marking . All MCQs must be attempted.		

Q. No. 1 (a) Prove that $\nabla \cdot (r^n \vec{r}) = (n+3)r^n$, where $\vec{r} = xi + yj + zk$. (10)

(b) If $\vec{a} \cdot (\vec{b} \times \vec{c}) = (\vec{a} \times \vec{b}) \cdot \vec{c}$, then prove that $\vec{a}$ and $\vec{c}$ are parallel.

Find the area of the region that is enclosed between the curves $y = x^2$ and $y = x + 6$. (10)

Q. No. 2 (a) Find the tangential and normal components of acceleration of a point describing the ellipse $x^2/a^2 + y^2/b^2 = 1$ with uniform speed V , when the particle is at $(0, b)$. (10)

(b) Find the solution of initial value problem by separation of variables:
 $\sqrt{1-y^2} dx - \sqrt{1-x^2} dy = 0$ (10)

Q. No. 3 (a) Find the general solution of the given differential equation by variation of parameters:
 $3y'' - 6y' + 6y = e^x$ (10)

(b) Find the power series solution of $(x+1)y'' + xy' - y = 0$. (10)

Q. No. 4 (a) Forces 2BC, CA, AB act along the sides of a triangle ABC. Show that their resultant is 0. Where D bisects BC and E is a point on CE such that $CE = 1/3 CA$. (10)

(b) Find the center of mass of the surface generated by the revolution of the arc of the parabola,

lying between the vertex and the latus rectum, about the x-axis.

(10)

Q. No. 5 (a) Obtain the Fourier series over the indicated interval for the given function:

$$f(x) = 3\pi + 2x, -\pi < x < 0; = 2x, 0 < x < \pi$$

(10)

(b) Solve the boundary value problem:

$$u_{xx} + u_{yy} = 0, 0 < x < a, 0 < y < b$$

$$u(x, 0) = 0, u(a, y) = 0, 0 \leq y \leq b$$

$$u(0, y) = 0, u(x, b) = f(x), 0 \leq x \leq a$$

(10)

Q. No. 6 (a) Use Newton's Raphson method to find the solution accurate to within 10^{-4}

(10)

(corrected up to four decimal places) for the given problem:

$$x - \cos x = 0, [0, \pi/2]$$

(b) Solve the system of linear equations using Gauss Seidel method (with three digit rounding arithmetic):

$$3x_1 + 4x_2 - x_3 = 8$$

$$5x_1 + 2x_2 + 2x_3 = 3$$

$$-x_1 + x_2 - 3x_3 = -8$$

(10)

Q. No. 7 (a) Use Euler's method to approximate the solution of the initial value problem.

(10)

$$y' = 1 + y/x, 1 \leq x \leq 2, y(1) = 2, \text{ with } h = 0.25$$

(b) Using Green's theorem, evaluate $\oint F(r) \cdot dr$ counter clock wise around the boundary curve C of the region R, where $F = [1/2 \cdot xy^4, 1/2 \cdot x^2 \cdot y]$, the rectangle with vertices (0, 0), (3, 0), (3, 2), (0, 2).

(10)

Q. No. 8 (a) Evaluate the Integral $\int_1^3 (1/x^2) dx$. Using Trapezoidal Rule for five points (corrected upto two decimal places).

(10)

(b) Find the D'Alembert solution of the wave equation $u_{xx} = (1/c^2) \cdot u_{tt}$ subject to the Cauchy Initial conditions $u(x, 0) = f(x)$, $u_t(x, 0) = g(x)$.

(10)