

FEDERAL PUBLIC SERVICE COMMISSION COMPETITIVE EXAMINATION-2024 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		MAXIMUM MARKS = 80

NOTE: (i) Part-II is to be attempted on the separate Answer Book.

- (ii) Attempt ONLY FOUR questions from PART-II. ALL questions carry EQUAL marks.
- (iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
- (iv) Candidate must write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
- (v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
- (vi) Extra attempt of any question or any part of the attempted question will not be considered.



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Roll Number

APPLIED MATHEMATICS

TIME ALLOWED: THREE HOURS

MAXIMUM MARKS = 100

- NOTE: (i) Attempt only FIVE questions in all. ALL questions carry EQUAL marks.
 - (ii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
 - (iii) Write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
 - (iv) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
 - (v) Extra attempt of any question or any part of the attempted question will not be considered.
 - (vi) Use of Calculator is allowed.

Q. No. 1 (a) Expand a fourier series of
$$f(x) = x^2$$
, $1 < x < 2$ (10)

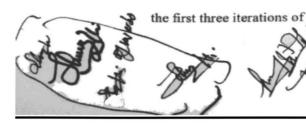
- (b) Find equation of integral surface of the differential equation 2y(z-3)p + (2x-z)q = y(2x-3) which passes through the circle $x^2 + y^2 = 2x$, z = 0.
- Q. No. 2 (a) Solve the higher order differential equation $y'''' + y'' = 3x^2 + 4Sinx 2Cosx$ (10)
 - (b) Solve the initial value problem $y'' 8y' + 15y = 9xe^{2x}$, y(0) = 5, y'(0) = 10 (10)
- Q. No. 3 (a) Solve the equation $4u_{xx} + 5u_{xy} + u_{yy} + u_x + u_y = 2$, also find its canonical form.
 - (b) Prove that $\int_{-1}^{1} x^n P_n(x) dx = \frac{2^{n+1}(n!)^2}{(2n+1)!}$, where $P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} (x^2 1)^n$ is

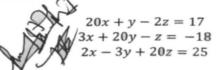
 Legender polynomial of degree n.
- Q. No. 4 (a) Verify the divergence theorem for $A = 4xi 2y^2j + z^2k$ taken over the region (10) bounded by $x^2 + y^2 = 4$, z = 0 and z = 3.
 - (b) State and prove Stoke's theorem. (10)
- Q. No. 5 (a) Using the modified Euler's method, obtain the solution of the differential equation (10)

$$\frac{dy}{dt} = t + \sqrt{y} = f(t, y)$$

with initial condition $y_0 = 1$ at $t_0 = 0$ for the range $0 \le t \le 0.6$ in step of 0.2.

- (b) Find the real roots of equation 4x + Cosx + 2 = 0 by using Newton Raphson (10) method, correct to four decimal places.
- Q. No. 6 (a) Solve the system of linear equations by Guass-Seidel iterative method and perform (10)





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APPLIED MATHEMATICS

- (b) Solve the following Van der Pol's equation y" (0.1)(1 y²)y' + y = 0, using fourth order Runge-Kutta method for x = 0.2, with the initial values y(0) = 1, y'(0) = 0.
- Q. No. 7 (a) Find the law of force for a particle moving in an orbit, $r = \frac{l}{1 eCos\theta'}$ where l is semi latus rectum and e is ecentricity.
 - (b) Prove that the speed required to project a particle from a height h to fall a horizental distance a from the point of projection is at least $\sqrt{g(\sqrt{a^2 + h^2}) h}$.
- Q. No. 8 (a) Find the radial and transvers components of velocity moving along a curve $ax^2 + by^2 = 1 \text{ at any time t if the polar angle } \theta = ct^2.$ (10)
 - (b) Find the centroid of the surface formed by the revolution of the cardioide $r = a(1 + Cos\theta) \text{ about the initial line.}$ (10)
