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14MAT21

Second Semester B.E. Degree Examination, June/July 2015
Engineering Mathematics – II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Solve $4\frac{d^4y}{dx^4} - 4\frac{d^3y}{dx^3} - 23\frac{d^2y}{dx^2} + 12\frac{dy}{dx} + 36y = 0$. (06 Marks)

b. Solve $\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = e^x + 1$ using inverse differential operator method. (07 Marks)

c. Solve $(D^2 - 2D)y = e^x \sin x$ using method of undetermined coefficients. (07 Marks)

2 a. Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. (06 Marks)

b. Solve $(D^2 + 4)y = x^2 + e^{-x}$ using inverse differential operator method. (07 Marks)

c. Solve $(D^2 - 2D + 2)y = e^x \tan x$ using method of variation of parameters. (07 Marks)

PART – B

3 a. Solve $\frac{dx}{dt} - 7x + y = 0$, $\frac{dy}{dt} - 2x - 5y = 0$. (06 Marks)

b. Solve $x^2\frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = e^x$. (07 Marks)

c. Solve $y = 2px + y^2p^3$ by solving for x. (07 Marks)

4 a. Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin(\log(1+x))$. (06 Marks)

b. Solve $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$ by solving for P. (07 Marks)

c. Solve $(px - y)(py + x) = a^2p$ by reducing to Clairaut's form. (07 Marks)

PART – C

5 a. From the function $f(x^2 + y^2, z - xy) = 0$ form the partial differential equation. (06 Marks)

b. Derive one dimensional wave equation as $\frac{\partial^2 u}{\partial t^2} = c^2\frac{\partial^2 u}{\partial x^2}$. (07 Marks)

c. Evaluate $\int_0^1 \int_{x^2}^{2-x} xy\, dy\, dx$ by changing the order of integration. (07 Marks)

6 a. Solve $\frac{\partial^2 u}{\partial x \partial y} = \sin x \sin y$ for which $\frac{\partial u}{\partial y} = -2\sin y$ when x = 0 and u = 0 when y is an odd multiple of $\frac{\pi}{2}$. (06 Marks)

b. Derive one dimensional heat equation as $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. (07 Marks)

c. Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz$. (07 Marks)

PART – D

7 a. Find the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ using double integral. (06 Marks)

b. Evaluate $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$ using beta and gamma functions. (07 Marks)

c. Express the vector Zi – 2xj + yk in cylindrical coordinates. (07 Marks)

8 a. Find the volume of the solid bounded by the planes x = 0, y = 0, x + y + z = 1 and z = 0 using triple integral. (06 Marks)

b. Evaluate $\int_0^{\pi/2} \sqrt{\sin\theta}\, d\theta \times \int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin\theta}}$ using beta and gamma functions. (07 Marks)

c. Express the vector field 2yi – zj + 3xk in spherical polar coordinate system. (07 Marks)

PART – E

9 a. Find the Laplace transform of $te^{-4t}\sin 3t$ and $\frac{e^{at} - e^{-at}}{t}$. (06 Marks)

b. Express f(t) in terms of unit step function and find its Laplace transform given that

$$f(t) = \begin{cases} t^2, & 0 < t < 2 \\ 4t, & 2 < t < 4. \\ 8, & t > 4 \end{cases}$$

(07 Marks)

c. Find $L^{-1}\left\{\frac{1}{(s+1)(s^2+9)}\right\}$ using convolution theorem. (07 Marks)

10 a. A periodic function f(t) with period 2 is defined by $f(t) = \begin{cases} t, & 0 < t < 1 \\ 2-t, & 1 < t < 2 \end{cases}$ find L{f(t)}. (06 Marks)

b. Find $L^{-1}\left\{\frac{5s-2}{3s^2+4s+8} + \log\left(\frac{1}{s^2}-1\right)\right\}$. (07 Marks)

c. Solve using Laplace transform method $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + y = te^{-t}$ with $y(0) = 1, y^1(0) = -2$. (07 Marks)

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