Reg. No. : | | | | | | | | | | |

Question Paper Code: 33021

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Third Semester

Civil Engineering

01UMA321 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to ALL Branches)

(Regulation 2013)

Duration: One hour | Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

1. The formula for finding the Euler constant a_n of a Fourier series in *[0, 2π]* is ________

   (a) $a_n = \int_0^{\pi} f(x) cosnx\, dx$ (b) $a_n = \int_0^{2\pi} f(x) cosnx\, dx$

   (c) $a_n = \frac{1}{\pi}\int_0^{2\pi} f(x) cosnx\, dx$ (d) $a_n = \frac{1}{\pi}\int_0^{\pi} f(x) cos\frac{n\pi x}{l}\, dx$

2. If *f(x)* is an odd function defined in $(-l\ ,\ l)$ the value of a_n is ________

   (a) 0 (b) $\frac{1}{\sqrt{3}}$ (c) $\frac{2n}{\pi}$ (d) 1

3. The Fourier cosine transform of e^{-3x} is ________

   (a) $\frac{2}{\pi}\left(\frac{3}{s^2+3^2}\right)$ (b) $\left(\frac{3}{s^2+3^2}\right)$ (c) $\sqrt{\frac{2}{\pi}}\left(\frac{3}{s^2+3^2}\right)$ (d) $\sqrt{\frac{2}{\pi}}\left(\frac{s}{s^2+3^2}\right)$

4. If Fourier Transform of *f(x) = F(s)* then the Fourier Transform of *f(ax)* is ______

   (a) $\frac{1}{s} F\left(\frac{s}{a}\right)$ (b) $F\left(\frac{s}{a}\right)$ (c) $\frac{1}{2} F\left(\frac{s}{a}\right)$ (d) $\frac{1}{|a|} F\left(\frac{s}{a}\right)$

5. $\lim_{z \to 1}$ (z-1) F(z) =

   (a) f(1) (b) $F(\infty)$ (c) $f(\infty)$ (d) f(0)

6. $Z\{cosn\theta\}$ is ________

(a) $\frac{(Z-cos\theta)}{Z^2-2Z\ cos\theta+1}$ (b) $\frac{Z\ (Z-cos\theta)}{Z^2-2Z\ cos\theta+1}$ (c) $\frac{Z}{Z^2-2Z\ cos\theta+1}$ (d) $\frac{1}{Z^2-2Z\ cos\theta+1}$

7. When the ends of a rod is non zero for one dimensional heat flow equation, the temperature function *u(x,t)* is modified as the sum of steady state and transient state temperatures. The transient part of the solution which,

(a) increases with increase of time (b) decreases with increase of time
(c) increases with decrease of time (d) increases with decrease of time

8. Classify the partial differential equation $4u_{xx} = u_t$.

(a) Hyperbolic (b) parabolic (c) Elliptic (d) Poisson

9. The finite difference approximation to $y_i' =$

(a) $\frac{y_{i+1} - y_{i-1}}{h}$ (b) $\frac{y_{i+1} + y_{i-1}}{h}$

(c) $\frac{y_{i+1} - y_{i-1}}{2h}$ (d) $\frac{y_{i+1} + y_{i-1}}{2h}$

10. The Laplace equation is

(a) $\nabla^2 u = \nabla x$ (b) $\nabla^2 u = f(x, y)$

(c) $\nabla^2 u - f(x, y) = 0$ (d) $\nabla^2 u = 0$

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. Expand the function $f(x) = \sin x, 0 < x < \pi$ in a Fourier cosine series. (8)

12. Find the Fourier cosine transform of e^{-4x} and hence find the values of $\int_0^\infty \frac{\cos 2x}{x^2+16} dx$ and $\int_0^\infty \frac{x \sin 2x}{x^2+16} dx$ (8)

13 Using Convolution theorem, evaluate $Z^{-1}\left[\frac{9z^3}{(3z-1)^2(z-2)}\right]$ (8)

14. A tightly stretched string of length l with fixed ends is initially in its equilibrium position. It is set vibrating by giving each point a velocity $v_0 \sin^3\left(\pi \frac{x}{l}\right)$. Find the displacement $y(x,t)$. (8)

15. Solve $\nabla^2 u = -10\left(x^2 + y^2 + 10\right)$ over the square mesh with sides $x = 0,\ y = 0,\ x = 3,\ y = 3$ with $u = 0$ on the boundary and mesh length 1 unit. (8)