

# Kerala Technological University

Sample Question Paper Set-1 :Differential Equations

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Answer all the questions selecting any one FULL question from each part

## PART-A

- 1a Solve  $\frac{d^2y}{dx^2} - 4y = \cosh(2x - 1) + 2^x$  6
- b Solve  $(D^2 - 2D + 5)y = e^{2x} \sin x$  7
- c Solve  $y'' - y' - 2y = x + \sin x$  by the method of undetermined coefficient 7

## OR

- 2a Solve the initial value problem  $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6x = 0$  given that  $y(0) = 0, \frac{dy}{dx}(0) = 15$  6
- b Solve  $D^2y + y = \tan x$  by the method of variation of parameters 7
- c Solve  $\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = e^x + 1$  7

## PART-B

- 3a Solve  $\frac{dx}{dt} - 7x + y = 0, \frac{dy}{dt} - 2x - 5y = 0$  6
- b Solve  $y \left( \frac{dy}{dx} \right)^2 + (x - y) \frac{dy}{dx} - x = 0$  7
- c Solve  $x^2 y'' + xy' + y = 2 \cos^2(\log x)$  7

## OR

- 4a Solve  $y = 2px + p^2y$  6
- b Find the general and singular solution of the equation  $p = \log(px - y)$  7
- c Solve  $(2x - 1)^2 y'' + (2x - 1)y' - 2y = 8x^2 - 2x + 3$  7

## PART C

- 5a Obtain the partial differential equation by eliminating the arbitrary function given  $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$  6
- b Solve  $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$  given  $\frac{\partial z}{\partial y} = -2 \sin y$  when  $x = 0$  and  $z = 0$  when  $y$  an odd multiple of  $\frac{\pi}{2}$  7
- c Derive one dimensional heat equation  $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$  7

## OR

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- 6a Evaluate  $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} dz dy dx$  6
- b Evaluate by changing the order of integration  $\int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} xy dy dx$  7
- c find the solution of the wave equation  $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$  by the method of separation of variables. 7

#### PART-D

- 7a Evaluate  $\int_0^2 (4 - x^2)^{3/2} dx$  by using Beta and Gamma functions 6
- b Prove that the spherical system is orthogonal. 7
- c Express the vector  $\vec{A} = x\vec{i} - 4x\vec{j} + 2y\vec{k}$  in cylindrical coordinates 7

#### OR

- 8a Find the area of an ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  by double integration. 6
- b Obtain the relation between beta and gamma function in the form  $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$  7
- c Obtain an expression for curl in orthogonal curvilinear coordinates. 7

#### PART-E

- 9a Find i)  $L\{t^2 e^{-2t} \sin t\}$  ii)  $L\left\{\frac{\sin^2 t}{t}\right\}$  6
- b Given  $f(t) = \begin{cases} E & 0 < t < a/2 \\ -E & a/2 < t < a \end{cases}$  where  $f(t+a) = f(t)$ . Show that  $L\{f(t)\} = \frac{E}{s} \tanh\left(\frac{as}{4}\right)$  7
- c Employ Laplace Transforms to solve the differential equation  $\frac{d^2 y}{dx^2} + 4 \frac{dy}{dx} + 4y = e^{-x}$  with the initial condition  $y(0) = 0, y'(0) = 0$  7

#### OR

- 10a find  $L^{-1}\left[\frac{s+5}{s^2-4s+13}\right]$  6
- b Find  $L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$  by using convolution theorem 7
- c Express  $f(t) = \begin{cases} 1 & 0 < t \leq 1 \\ t & 1 < t \leq 2 \\ t^2 & t > 2 \end{cases}$  in terms of unit step function and hence find its Laplace transforms 7

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