F.E. Sem - II (HEP 2020) (All branch) May 2026 11/05/2026.

(Time: 2 hours) **Max Marks: 60**

Note: (1) Question No. 1 is Compulsory.
(2) Answer any three questions from Q.2 to Q.6.
(3) Figures to the right indicate full marks.

Q1. Attempt any **Five (Sub divisions) Questions** from the following.

a) Solve $(x - 2e^y)dx + (y + x\ sin\ x)dy = 0.$ **3**

b) Use Euler's method to find the approximate value of y correct up to four decimal places for x = 0.1 given $\frac{dy}{dx} = x - y^2$ when y(0) = 1 and by considering h = 0.02. **3**

c) Evaluate $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} dzdydx$ **3**

d) Evaluate $\int_0^\infty e^{-x^2} dx$ **3**

e) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} x^2 y\ dydx$ **3**

f) Solve $(D^4 - 9D^2)y = 0$ **3**

Q2.

a) Solve $\frac{dy}{dx} = x^2 + y\ where$ y(0.05)=1.0513 by Euler's modified formula for x = 0.1 up to four decimal places and four approximations. **4**

b) Evaluate $\int_0^1 \frac{x^2}{\sqrt{1-x^4}} dx \int_0^1 \frac{1}{\sqrt{1-x^4}} dx.$ **5**

c) Solve using method of variation of parameter **6**

$$(D^2 + 3D + 2)y = e^{e^x}$$

Q3.

a) Evaluate $\int_0^{\pi/4} \int_0^{\sqrt{\cos 2\theta}} \frac{r}{(1+r^2)^2} drd\theta$ **4**

b) Solve $(x^2 + y^2 + 2x)dx + 2ydy = 0.$ **5**

c) Apply Runge-Kutta method of forth order to find an approximate value of y at x = 0.2 if $\frac{dy}{dx} = x - y^2$, given that y(0)=1 in two steps by taking h=0.1. **6**

Q4.

a) Solve $(D^2 + 4D + 4)y = \frac{e^{-2x}}{x^5}$ 4

b) If the density at any point on a circular lamina of radius 'a' is k-times the square of its distance from affixed point on the circumference , find mass. 5

c) Solve the following differential equation $\frac{dy}{dx} + \frac{2}{x}y = \frac{y^3}{x^3}$. 6

Q5.

a) Prove that $\int_0^1 \frac{x^a - 1}{\log x} dx = \log(1 + a), \quad a \geq 0.$ 4

b) Find the area bounded by $y^2 = 4x$ *and* $y = 2x - 4$. 5

c) Change the coordinate system and evaluate 6

$\int_0^a \int_0^{\sqrt{a^2 - x^2}} y\sqrt{x^2 + y^2} dy dx$

Q6.

a) Solve the following differential equation 4

$(D^2 + 4D + 4)y = e^{2x} + \cos 2x.$

b) Change the order of integration $\int_0^4 \int_{2-x}^{2+x} f(x, y) dy dx$ 5

c) Find the approximate value of $\int_0^1 \frac{x^2}{1+x^3} dx$ using (i) Simpson's $(1/3)^{rd}$ rule (ii) Trapezoidal rule and state which is the feasible method for the value of the integral. 6
