USN | | | | | | | | | | 10MAT21

Second Semester B.E. Degree Examination, Dec.2014/Jan.2015
Engineering Mathematics -

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing at least two from each part.*
2. Answer all objective type questions only on OMR sheet page 5 of the answer booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.

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.

PART — A

1 a. Choose the correct answers for the following : (04 Marks)

i) A differential equation of the first order but of higher degree, solvable for x, has the solution as:
A) F(y, p, c) = 0 B) F(x, p, c) C) F(x, y, c) = 0 D) $\phi(x, y, C_1, C_2) = 0$

ii) If $xy + C = C^2x$ is the general solution of a differential equation then its singular solution is
A) y = x B) y = -x C) $4x^2y+1=0$ D) $4x^2y-1=0$

iii) The general solution of Clairaut's equation is,
A) y = Cf(x) + f(C) B) y = Cx + f(C) C) x = Cf(y) + f(C) D) x = Cy + g(C)

iv) The general solution of $p^2 - 7p + 12 = 0$ is,
A) $(y - 3x - c)(y - 4x - c) = 0$ B) $(y - c)(x - c) = 0$
C) $(3x\ c)(4x - c)$ D) $(y + 3x + c)(y - 4x - c) = 0$

b. Solve : $xp^2 - (2x + 3y)p + 6y = 0$. (05 Marks)

c. Solve : $y = 3x + \log p$ (05 Marks)

d. Obtain the general solution and the singular solution of the equation $xp^3 - yp^2 + 1 = 0$ as Clairaut's equation. (06 Marks)

2 a. Choose the correct answers for the following : (04 Marks)

i) The particular integral of $(D^2 + a^2)y = \sin ax$ is,
A) $\frac{-x\cos ax}{2a}$ B) $\frac{x\cos ax}{2a}$ C) $\frac{x\sin ax}{2a}$ D) $\frac{-x\sin ax}{2a}$

ii) The solution of the differential equation $(D^4 - 5D^2 + 4)y = 0$ is,
A) $y = C_1e^x + C_2e^{-x} + C_3e^{2x} + C_4e^{-2x}$
B) $y = (C_1 + C_2x + C_3x^2 + C_4x^3)e^{2x}$
C) $y = C_1 \cos x + C_2 \sin x + C_3 \cos 2x + C_4 \sin 2x$
D) None of these

iii) The particular integral of $(D - 1)^2 y = 3e^x$ is,
A) $\frac{-xe^x}{2}$ B) $-\frac{3}{2}x^2e^x$ C) $\frac{3}{2}x^2e^x$ D) $\frac{2}{3}x^2e^x$

iv) The roots of auxiliary equation of $D^2(D^2 + 2D)^2 y = 0$ are:
A) 0,0,0,0,2,2 B) 0,0,0,0,-2,-2 C) 0,0,2,2,-2,-2 D) 2,2,2,2,0,0

b. Solve : $(D^2 - 2D + 1)y = xe^x + x$ (05 Marks)

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

d. Solve : $\frac{dx}{dt} - 7x + y = 0$, $\frac{dy}{dt} - 2x - 5y = 0$. (06 Marks)

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3 a. Choose the correct answers for the following : (04 Marks)

i) The complementary function of $x^2y'' - 3xy' + 4y = x$ is:

A) $(C_1 + C_2 \log x)x^2$ B) $(C_1 + C_2 x)e^{2x}$

C) $C_1 + C_2 x$ D) $\frac{C_1}{x} + \frac{C_4}{x}$

ii) By the method of variation parameters, the value of 'W' is called,

A) Euler's function B) Wronskian of the function

C) Demorgan's function D) Cauchy's function

iii) The equation $(2x+1)^2y'' - 6(2x+1)y' + 16y = 8(2x+1)^2$ by putting $g\ 2x+1)$ with $D = \frac{}{dz}$ reduces to

A) $(D^2 + 4D + 4)y = 3e^{2z}$ B) $(D^2 - 4D + 4)y = 2e^{2z}$

C) $(D^2 - 4D + 4)y = 0$ D) None of.these

iv) To find the series solution for the equation $2x^2y'' - xy'$ 4- $(1-x^2)y = 0$, we assume the solution as,

A) $y = \sum a_r x$ S) $y = \sum_{r=1:1} a_{r+i} x^{r+1}$ $\sum_{r=0} x^{r-1}$ $= \sum^{\infty} a_r x^{K}$"

b. Solve : $(D^2 + a^2)y = \sec ax$ by method of variation of parameters. (05 Marks)

c. Solve $(3x+2)^2 y'' + 3(3x+2)y' - 36y = 8x^2 + 4x + 1$ (05 Marks)

d. Solve : $y'' + xy' + y = 0$ in series solution. (06 Marks)

a. Choose the correct answers for the following : (04 Marks)

i) $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$, d' 31 40e arbitrary constants is a solution of:

A) $2z = p^2x + qy$.- B) $2z = px + q^2y$ C) $2z = px + qy$ D) None of these

ii) Trauxiliary equations of Lagrange's linear equation $Pp + Qq = R$ are:

A) $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ B) $\frac{dx}{p} = \frac{dy}{q} = \frac{dz}{R}$, $\frac{dx}{x}\ \frac{dy}{y}\ \frac{dz}{z}$ D) $\frac{dx}{x} + \frac{dy}{y} + \frac{dz}{z} = 0$

iii) General solution of the equation $\frac{\partial^2 z}{\partial x^2} = x + y$ is,

A) $\frac{x^3}{6} + \frac{x}{2} + f(y) + g(y)$ B) $\frac{x^3}{6}\ \frac{x^2y}{2} + f(y) + yg(y)$

C) $\frac{x^3}{6} + \frac{x^2y}{2} + xf(y) + g(y)$ D) $\frac{x^3}{6} + \frac{x^2y}{2} + xf(y) + yg(y)$

iv) Suitable set of multipliers to solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ is,

A) (0, 1, 1) B) (x, y, z) C) $(0, \frac{1}{x}, \frac{1}{y})$ D) $(\frac{1}{x}, \frac{1}{y}, \frac{1}{z})$

b. Form a partial differential equation by eliminating arbitrary function from the relation, $(1)(xy+z^2, x+y+z) = 0$ (05 Marks)

c. Solve : $(y^2 + z^2)p + x(yq - z) = 0$ (05 Marks)

d. Solve by the method of separation of variables $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$ (06 Marks)

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PART— B

a. Choose the correct answers for the following : (04 Marks)

i) 2x ff(X y)dydx =
as

A) 3 B) 4 C) 5 D) 6

ii) 2 3 2 if f Xy²zdzdydx =
oi

A) 36 B) 16 C) 26 D) 46

iii) The integral 21 2 dx is,

A) If $\frac{1}{2}$) B) $\Gamma(-\frac{1}{2})$ C) $\Gamma\Gamma_2)$ D) $\Gamma(-\frac{3}{2})$

iv) The value of $\beta(5, 3) + \beta(3, 5)$ is:

A) $\frac{2}{35}$ B) -$\frac{3}{4}$ 5 C) $\frac{3}{35}$ D) $\frac{4}{35}$

b. Evaluate fi xy(x + y)dydx taken over the area between y = X and y = x. (05 Marks)

c. Evaluate : 1 1 1(x + y + z)dydxdz (05 Marks)
-1 0 x-z

d. Show that 1 2 de / sin 0 x sin Ode = TE (06 Marks)
0 0

6 a. Choose the correct answers for the following : (04 Marks)

i) Gauss Divergence theorem is a relation between:
A) a line integral and a surface integral B) a surface integral and a volume integral
C) a line integral and a volume integral D) two volume integrals

ii) f Mdx + Ndy is also equal to,
c

A) $\iint_R \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right) dxdy$ B) $\iint_R \left(\frac{\partial M}{\partial y} + \frac{\partial N}{\partial x}\right) dxdy$

C) $\iint_R \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right) dxdy$ D) $\iint_R \left(\frac{\partial N}{\partial x} + \frac{\partial M}{\partial y}\right) dxdy$

iii) Using the following integral, work done by a force F can be calculated:
A) Surface integral B) Volume integral C) Both (A) and (B) D) Line integral

iv) If F = x²i + xyj then the value of SF. dr from (0, 0) to (1, 1) along the line y — x is,

A) 2 / 3 B) 3 / 2 C) 1 / 3 D) 112

b. Find the area between the parabolae, $y^2 = 4x$ and $x^2 =$ Lly with the help of Green's theorem in a plane. (05 Marks)

c. Evaluate f xydx + xy²dy by Stoke's theorem where C is the square in the x-y plane with vertices (1, 0), (-1, 0), (0, 1) and (0, -1) (05 Marks)

d. Evaluate HF.fids given F = xi + yj + zk over the sphere $x^2 + y^2 + z^2 = a^2$ by using Gauss divergence theorem. (06 Marks)

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a. Choose the correct answers for the following : (04 Marks)

i) If L{f(t)} = F(s) then L{ fM is,

A) IF(ods B) 1F(s)ds C) IF(s)ds D) 1F(s)ds

ii) If $L\left\{\frac{\cos at - \cos bt}{t}\right\} = \frac{1}{2}\log\frac{s^2+b^2}{s^2+a^2}$ then $L\left\{\frac{\sin^2 t}{t}\right\}$.

A) $\frac{1}{4}\log(\frac{s^2+4}{s^2})$ B) $\frac{1}{2}\log\frac{s^2+1}{s^2}$ C) $\frac{1}{4}\log(\frac{s}{s^2+4})$ D) $\frac{1}{2}\frac{s}{s^2+4}$

iii) $L\{e^{3t}H(t-4)\}=$

A) $\frac{e^{12-4s}}{s+3}$ B) $\frac{e^{12-4s}}{s-3}$ C) $\frac{e^{12+4s}}{s+3}$ D) $\frac{e^{12+4s}}{s-3}$

iv) $L\{\delta(t-a)\}=$

A) (-a) e B) aneas C) ane as D) e'

b. Find the Laplace transform of $t^5 e^{4t}\cosh 3t$. (05 Marks)

c. Find $\int_0^\infty e^{-t}\, t \sin 3t\, dt$ (05 Marks)

d. Given $f(t) = \begin{cases} E, & 0 < t < \frac{a}{2} \\ -E, & \frac{a}{2} < t < a \end{cases}$ where $g(t+a) = g(t)$, show that $L\{f(t)\} = \frac{E}{s}\tanh\frac{as}{4}$. (06 Marks)

8 a. Choose the correct answer for the following : (04 Marks)

i) $L^{-1}\left\{\frac{1}{(s+1)^3}\right\} =$

A) $\frac{t^2 e^{-t}}{2}$ B) $e^t\frac{t^2}{2}$ C) $\frac{t^2}{2}$ D) $\frac{t^2 e^{-t}}{6}$

ii) $L^{-1}\left\{\log\frac{s+4}{s-4}\right\}$ ... (s - 4 ... t

A) 1 B) $\frac{1-e^{4t}}{t}$ C) $\frac{e^{4t}-e^{-3t}}{t}$ D) $\frac{e^{-4t}-e^{-3t}}{t}$

iii) $L^{-1}\left\{\frac{s}{s^2+5}\right\}$

A) sin $\sqrt{5}t$ B) $\frac{1}{5}\cos\sqrt{5}t$ C) $\frac{1}{5}\cos 5t$ D) $\cos\sqrt{5}t$

iv) $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}=$

A) t sin at B) t cos at / 2a C) t sin at / 2a D) tcosat

b. Find $L^{-1}\left\{\frac{s^2+4}{s(s+4)(s-4)}\right\}$. (05 Marks)

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

d. Solve by using Laplace transform $y''(t)+ y(t) = 0$; $y(0) = 2$, $y(\pi/2)=1$ (06 Marks)

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