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14MAT21

Second Semester B.E. Degree Examination, June/July 2016
Engineering Mathematics – II

Time: 3 hrs. Max. Marks:100

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

Module – 1

1 a. Solve the boundary value problem,
$y'' + 4y' + 4y = 8x^2$. Given $y(0) = 1, y'(0) = 2$ **(07 Marks)**

b. Solve : $y'' + 4y = x^2 + \cos 2x + 2^{-x}$. **(06 Marks)**

c. Solve by method of undetermined coefficients $y'' - 5y' + 6y = 2e^x + 4\cos 2x$. **(07 Marks)**

2 a. Solve the following differential equation by the method of variation of parameters:
$y'' - 2y' + y = \frac{e^x}{x}$. **(07 Marks)**

b. Solve $y'' - 2y' + y = xe^x + x$. **(06 Marks)**

c. Solve $(D^3 + D^2 - 4D - 4)y = 3e^{-x} - 4x - 6$. **(07 Marks)**

Module – 2

3 a. Solve the system of differential equations, $\frac{dx}{dt} + 2y = e^t$; $\frac{dy}{dt} - 2x = e^{-t}$. **(07 Marks)**

b. Solve for P, given that
$P^2 + 2PY \cot x = y^2$ **(06 Marks)**

c. Solve the Legendre's Linear differential equation,
$(2x+1)^2 y'' - (2x+1)y' - 12y = x\log(2x+1)$. **(07 Marks)**

4 a. Find the general and singular solution of the differential equation $y = px + \sqrt{a^2p^2 + b^2}$. **(07 Marks)**

b. Solve $x^2y'' + 5xy' + 13y = \log x + x^2$. **(06 Marks)**

c. Find the general and singular solution of,
$(x^2 - 1)p^2 - 2xyp + y^2 - 1 = 0$ **(07 Marks)**

Module – 3

5 a. Form a partial differential equation by eliminating the arbitrary function from the relation,
$f(x^2 + 2yz, y^2 + 2zx) = 0$ **(07 Marks)**

b. Derive one dimensional wave equation. **(06 Marks)**

c. Evaluate $\int_0^3 \int_1^{\sqrt{4-y}} (x+y)\,dx\,dy$, by changing the order of integration. **(07 Marks)**

6 a. Obtain the solution of heat equation by variable separable method. **(07 Marks)**

b. Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}\,dz\,dy\,dx$ **(06 Marks)**

c. Solve the equation, $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + 2z = 0$, Given that $z = e^y$ and $\frac{\partial z}{\partial x} = 0$, where $x = 0$ **(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. Obtain the relation between Beta and Gamma function, $B(m,n) = \frac{\Gamma m\, \Gamma n}{\Gamma(m+n)}$ **(07 Marks)**

b. Prove that the cylindrical co-ordinates system is orthogonal. **(06 Marks)**

c. Using triple integral find the volume of the tetrahedron bounded by the planes, $x = 0, y = 0, z = 0$ and $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$. **(07 Marks)**

8 a. Find the divergence of the vector,
$f = (\cos\phi + \sin\phi)e_R + (\cos\phi - \sin\phi)e_\phi + e_z$
Given in cylindrical polar co-ordinates. **(07 Marks)**

b. Find the area bounded by the area of the ellipse,
$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, in the first quadrant. **(06 Marks)**

c. Evaluate by using Beta and Gamma function,
$\int_0^a y^4 \sqrt{a^2 - y^2}\, dy$. **(07 Marks)**

Module – 5

9 a. Find the Laplace transform of,
i) $te^{-2t}\sin 4t$ ii) $\frac{1-\cos t}{t}$. **(07 Marks)**

b. Find the solution of differential equation that represents the damped harmonic motion of the spring mass system,
$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 0$, with $y(0) = 2$, $y'(0) = 0$ **(06 Marks)**

c. Using convolution theorem find the inverse Laplace transforms,
$F(s) = \frac{s}{(s-1)(s^2+4)}$ **(07 Marks)**

10 a. Find the Laplace transform of the periodic function with period 2a:
$$f(t) = \begin{cases} t & ;\ \text{for } 0 < t < a \\ 2a - t; & \text{for } a < t < 2a \end{cases}$$
Draw the graph of the output function. **(07 Marks)**

b. Find $L^{-1}\left\{\frac{7s+4}{4s^2+4s+9} + \frac{1}{(s+3)^4}\right\}$. **(06 Marks)**

c. Express the following function in terms of unit step function and hence find its Laplace-Transform,
$$f(t) = \begin{cases} 1\ ; & 0 < t < 1 \\ 2t\ ; & 1 < t \le 2. \\ 3t^2; & t \ge 2 \end{cases}$$ **(07 Marks)**

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