# CBCS Scheme

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**15MAT21**

## Second Semester B.E. Degree Examination, June/July 2017
## Engineering Mathematics – II

Time: 3 hrs. Max. Marks: 80

**Note:** ***Answer FIVE full questions, choosing one full question from each module.***

### Module-1

1 a. Solve : $\frac{d^2y}{dx^2} - 4y = \cosh(2x-1) + 3^x$. **(05 Marks)**

b. Solve : $(D^2 - 4D + 3)y = e^{2x}.\cos 3x$. **(05 Marks)**

c. Apply the method of undetermined coefficients to solve $y'' - 3y' + 2y = x^2 + e^x$. **(06 Marks)**

**OR**

2 a. Solve : $(D^4 - 1)y = 0$. **(05 Marks)**

b. Solve : $(D^2 - 4D + 4)y = 8(e^{2x} + \sin 2x)$. **(05 Marks)**

c. By the method of variation of parameters solve $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$. **(06 Marks)**

### Module-2

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

b. Solve : $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$. **(05 Marks)**

c. Solve $(px - y)(py + x) = 2p$ by reducing it into the Clairauit's form by taking the substitution $X = x^2$, $Y = y^2$. **(06 Marks)**

**OR**

4 a. Solve : $(1+x^2)y'' + (1+x)y' + y = \sin\{\log(1+x)^2\}$. **(05 Marks)**

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

c. Show that the equation $xp^2 + px - py + 1 - y = 0$ is a Clairauit's equation. Hence obtain the general solution and the singular solution. **(06 Marks)**

### Module-3

5 a. Form a partial differential equation by eliminating $\phi$ and $\psi$ from the relation $z = x\phi(y) + y\psi(x)$. **(05 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2} - a^2 z = 0$ under the conditions z = 0 when x = 0 and $\frac{\partial z}{\partial x} = a\sin y$ when x = 0. **(05 Marks)**

c. Derive an expression for the one dimensional heat equation. **(06 Marks)**

**OR**

6 a. Form a partial differential equation by eliminating $\phi$ from $\phi(x + y + z, xy + z^2) = 0$. **(05 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$ given that $\frac{\partial z}{\partial y} = -2\sin y$, when x = 0 and z = 0 when y is an odd multiple of $\frac{\pi}{2}$. **(05 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.

c. Use the method of separation of variables to solve the wave equation $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$. **(06 Marks)**

## Module-4

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

b. Evaluate $\int_{-c}^{c} \int_{-b}^{b} \int_{-a}^{a} (x^2+y^2+z^2)\,dx\,dy\,dz$. **(05 Marks)**

c. Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ using definition of $\Gamma(n)$. **(06 Marks)**

**OR**

8 a. Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\,dx\,dy$ by changing into polar coordinates. **(05 Marks)**

b. Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} \frac{dz\,dy\,dx}{\sqrt{a^2-x^2-y^2-z^2}}$. **(05 Marks)**

c. Show that $\int_0^{\frac{\pi}{2}} \sqrt{\sin\theta}\,d\theta . \int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin\theta}} = \pi$. **(06 Marks)**

## Module-5

9 a. Find the Laplace transform of,

$2^t + \frac{\cos 2t - \cos 3t}{t} + t\sin t$. **(05 Marks)**

b. A periodic function of period 2a is defined by, $f(t) = \begin{cases} E & \text{for } 0 \le t \le a \\ -E & \text{for } a < t \le 2a \end{cases}$ where E is a constant. Show that $L\{f(t)\} = \frac{E}{S}\text{Tanh}\left(\frac{aS}{2}\right)$. **(05 Marks)**

c. Find $L^{-1}\left\{\log\left[\frac{s^2+1}{s(s+1)}\right]\right\}$. **(06 Marks)**

**OR**

10 a. Express $f(t) = \begin{cases} \sin t, & 0 < t \le \frac{\pi}{2} \\ \cos t, & t > \frac{\pi}{2} \end{cases}$ in terms of unit step function and hence find its laplace transform. **(05 Marks)**

b. By using the convolution theorem find $L^{-1}\left\{\frac{1}{(s^2+a^2)^2}\right\}$. **(05 Marks)**

c. By using Laplace transforms, solve $\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^{2t}$, $x(0) = 0$, $\frac{dx}{dt}(0) = -1$. **(06 Marks)**

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