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# BRAINWARE UNIVERSITY

### Term End Examination 2024-2025
### Programme – B.Tech.(ME)-2024/B.Tech.(EE)-2024
### Course Name – Engineering Mathematics-II
### Course Code - BBS00012
### ( Semester II )

**Full Marks : 60**                                                      **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

### Group-A
(Multiple Choice Type Question)                                          1 x 15=15

1.  *Choose the correct alternative from the following :*

(i)  Classify which of the following is an ordinary differential equation.

a) $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$               b) $\frac{d^2 y}{dx^2} + 3\frac{dy}{dx} + 2y = 0$

c) $x^2 + y^2 = 1$                                       d)  None of these

(ii) Identify the solution of the differential equation $\frac{dy}{dx} = 3x^2$

a) $y = x^3 + c$                                        b) $y = 3x^3 + c$

c) $y = x^2 + c$                                        d) $y = 3x + c$

(iii) Choose from the following: P.I of $x^2\frac{d^2 y}{dx^2} + x\frac{dy}{dx} = \cos\log x$

a) $-\cos x$                                             b) $\cos x$

c) $-\cos(\log x)$                                      d) $\cos(\log x)$

(iv) Choose from the following: The differential equation $(y^2 e^{xy^2} + 4x^3)dx + (2xye^{xy^2} - 3y^2)dy = 0$

a) linear, homogeneous and exact               b) non-linear, homogeneous and exact
c) non-linear, non-homogeneous and exact       d) none of these

(v) Identify $L\{\cos h\, 3t\}$

374- 18

a) $\dfrac{3}{s^2+9}$

b) $\dfrac{3}{s^2-9}$

c) $\dfrac{s}{s^2+9}$

d) $\dfrac{s}{s^2-9}$

(vi) Identify $L\{sin^2 t\}$

a) $\dfrac{2s}{s^2+4}$

b) $\dfrac{2}{s(s^2+4)}$

c) $\dfrac{2}{(s^2+4)}$

d) none of these

(vii) Estimate $L\{te^{2t}\}$

a) $\dfrac{1}{s-2}$

b) $2(s-2)^2$

c) $\dfrac{1}{(s-2)^2}$

d) $\dfrac{2!}{s^2}$

(viii) Identify $L\{\frac{sin2t}{t}\}$

a) $sin^{-1}\dfrac{s}{2}$

b) $tan^{-1}\dfrac{s}{2}$

c) $cot^{-1}\dfrac{s}{2}$

d) $cos^{-1}\dfrac{s}{2}$

(ix) Examine $L^{-1}\left\{\dfrac{3}{s^5}\right\}=$

a) $\dfrac{3t^4}{4!}$

b) $\dfrac{3t^5}{5!}$

c) $\dfrac{3t^4}{5!}$

d) none of these

(x) Examine from the following that is a property of the Laplace Transform.
a) Time-shifting
b) Convolution
c) Scaling
d) All of these

(xi) Estimate the final step in solving an ODE using the Laplace Transform.
a) Taking the Inverse Laplace Transform
b) Applying boundary conditions
c) Performing partial fraction decomposition
d) Differentiating both sides

(xii) Choose the general form of 1-dimensional Wave equation.

a) $\dfrac{\partial^2 u}{\partial x^2}=k^2\dfrac{\partial^2 u}{\partial t^2}$

b) $\dfrac{\partial^2 u}{\partial x^2}=\dfrac{1}{k^2}\dfrac{\partial^2 u}{\partial t^2}$

c) $\dfrac{\partial^2 u}{\partial x^2}=\dfrac{1}{k}\dfrac{\partial^2 u}{\partial t^2}$

d) $\dfrac{\partial^2 u}{\partial x^2}=\dfrac{\partial^2 u}{\partial t^2}$

(xiii) Select the correct option. Linear partial differential equations are reduced to ordinary differential equations in which of these methods.

a) Change of variables
b) Fundamental equations
c) Superposition principle
d) Separation of variables

(xiv) The partial differential equation $z_{xx} - x^2 z_{yy} = 0, y > 0, x > 0$ can be classified as

a) Elliptic

b) Parabolic

c) Hyperbolic

d) Parabolic in $y \geq x$ and hyperbolic in $y < x$

(xv) Calculate the correct one: $\frac{2!}{2\pi i} \int_{|z|=3} \frac{z^2 + 3z + 4}{(z-1)^3} dz =$

a) $2$

b) $0$

c) $\pi i$

d) None of these

## Group-B
(Short Answer Type Questions)                                    3 x 5=15

2. Identify $L\{5t^2 + 3\cos 2t + 7e^{-t}\}$                        (3)

3. Solve the differential equation                                 (3)
$$\frac{d^2 y}{dx^2} - 24\frac{dy}{dx} + 144y = 0$$

4. Estimate $L^{-1}\left\{\frac{3s+7}{s^2 - 2s - 3}\right\}$        (3)

5. Solve $zp = -x$                                                 (3)

6. Evaluate the general solution of                               (3)
$$\frac{d^2 y}{dx^2} + 4y = 0$$

**OR**

Evaluate P.I                                                      (3)
$$\frac{1}{D^2 + 1}xe^{-2x}$$

## Group-C
(Long Answer Type Questions)                                      5 x 6=30

7. Estimate the solution of the initial value problem described by (5)
   PDE: $u_{tt} - c^2 u_{xx} = e^x$ with the given condition $u(x, 0) = 5$, $u_t(x, 0) = x^2$
   using any suitable solution method.

8. Identify $\int_i^{2-i} (3xy + iy^2)dz$ along the straight line joining $z = i$ and $z = 2 - i$ (5)

9. Using Cauchy residue theorem determine $\oint \frac{z+1}{z^2-2z} dz$ where $C: |z| = 5$ (5)

10. Determine $L\{t\ sinat\}$ (5)

11. Use Convolution Theorem to determine $L^{-1}\{\frac{1}{(s+a)(s+b)}\}$ (5)

12. Identify the general solution from the differential equation (5)

$$y\ logy\ dx + (x - log\ y)\ dy = 0$$

**OR**

Estimate the solution of the differential equation: $y'' - 2y' + y = e^x$ using method of (5)
variation of parameters.

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