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E-928

B. E. IInd Semester (Main & Re-Exam) Examination, May – 2019

MATHEMATICS - II

(New Course)

Branch : Civil, CSE, ECE, EE & ME

Time : Three Hours] *[Maximum Marks : 60*

[Minimum Marks : 30

Note : Attempt *all* questions in **Section – A**, any *four* questions from **Section – B** and *three* questions from **Section – C**.

SECTION – A [Marks : 1 × 10 = 10

1. The particular integral of the differential equation $\frac{d^2y}{dx^2}+a^2y=\sin ax$ is :

(a) $-\frac{x}{2a}\cos ax$ (b) $\frac{x}{2a}\cos ax$ (c) $-\frac{ax}{2}\cos ax$ (d) $\frac{ax}{2}\cos ax$

2. On putting $x=e^z$, the transformed differential equation of $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y=x$ is :

(a) $\frac{d^2y}{dz^2}-y=e^x$ (b) $\frac{d^2y}{dz^2}+y=e^z$ (c) $\frac{dy}{dz}+y=e^z$ (d) $\frac{dy}{dz}-y=e^{z^2}$

3. At $x=0$ the differential equation $\frac{d^2y}{dx^2}+\frac{1}{x^2}\frac{dy}{dx}+\frac{1}{x^3}y=0$ has :

(a) Ordinary point (b) Regular singular point

(c) Irregular singular point (d) None of these point

4. Legendre differential equation is :

(a) $(1+x^2)\frac{d^2y}{dx^2}+2x\frac{dy}{dx}+n(n+1)y=0$ (b) $(1+x^2)\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+n(n+1)y=0$

(c) $(1-x^2)\frac{d^2y}{dx^2}+2x\frac{dy}{dx}+n(n+1)y=0$ (d) $(1-x^2)\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+n(n+1)y=0$

5. Laplace transform of $t^3 e^{-3t}$ is :

(a) $\frac{7}{(s+4)^2}$ (b) $\frac{s}{(s+3)^2}$ (c) $\frac{6}{(s+3)^4}$ (d) $-\frac{2}{(s+6)^3}$

6. Inverse Laplace Transform of $\frac{e^{-3s}}{s^3}$ is :

(a) $(t-3)\, u_3(t)$ (b) $(t-3)^2\, u_3(t)$ (c) $(t+3)^2\, u_3(t)$ (d) $(t+3)\, u_3(t)$

7. If $f(x) = x^2$ is expanded in a Fourier series in $(-\pi, \pi)$ then $b_n =$

(a) 1 (b) 0 (c) π (d) $-\pi$

8. If the roots of the A.E. are m_1, m_1, m_2 then the C.F. is :

(a) $f_1(y+m_1x)+xf_2(y+m_1x)+f_3(y+m_2x)$

(b) $f_1(y-m_1x)+xf_2(y+m_1x)+f_3(y+m_2x)$

(c) $f_1(y+m_1x)+xf_2(y+m_1x)+f_3(y-m_1x)$

(d) $f_1(y+m_1x)+xf_2(y+m_1x)+f_3(y+m_1x)$

9. Laplace equation in polar coordinate system is :

(a) $\frac{\partial^2 u}{\partial r^2}+\frac{\partial u}{\partial r}+\frac{\partial^2 u}{\partial \theta}=0$ (b) $\frac{\partial^2 u}{\partial r^2}+\frac{1}{r}\frac{\partial u}{\partial r}+\frac{1}{r^2}\frac{\partial^2 u}{\partial \theta^2}=0$

(c) $\frac{\partial^2 u}{\partial r^2}+\frac{1}{r}\frac{\partial u}{\partial r}=0$ (d) $\frac{\partial^2 u}{\partial r^2}+\frac{\partial u}{\partial r}+\frac{1}{r}\frac{\partial^2 u}{\partial \theta^2}=0$

10. In one dimensional heat flow, the condition on temperature is :

(a) Temperature always increases

(b) Temperature decreases as time increases

(c) Temperature always decreases

(d) Temperature remains always nonzero at all times

SECTION – B

[Marks : 5 × 4 = 20

1. Solve the differential equation $(D^2+4D+4)y = 8x^2e^{2x}\sin 2x$.

2. Prove that $P_n(x)$ is the coefficient of z^n in the expansion of $(1-2xz+z^2)^{-\frac{1}{2}}$ in ascending powers of x.

3. Draw the graph of the periodic function $f(t)=\begin{cases} t, & 0<t<\pi \\ \pi-t, & \pi<t<2\pi \end{cases}$ and find its Laplace transform.

4. Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = \sin x \cos 2y$.

5. Solve the partial differential equation by separation of variables method, $u_{xx} = u_y + 2u$ given that $u(0, y) = 0$ and $\frac{\partial}{\partial x} u(0, y) = 1 + e^{-3y}$.

6. Solve the following differential equation $x^3 \frac{d^3 y}{dx^3} + 3x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + y = x + \log x$.

SECTION – C

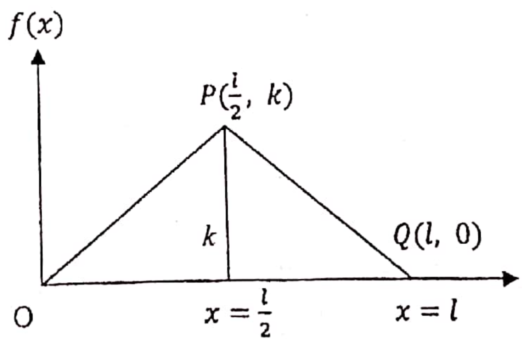
[Marks : 10 × 3 = 30

1. Solve the following differential equation by using method of variation of parameter $\frac{d^2 y}{dx^2} - 3\frac{dy}{dx} + 2y = \frac{e^x}{1+e^x}$.

2. Solve in series the following differential equation $x\frac{d^2 y}{dx^2} + \frac{dy}{dx} + x^2 y = 0$.

3. Solve the following differential equation by using Laplace transform $ty'' + y' + 4ty = 0$ given that $y = 3$ and $y' = 0$ when $t = 0$.

4. Find the half rage Fourier sine series for $f(x)$ given in the range $(0, l)$ by the graph OPQ as shown in figure.



5. A string is stretched and fastened to two points l apart. Motion is started by displacing the string into the form $y = k(lx - x^2)$ from which it is released at time $t = 0$. Find the displacement of any point on the string at a distance x from one end at time t.