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15MAT21

Second Semester B.E. Degree Examination, June/July 2019
Engineering Mathematics – II

Time: 3 hrs. Max. Marks: 80

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

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-1

1 a. Solve $(D^2-4D+4)y=e^{2x}+\cos 2x+4$ by inverse differential operator method. **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+5y=e^{2x}\sin x$ by inverse differential operator method. **(05 Marks)**

c. Using the method of undetermined coefficients, solve $y''-3y'+2y=x^2+e^x$. **(05 Marks)**

OR

2 a. Solve $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+y=xe^x\sin x$ by inverse differential operator method. **(06 Marks)**

b. Solve $(D^3-6D^2+11D-6)y=e^{-2x}+e^{-3x}$ by inverse differential operator method. **(05 Marks)**

c. Solve $y''-2y'+y=\frac{e^x}{x}$ by method of variation of parameters. **(05 Marks)**

Module-2

3 a. Solve $(2x-1)^2\frac{d^2y}{dx^2}+(2x-1)\frac{dy}{dx}-2y=8x^2-2x+3$. **(06 Marks)**

b. Solve $xy\left(\frac{dy}{dx}\right)^2-(x^2+y^2)\frac{dy}{dx}+xy=0$ **(05 Marks)**

c. Solve $x^2(y-px)=p^2y$ by reducing into Clairaut's form and using the substation $X=x^2$ and $Y=y^2$. **(05 Marks)**

OR

4 a. Solve $x^2y''-xy'+2y=x\sin(\log x)$. **(06 Marks)**

b. Obtain the general solution of the differential equation $p^2+4x^5p-12x^4y=0$. **(05 Marks)**

c. Obtain the general and singular solution of $y=2px+p^2y$. **(05 Marks)**

Module-3

5 a. Form the partial differential equation by eliminating the arbitrary function from the relation $Z=y\,f(x)+x\,g(y)$. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x\partial y}=\sin x\sin y$ for which $\frac{\partial z}{\partial y}=-2\sin y$ when x = 0 and z = 0 when y is an odd multiple of $\pi/2$. **(05 Marks)**

c. Derive one dimensional wave equation $\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}$. **(05 Marks)**

OR

6 a. Form a partial differential by eliminating the arbitrary function ϕ from the relation $\phi(x^2+y^2+z^2, z^2-2xy)=0$. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2}+4z=0$, given that when x = 0, $z=e^{2y}$ and $\frac{\partial z}{\partial x}=2$ **(05 Marks)**

c. Determine the solution of the heat equation $\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial K^2}$ by the method of separation of variables for the constant K is positive. **(05 Marks)**

Module-4

7 a. Evaluate $\int_1^2\int_3^4 (xy+e^y)dydx$. **(06 Marks)**

b. Evaluate $\int_0^{4a}\int_{x^2/4a}^{2\sqrt{ax}} dydx$ by changing the order of integration. **(05 Marks)**

c. Obtain the relation between the beta and gamma function in the form

$$\beta(m,n)=\frac{\Gamma(m)\cdot\Gamma(n)}{\Gamma(m+n)}$$ **(05 Marks)**

OR

8 a. Evaluate $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}dxdy$ by changing into polar coordinates. **(06 Marks)**

b. Evaluate $\int_0^a\int_0^x\int_0^{x+y} e^{x+y+z}dzdydx$. **(05 Marks)**

c. Using beta and gamma function, prove that $\int_0^1 \frac{x^2}{\sqrt{1-x^4}}dx \times \int_0^1 \frac{x^2}{\sqrt{1+x^4}} = \frac{\pi}{4\sqrt{2}}$. **(05 Marks)**

Module-5

9 a. Find $L\left[\frac{\cos 2t-\cos 3t}{t}+t\sin t\right]$. **(06 Marks)**

b. If $f(t)=\begin{cases} t & 0\le t\le\pi \\ 2\pi-t & \pi<t\le 2\pi \end{cases}$, where $f(t+2\pi)=f(t)$, then prove that $L[f(t)]=\frac{1}{s^2}\tan h\left[\frac{\pi s}{2}\right]$. **(05 Marks)**

c. Find $L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$ using convolution theorem. **(05 Marks)**

OR

10 a. Express $f(t)=\begin{cases} 1 & 0<t<1 \\ t & 1<t<2 \\ t^2 & t>2 \end{cases}$ in term of unit step function and hence find its Laplace transform. **(06 Marks)**

b. Find $L^{-1}\left[\frac{s+5}{s^2-6s+13}\right]$. **(05 Marks)**

c. Employ the Laplace transform to solve the differential equation $y''(t)+4y'(t)+4y(t)=e^{-t}$ with the initial condition y(0) = 0 and y'(0) = 0. **(05 Marks)**