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 $\iint_S \underline{A}.\bar{n}\, ds$ where $\bar{A} = 18z\underline{i} - 12\underline{j} + 3y\underline{k}$ 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 $\frac{d^2y}{dx^2} + y = Co\sec x$ **(10)**

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

Q. No. 5. **(a)** Solve the initial value problem **(10)**

$$x(2+x)\frac{dy}{dx} + 2(1+x)y = 1 + 3x^2, \qquad y(-1) = 1$$

(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(o,t)=u(l,t)=0 and $u(x,o)=lx-x^2$

APPLIED MATHEMATICS

Q. No. 7. **(a)** By using regular Falsi method, solve **(10)**
$Logx - Cosx = 0$

(b) Find the value of $f(7.5)$ by using Newton Gregory Backward Difference Interpolation formula. **(10)**
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)**

$$\int_0^x \frac{Sint}{t} dt \quad for \;\; x = 0\,(0.1)1$$

(b) Use fourth order RK method to solve **(10)**

$$\frac{dy}{dx} = t + y \;;\quad y(0) = 1 \quad from\ t = 0 \;\; to\ t = 0.4\ taking\ \ h = 0.4$$

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