

(OLD COURSE)

QP Code : MV-17726

(3 Hours)

[ Total Marks : 100

- N. B. : (1) Question No. 1 is compulsory.  
 (2) Attempt any four questions from the remaining six questions.  
 (3) Figures to the right hand side indicate full marks.

1. (a) Solve  $(2D^2 + 5D - 12)y = 0$  3  
 (b) Evaluate  $\int_0^{\infty} x e^{-x^4} dx$  3  
 (c) Evaluate  $\int_0^1 \int_{x^2}^x xy(x+y) dy dx$  3  
 (d) Evaluate  $\int_0^1 \sqrt{1-x^4} dx$  3  
 (e) If  $B(n,3) = \frac{1}{105}$  find 'n' where n is +ve integer. 4  
 (f) Using Euler's method find approximate value of y at x=1 in five steps taking n = 0.2. Given  $\frac{dy}{dx} = x+y$  and  $y(0) = 1$ . 4
2. (a) Prove that  $\int_0^3 \frac{x^{\frac{3}{2}}}{\sqrt{3-x}} dx \cdot \int_0^1 \frac{dx}{\sqrt{1-x^4}} = \frac{432}{35} \pi$  6  
 (b) Solve  $(D^2 - D + 1)Y = \cos 2x$ . 6  
 (c) Solve the differential equation  $\frac{dy}{dx} = xy$  with initial conditions  $y(1) = 2$  and find y at (i)  $x = 1.2$  (ii)  $x = 1.4$ . By Runge-Kutta method of Fourth order. 8
3. (a) In a circuit containing inductance, L, resistance R, voltage E, the current I, is given by  $L \frac{dI}{dt} + RI = E$ , find current I at time t if at  $t = 0, I = 0$  and L, R, E are constant. 6  
 (b) Find the length of the astroid  $x = a \cos^3 t, y = a \sin^3 t$  6  
 (c) Solve  $\frac{d^2y}{dx^2} - 4 \frac{dy}{dx} + 4y = x^2 + e^x + \cos^2 x$  8

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4. (a) Evaluate  $\int_0^a \int_0^a \int_0^a (yz + zx + xy) dx dy dz$  6

(b) Find the volume bounded by the cone  $z^2 = x^2 + y^2$  and the paraboloid; 6

$$z = x^2 + y^2$$

(c) Apply the method of variation of parameters to solve 8

$$(D^2 - 2D + 2)y = e^x \tan x.$$

5. (a) Solve using Taylor's series method the differential equation  $\frac{dy}{dx} = x + y$  start 6  
from  $x = 1, y = 0$  and carry to  $x = 1.2$  with  $h = 0.1$

(b) Find by double integration the area of the cardioid  $r = a(1 + \cos \theta)$  6

(c) Change the order of integration and evaluate 8

$$\int_0^a \int_{\frac{x}{a}}^{2a-x} xy \, dy \, dx$$

6. (a) Change to polar co-ordinates and evaluate 6

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

(b) Find the length of the cardioid  $r = a(1 - \cos \theta)$  which lies outside the circle 6

$$r = a \cos \theta.$$

(c) Prove that  $B(m, n) = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}$  8

7. (a) Solve  $(x^2 + y^2 + 1) dx - 2xy dy = 0$  6

(b) Solve  $\frac{dy}{dx} = x^3 y^3 - xy$  6

(c) Solve  $(D^2 + 2)y = e^x \cos x + x^2 e^{3x}$  8

