CBCS Scheme

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15MAT21

Second Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – II

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Solve $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} + \frac{4dy}{dx} - 4y = \sinh(2x+3)$ by inverse differential operator method. **(05 Marks)**

b. Solve $\frac{d^2y}{dx^2} - \frac{3dy}{dx} + 2y = xe^{3x} + \sin 2x$ by inverse differential operator method. **(05 Marks)**

c. Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ by the method of variation of parameters. **(06 Marks)**

OR

2 a. Solve $y'' - 2y' + y = x\cos x$ by inverse differential operator method. **(05 Marks)**

b. Solve $\frac{d^2y}{dx^2} + 4y = x^2 + 2^{-x} + \log 2$ by inverse differential operator method. **(05 Marks)**

c. Solve $\frac{d^2y}{dx^2} + \frac{2dy}{dx} + 4y = 2x^2 + 3e^{-x}$ by the method of undetermined coefficients. **(06 Marks)**

Module-2

3 a. Solve $x^3\frac{d^3y}{dx^3} + 3x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = x + \log x$. **(05 Marks)**

b. Solve $y - 2px = \tan^{-1}(xp^2)$. **(05 Marks)**

c. Solve $xy\left(\frac{dy}{dx}\right)^2 - (x^2+y^2)\frac{dy}{dx} + xy = 0$. **(06 Marks)**

OR

4 a. Solve $(2x+5)^2y'' - 6(2x+5)y' + 8y = 6x$. **(05 Marks)**

b. Solve $y = 2px + y^2p^3$. **(05 Marks)**

c. Solve the equation : $(px-y)(py+x) = a^2p$ by reducing into Clairaut's form, taking the substitution $X = x^2$, $Y = y^2$. **(06 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-3

5 a. Obtain the partial differential equation by eliminating the arbitrary function given $z = yf(x) + x\phi(y)$. **(05 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2} = xy$ subject to the conditions $\frac{\partial z}{\partial x} = \log(1+y)$ when $x = 1$, and $z = 0$ when $x = 0$. **(05 Marks)**

c. Derive one dimensional heat equation in the form $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. **(06 Marks)**

OR

6 a. Obtain the partial differential equation given $f\left(\frac{xy}{z}, z\right) = 0$. **(05 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial z}{\partial x} - 4z = 0$ subject to the conditions that $z = 1$ and $\frac{\partial z}{\partial x} = y$ when $x = 0$. **(05 Marks)**

c. Obtain the solution of one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ by the method of separation of variables for the positive constant. **(06 Marks)**

Module-4

7 a. Evaluate $I = \int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} xyz \, dz \, dy \, dx$. **(05 Marks)**

b. Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by double integration. **(05 Marks)**

c. Derive the relation between beta and gamma function as $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(06 Marks)**

OR

8 a. Evaluate $\int_0^a \int_y^a \frac{x \, dx \, dy}{x^2 + y^2}$ by changing the order of integration. **(05 Marks)**

b. Evaluate $\int_0^a \int_0^{\sqrt{a^2-y^2}} y\sqrt{x^2+y^2} \, dx \, dy$ by changing into polar co-ordinates. **(05 Marks)**

c. Evaluate $\int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin\theta}} \times \int_0^{\pi/2} \sqrt{\sin\theta} \, d\theta$ by using Beta-Gamma functions. **(06 Marks)**

Module-5

9 a. Find the Laplace transform of $te^{2t} + \frac{\cos 2t - \cos 3t}{t} + t\sin t$. **(05 Marks)**

b. Express the function $f(t) = \begin{cases} \pi - t, & 0 < t \le \pi \\ \sin t, & t > \pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

c. Solve $y'' + 6y' + 9y = 12t^2e^{-3t}$ subject to the conditions, $y(0) = 0 = y'(0)$ by using Laplace transform. **(06 Marks)**

OR

10 a. Find he inverse Laplace form of $\frac{7s+4}{4s^2+4s+9}$. **(05 Marks)**

b. Find the Laplace transform of the full wave rectifier $f(t) = E \sin \omega t$, $0 < t < \pi/\omega$ having period π/ω. **(05 Marks)**

c. Obtain the inverse Laplace transform of the function $\frac{1}{(s-1)(s^2+1)}$ by using convolution theorem. **(06 Marks)**

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