Engineering Mathematics-II VTU CBCS Question Paper Set 2018

CBCS Scheme

USN | | | | | | | | | |

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 ϕ and ψ 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 ϕ 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)**

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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CBCS Scheme

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15MAT21

Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Mathematics - II

Time: 3 hrs. Max. Marks: 80

Note: ***Answer 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 $(D-2)^2 y = 8(e^{2x} + x + x^2)$ by inverse differential operator method. **(06 Marks)**

b. Solve $(D^2 - 4D + 3)y = e^x \cos 2x$, by inverse differential operator method. **(05 Marks)**

c. Solve by the method of variation of parameters $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$. **(05 Marks)**

OR

2 a. Solve $(D^2 - 1)y = x \sin 3x$ by inverse differential operator method. **(06 Marks)**

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

c. Solve $(D^2 + 2D + 4)y = 2x^2 + 3e^{-x}$ by the method of undetermined coefficient. **(05 Marks)**

Module-2

3 a. Solve $x^3 y''' + 3x^2 y'' + xy' + 8y = 65\cos(\log x)$. **(06 Marks)**

b. Solve $xyp^2 + p(3x^2 - 2y^2) - 6xy = 0$. **(05 Marks)**

c. Solve the equation $y^2(y - xp) = x^4 p^2$ by reducing into Clairaut's form, taking the substitution $x = \frac{1}{x}$ and $y = \frac{1}{y}$. **(05 Marks)**

OR

4 a. Solve $(2x+3)^2 y'' - (2x+3)y' - 12y = 6x$. **(06 Marks)**

b. Solve $p^2 + 4x^5 p - 12x^4 y = 0$. **(05 Marks)**

c. Solve $p^3 - 4xyp + 8y^2 = 0$. **(05 Marks)**

Module-3

5 a. Obtain the partial differential equation by eliminating the arbitrary function. $Z = f(x + at) + g(x - at)$. **(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. Find the solution of the 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. **(05 Marks)**

OR

6 a. Obtain the partial differential equation by eliminating the arbitrary function $\ell x + my + nz = \phi(x^2 + y^2 + z^2)$. **(06 Marks)**

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

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

Module-4

7 a. Evaluate $\int_{-1}^{1} \int_{0}^{z} \int_{x-z}^{x+z} (x+y+z)\, dy\, dx\, dz$. **(06 Marks)**

b. Evaluate $\int_{0}^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} xy\, dy\, dx$ by changing the order of integration. **(05 Marks)**

c. Evaluate $\int_{0}^{4} x^{3/2} (4-x)^{5/2}\, dx$ by using Beta and Gamma function. **(05 Marks)**

OR

8 a. Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\, dx\, dy$ by changing to polar co-ordinates. Hence show that $\int_0^\infty e^{-x^2} dx = \sqrt{\pi/2}$. **(06 Marks)**

b. Find by double integration, the area lying inside the circle $r = a \sin\theta$ and outside the cardioid $r = a(1 - \cos\theta)$. **(05 Marks)**

c. Obtain the relation between beta and gamma function in the form $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(05 Marks)**

Module-5

9 a. Find i) $L\{e^{-3t}(2\cos 5t - 3\sin 5t)\}$ ii) $L\left\{\frac{\cos at - \cos bt}{t}\right\}$. **(06 Marks)**

b. If a periodic function of period 2a is defined by

$$f(t) = \begin{cases} t & \text{if } 0 \le t \le a \\ 2a - t & \text{if } a \le t \le 2a \end{cases}$$

then show that $L\{f(t)\} = \frac{1}{s^2} \tan h\left(\frac{as}{2}\right)$. **(05 Marks)**

c. Solve the equation by Laplace transform method. $y''' + 2y'' - y' - 2y = 0$. Given $y(0) = y'(0) = 0$, $y''(0) = 6$. **(05 Marks)**

OR

10 a. Find $L^{-1}\left\{\frac{s+3}{s^2 - 4s + 13}\right\}$. **(06 Marks)**

b. Find $L^{-1}\left\{\frac{s}{(s^2 + a^2)^2}\right\}$ by using Convolution theorem. **(05 Marks)**

c. Express $f(t) = \begin{cases} \sin t, & 0 \le t < \pi \\ \sin 2t, & \pi \le t < 2\pi \\ \sin 3t, & t \ge 2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transforms. **(05 Marks)**

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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)**

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

c. Solve $y'' + 6y' + 9y = 12t^2 e^{-3t}$ 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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Second Semester B.E. Degree Examination, June/July 2016
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 : $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. **(05 Marks)**

b. Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x-1) + 3^x$, using inverse differential operator method. **(05 Marks)**

c. Solve : $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$ by the method of variation of parameters. **(06 Marks)**

OR

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

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

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

Module-2

3 a. Solve : $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 4y = (1+x)^2$ **(06 Marks)**

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

c. Solve : $y = 2px + p^2y$ by solving for x. **(05 Marks)**

OR

4 a. Solve : $(3x+2)^2 y'' + 3(3x+2)y' - 36y = 8x^2 + 4x + 1$. **(06 Marks)**

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

c. Solve the equation $(px - y)(py + x) = 2p$ by reducing it into Clairaut's form by taking a substitution $X = x^2$ and $Y = y^2$. **(05 Marks)**

Module-3

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

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

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

OR

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

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

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

Module-4

7 a. Evaluate $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} xyz \, dz \, dy \, dx$. (06 Marks)

b. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy \, dy \, dx$ by changing the order of integration. (05 Marks)

c. Obtain the relation between beta and gamma function in the form, $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. (05 Marks)

OR

8 a. Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$ by changing into polar co-ordinates. (06 Marks)

b. Find the area enclosed by the curve $r = a(1+\cos\theta)$ above the initial line. (05 Marks)

c. Prove that $\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin\theta}} \times \int_0^{\frac{\pi}{2}} \sqrt{\sin\theta} \, d\theta = \pi$ (05 Marks)

Module-5

9 a. Evaluate : (i) $L\left\{\frac{\cos 2t - \cos 3t}{t}\right\}$ (ii) $L\{t^2 e^{-3t} \sin 2t\}$ (06 Marks)

b. If $f(t) = \begin{cases} t, & 0 \le t \le a \\ 2a - t, & a \le t \le 2a \end{cases}$, $f(t+2a) = f(t)$ then show that $L[f(t)] = \frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$. (05 Marks)

c. Solve by using Laplace transforms,
$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$, $y(0) = 0$, $y'(0) = 0$ (05 Marks)

OR

10 a. Evaluate $L^{-1}\left\{\frac{4s+5}{(s+1)^2(s+2)}\right\}$. (06 Marks)

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

c. Express $f(t) = \begin{cases} 1, & 0 < t \le 1 \\ t, & 1 < t \le 2 \\ t^2, & t > 2 \end{cases}$ in terms of unit step function and hence find its Laplace transform. (05 Marks)

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