Department of Mathematics
National Institute of Technology Kurukshetra
B.Tech. (Ist Semester) MID TERM 2 Exam, Feb -2021

Subject: Differential Calculus and Differential Equations

Code: MAIR 11 **Max. Marks: 15**

Branch: CE, CS, EC, EE, IT, ME, PI

Timings: 9:30a.m-10:10 a.m.

Note: a) All questions are compulsory.
b) This question paper consists of two parts. **Part A** has 7 objective questions of one mark each and **Part B** has 4 questions of 2 marks each.

PART A

1) If $u = e^x sin\, y, v = e^x cos\, y$ then u and v are –

(A) Functionally Independent (B) Functionally Dependent

(C) Cannot be Predicted (D) None

2) If diff. eqn. $(D+3)x = Q(t); D \equiv \frac{d}{dt}$ then $\frac{1}{D+3}Q(t)$ is –

(A) $e^{3t}\int Q(t)e^{-3t}dt$ (B) $e^{-3t}\int Q(t)e^{3t}dt$

(C) $e^{3x}\int Q(t)e^{-3x}dx$ (D) $e^{-3x}\int Q(t)e^{3x}dx$

3) In method of Undetermined Coefficient, the diff. eqn. $(D^2+4D+4)y = 12e^{-2x}$ has trial solution –

(A) $c_1x^3e^{-2x}$ (B) $c_1x^2e^{-2x}$

(C) c_1e^{-2x} (D) c_1xe^{-2x}

4) The diff. eqn. $y''' + 12y'' + y' + 9y = e^x sin3x$ is –

(A) Non-Homogeneous, Linear diff.eqn. with constant coeff.

(B)Homogeneous, Linear diff.eqn. with constant coeff.

(C) Non-Homogeneous, non-Linear diff.eqn. with constant coeff.

(D) Homogeneous, non-Linear diff.eqn. with constant coeff.

5) By using the transformation $x = e^z$, the diff. eqn.

$x^2 \frac{d^2y}{dx^2} + 7x\frac{dy}{dx} + 13y = \log x$ can be reduced into the diff. eqn. as–

(A) $\frac{d^2y}{dz^2} + 6\frac{dy}{dz} + 13y = \log z$ (B) $\frac{d^2y}{dz^2} + 14\frac{dy}{dz} + 13y = z^2$

(C) $\frac{d^2y}{dz^2} + 6\frac{dy}{dz} + 13y = z$ (D) $\frac{d^2y}{dz^2} + 14\frac{dy}{dz} + 13y = z$

6) The Legendre's linear diff. eqn. $(ax+b)^2\frac{d^2y}{dx^2} + (ax+b)\frac{dy}{dx} + y = Q(x)$ can be reduced to Linear diff. eqn. with constant coeff. by using the transformation–

(A) $ax = e^z$ (B) $ax + b = e^z$

(C) $ax = e^{-z}$ (D) $ax + b = e^{-z}$

7) RLC circuit is modelled as –

(A) $L\frac{d^2Q}{dt^2} + R\frac{dQ}{dt} + \frac{Q}{C} = E(t)$ (B) $L\frac{d^2I}{dt^2} + R\frac{dI}{dt} = E(t)$

(C) $L\frac{d^2Q}{dt^2} + R\frac{dQ}{dt} + \frac{Q}{C} = \frac{dE}{dt}$ (D) $L\frac{d^2I}{dt^2} + R\frac{dI}{dt} + \frac{I}{C} = E(t)$

PART B

8) Suppose $y_P(x) = xcos2x$ is a particular solution of $y'' + \alpha y = -4sin2x$. Then the constant $'\alpha'$ equals –

(A) -4 (B) -2

(C) 2 (D) 4

9) The particular integral for the diff. eqn. $(D^2+4)y = sin^2x$ is –

(A) $\frac{1}{4} + \frac{1}{4}xsin2x$ (B) $\frac{1}{8} - \frac{1}{4}xsin2x$

(C) $\frac{1}{8} - \frac{1}{8}xsin2x$ (D) $\frac{1}{16} + \frac{1}{4}xsin2x$

10) If $y_1(x)$ and $y_2(x)$ are two linearly independent solutions for the equation $(D^2 + 16)y = 32sec2x$, then Wronskian W(y_1, y_2) is –

(A) $\frac{1}{8} or -\frac{1}{8}$ (B) $8 \; or -8$

(C) $16 \; or -16$ (D) $4 \; or -4$

11) A cup of coffee at 72K is placed in a room of 44K. After half an hour, the coffee has cooled to 61K then the temperature of the coffee after another half an hour –

(A) $T(60) = 44 + 28\, e^{-0.017(60)}$ (B) $T(60) = 44 + 24\, e^{-0.017(60)}$

(C) $T(60) = 44 + 30\, e^{-0.017(60)}$ (D) $T(60) = 44 + 26\, e^{-0.017(60)}$