



**FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2020
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT**

Roll Number

APPLIED MATHEMATICS

TIME ALLOWED: THREE HOURS

MAXIMUM MARKS = 100

NOTE:(i) Attempt **ONLY FIVE** questions. **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) Candidate must 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) Prove that $\nabla^2 r^n = n(n+1)r^{n-2}$ **(10)**

(b) Evaluate $\int_S \underline{A} \cdot \underline{n} \, ds$ where $\underline{A} = 18z\underline{i} - 12\underline{j} + 3y\underline{k}$ and S is that part of the plane $2x + 3y + 6z = 12$ which is located in the 1st octant. **(10)**

Q. No. 2. A particle P of mass m slides down a frictionless inclined plane AB of an angle α with the horizontal. If it starts from rest at the top A, find (a) the acceleration (b) the velocity and (c) the distance travelled after time t. **(20)**

Q. No. 3. (a) Discuss the motion of a particle moving in a straight line if it starts from rest at a distance 'a' from a point O and moves with an acceleration equal to k times its distance from O. **(10)**

(b) Find radial and transversal components of velocity and acceleration. **(10)**

Q. No. 4. (a) Solve $\frac{d^2 y}{dx^2} + y = \text{Cosec } x$ **(10)**

(b) Solve $dy + \frac{y - \sin x}{x} dx = 0$ **(10)**

Q. No. 5. (a) Solve the initial value problem **(10)**
 $x(2+x)\frac{dy}{dx} + 2(1+x)y = 1 + 3x^2, \quad y(-1) = 1$

(b) Find the general solution of the equation **(10)**
 $(D^3 - 2D + 1)y = 2x^3 - 3x^2 + 4x + 5$

Q. No. 6. (a) Find the Fourier series of f: **(10)**
$$f(x) = \begin{cases} x, & 0 < x < 1 \\ 0, & 1 < x < 2 \end{cases}$$

(b) Solve the boundary value problem $\frac{\partial^2 u}{\partial x^2} = \frac{1}{k} \frac{\partial u}{\partial t}$ **(10)**
Satisfying $u(0,t) = u(l,t) = 0$ and $u(x,0) = lx - x^2$

APPLIED MATHEMATICS

- Q. No. 7.** **(a)** By using regular Falsi method, solve **(10)**
 $\text{Log}x - \text{Cos}x = 0$
- (b)** Find the value of $f(7.5)$ by using Newton Gregory Backward Difference **(10)**
 Interpolation formula.
 X: 5, 6.1, 6.9, 8, 8.6
 $f(x): 3.49, 4.82, 5.96, 7.5, 8.2$
- Q. No. 8.** **(a)** Applying the Taylor series method, compute **(10)**
$$\int_0^x \frac{\text{Sin}t}{t} dt \text{ for } x = 0 \text{ (0.1) } 1$$
- (b)** Use fourth order RK method to solve **(10)**
$$\frac{dy}{dx} = t + y ; y(0) = 1 \text{ from } t = 0 \text{ to } t = 0.4 \text{ taking } h = 0.4$$
