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Second Semester B.E. Degree Examination, Dec.2019/Jan.2020

Engineering Mathematics – II

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Solve : $y'' + 3y' + 2y = 1 - 2e^x + e^{2x}$. (06 Marks)
 b. Solve : $y'' + 2y = x^2$. (07 Marks)
 c. Solve : $y'' + y = \operatorname{cosec} x$ by method of variation of parameter. (07 Marks)

OR

- 2 a. Solve $(D^3 - 6D^2 + 11D - 6)y = 0$. (06 Marks)
 b. Solve : $(D^2 - 1)y = \sin 2x$. (07 Marks)
 c. Solve by the method of undetermined coefficient $(D^2 + D - 2)y = x$. (07 Marks)

Module-2

- 3 a. Solve $x^2 \frac{d^2y}{dx^2} + 5x \frac{dy}{dx} + 4y = x^2 + 1$. (06 Marks)
 b. Solve for P, given that $y \left(\frac{dy}{dx} \right)^2 + (x - y) \frac{dy}{dx} - x = 0$. (07 Marks)
 c. Solve the equation $(px - y)(x - py) = 2p$. Reducing it into Clairauts form by taking a substitution $U = x^2$ and $V = y^2$. (07 Marks)

OR

- 4 a. Solve : $(1 + x)^2 y'' + (1 + x)y' + y = \sin 2[\log(1 + x)]$. (06 Marks)
 b. Solve the system of equations $\frac{dx}{dt} = 3x - 4y$, $\frac{dy}{dx} = x - y$. (07 Marks)
 c. Find the general and singular solution for $\sin px \cos y = \cos px \sin y + p$. (07 Marks)

Module-3

- 5 a. Form partial differential equation by eliminating arbitrary function from $f(x^2 + y^2, z - xy) = 0$. (06 Marks)
 b. Evaluate : $\int_0^a \int_0^b \int_0^c xyz \, dx \, dy \, dz$. (07 Marks)
 c. Obtain the solution of one dimensional wave equation by variable separable method. (07 Marks)

OR

- 6 a. Solve : $\frac{\partial^2 z}{\partial x \partial y} = \frac{x}{y} + a$. (06 Marks)
- b. Evaluate : $\int_0^{\infty} \int_x^{\infty} \frac{e^{-y}}{y} dy dx$ by changing the order of integration. (07 Marks)
- c. Derive one dimensional heat equation in the form $u_t = c^2 u_{xx}$. (07 Marks)

Module-4

- 7 a. Show that the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is $\frac{16}{3}a^2$. (06 Marks)
- b. Obtain the relation a between Beta and Gamma function on the form $p(m, n) = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}$. (07 Marks)
- c. Express the vector $\vec{A} = x\hat{i} - 2x\hat{j} + y\hat{k}$ in cylindrical coordinates. (07 Marks)

OR

- 8 a. Show that $\int_{-1}^1 (1+x)^{p-1} (1-x)^{q-1} dx = 2^{p+q-1} \beta(p, q)$. (06 Marks)
- b. Find the volume of the tetrahedron bounded by the planes $x = 0, y = 0, z = 0, \frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$. (07 Marks)
- c. Express divergence of \vec{F} where $\vec{F} = x\hat{i} - y\hat{j} + z\hat{k}$ in spherical polar co-ordinates. (07 Marks)

Module-5

- 9 a. Find i) $L\{e^{2t} + 4t^3 + 3\cos 3t\}$ ii) $L\left\{\frac{\sin t}{t}\right\}$. (06 Marks)
- b. Find the Laplace transfer of the triangular wave of period $2a$ given by $f(t) = \begin{cases} t & 0 < t < a \\ 2a - t & a < t < 2a \end{cases}$ (07 Marks)
- c. Solve $y' + y = t$ by using Laplace transformation, given $y(0) = 0$. (07 Marks)

OR

- 10 a. Find the inverse Laplace transforms of :
i) $\log\left(\frac{s+1}{s-1}\right)$ ii) $\frac{2s-4}{4s^2+25}$. (06 Marks)
- b. Express $f(t) = \begin{cases} 0 & 0 < t < 1 \\ t-1 & 1 < t < 2 \\ 1 & t > 2 \end{cases}$ in terms of unit step function and hence find its Laplace transformation. (07 Marks)
- c. Apply convolution theorem to evaluate $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$. (07 Marks)
