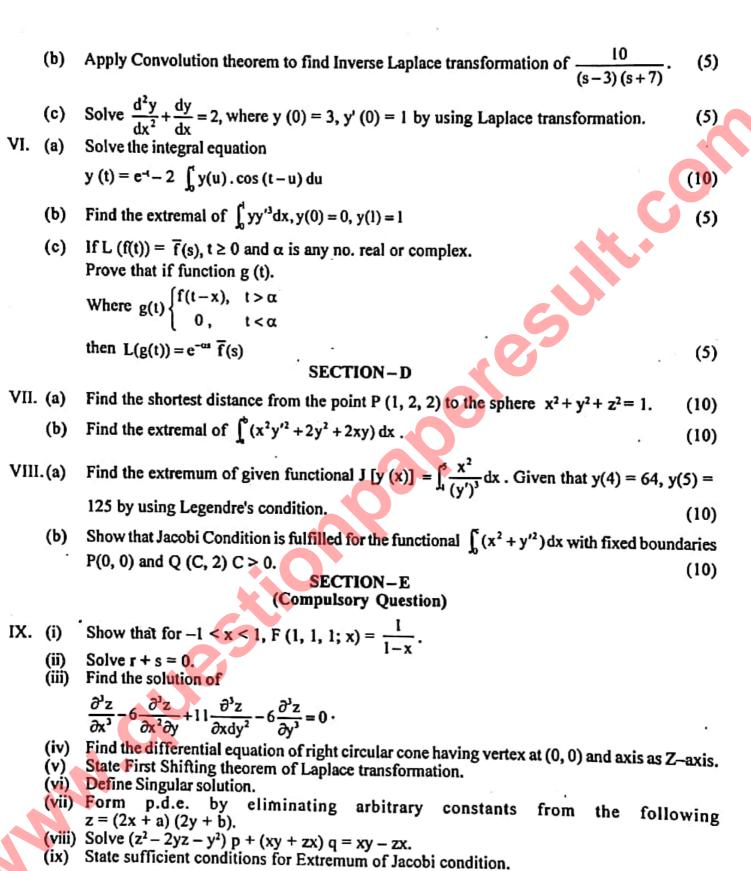
## DIFFERENTIAL EQUATIONS-II

Note: Attempt one question each from Sections A, B, C and D carrying 20 marks each, and, the entire Section E is compulsory consisting of 10 short answer questions carrying 2 marks each.

Time: Three Hours

Solve in series  $x^2 \frac{d^2y}{dx^2} + x \cdot \frac{dy}{dx} + (x^2 - 4) = 0$ . (10)I. Prove that  $e^{\frac{h}{2}(\frac{1}{1})}$  is a generating function of Bessel's function. (10)Find the Eigenvalues and Eigenfunctions of Sturm Liouville's problem  $\frac{d^2y}{dx^2} + \lambda y = 0$ II. (10)y(0) = 0 and  $y(\alpha) = 0$ Prove that (b)  $\frac{d}{dx}$  F (1, m, p;x) =  $\frac{lm}{p}$  F (P + 1, m + 1, p + 1; x). (5) Express  $5x^2 - 3x + 6$  in terms of Legendre's polynomial. (5) Find the general solution of partial differential equation  $r - q = e^{x+y}$ . (10)III. (a) Solve for complete solution  $(p^2 + q^2)$  y = qz by Charpit's method. (10)Solve the partial differential equation IV.  $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial y^2} + \frac{\partial z}{\partial x} + 3 \frac{\partial z}{\partial y} = 2z + e^{x-y} - x^2 y.$ (10)Solve  $p^2 + q^2 - 2px - 2qy + 1 = 0$ . SECTION-C (10)Find the extremal of the functional  $\int_0^{\frac{x}{2}} (y'^2 + z'^2 + 2yz) dx$ . Given that y (0) = 0,  $y\left(\frac{\pi}{2}\right) = 1$ , z(0) = 0,  $z\left(\frac{\pi}{2}\right) = -1$ (10)

Maximum Marks: 100



(x) Prove that  $J_{1/2}^2(x) + J_{1/2}^2(x) = \frac{2}{x}$ .

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 $2 \times 10 = 20$