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14MAT21

Second Semester B.E. Degree Examination, Aug./Sept.2020
Engineering Mathematics – II

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. (06 Marks)
- b. Solve $y'' - 4y' + 4y = e^x$. (07 Marks)
- c. Solve $\frac{d^2y}{dx^2} + y = \tan x$ by the method of variation of parameters. (07 Marks)
- 2 a. Solve $(D^2 - 2D + 5)y = (\sin x)$. (06 Marks)
- b. Solve $y'' + 2y' + y = 2x + x^2$. (07 Marks)
- c. Solve by the method of undeterminant coefficient $(D^2 + 1)y = x^2$. (07 Marks)

Module-2

- 3 a. Solve $\frac{dx}{dt} + 2y = -\sin t$, $\frac{dy}{dt} - 2x = \cos t$. (07 Marks)
- b. Solve $(1+x)^2 y'' + (1+x)y' + y = \sin 2[\log(1+x)]$. (07 Marks)
- c. Solve $y\left(\frac{dy}{dx}\right)^2 + (x-y)\frac{dy}{dx} - x = 0$. (06 Marks)
- 4 a. Solve $x^3 y''' + 3x^2 y'' + xy' + 8y = 65 \cos(\log x)$. (07 Marks)
- b. Obtain the general solution of $x^2 p^4 + 2xp - y = 0$. (07 Marks)
- c. Show that the equation $xp^2 + px - py + 1 - y = 0$ is Clairaut's equation. Hence obtain the general solution. (06 Marks)

Module-3

- 5 a. Form the partial differential equation by eliminating the arbitrary functions ϕ and Ψ from the relation $Z = \phi(x + ay) + \psi(x - ay)$. (06 Marks)
- b. Derive one dimensional heat equation. (07 Marks)
- c. Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} dx dy dz$. (07 Marks)
- 6 a. Solve the partial differential equation $\frac{\partial^2 u}{\partial x^2} = x + y$ by direct integration. (06 Marks)
- b. Derive one dimensional wave equation. (07 Marks)
- c. Evaluate $\iint_R (x^2 + y^2) dx dy$ where R is the region bounded by the lines $y = 0$, $y = x$ and $x = 1$. (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Using multiple integrals, find the area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (06 Marks)
- b. Prove that $\beta(m, n) = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}$ (07 Marks)
- c. Express the vector $\vec{F} = 2y\hat{i} - z\hat{j} + 3x\hat{k}$ in cylindrical coordinates. (07 Marks)
- 8 a. Find the area bounded between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ using double integration. (06 Marks)
- b. Show that $\int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin\theta}} \times \int_0^{\pi/2} \sqrt{\sin\theta} d\theta = \pi$. Using Beta and Gamma functions. (07 Marks)
- c. Prove that the cylindrical coordinate system orthogonal. (07 Marks)

Module-5

- 9 a. Find the Laplace transform of $\frac{\cos at - \cos bt}{t}$. (06 Marks)
- b. Find the Laplace transform of $\begin{cases} 1, & 0 < t \leq 1 \\ t, & 1 < t \leq 2 \\ t^2, & t > 2 \end{cases}$ (07 Marks)
- c. Using convolution theorem, find the inverse Laplace transform of $\frac{s}{(s^2 + a^2)^2}$. (07 Marks)
- 10 a. Find the inverse Laplace transform of $\frac{s+5}{s^2-6s+13}$. (06 Marks)
- 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 $L\{f(t)\} = \frac{E}{S} \tanh\left(\frac{as}{4}\right)$. (07 Marks)
- c. Solve the differential equation $y'' + 4y' + 3y = e^{-t}$ with $y(0) = 1 = y'(0)$ using Laplace transforms. (07 Marks)

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