

(6 Pages)

Reg. No. :

Code No. : 30354 E Sub. Code : SSMA 4 A/
ASMA 41

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2022

Fourth Semester

Mathematics — Main

Skill Based Subject — TRIGONOMETRY, LAPLACE
TRANSFORM AND FOURIER SERIES

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The coefficient of $\cos^{n-1} \theta$ in the expansion of $\frac{\sin n\theta}{\sin \theta}$

- (a) 2^n (b) 2^{n-1}
(c) $2n-1$ (d) 0

2. If $x = \cos \theta + i \sin \theta$, then the value of $x^n + \frac{1}{x^n}$

- (a) $2 \cos \theta$ (b) $2 \sin \theta$
(c) $2 \cos n\theta$ (d) $2 \sin n\theta$

3. The value of $\cosh^2 x + \sinh^2 x$ is

- (a) 1 (b) 0
(c) $\cosh 2x$ (d) $\sinh 2x$

4. The value of $\log_e (x + \sqrt{x^2 - 1})$ is

- (a) $\cosh^{-1} x$ (b) $\sinh^{-1} x$
(c) 0 (d) 1

5. The value of $L(e^{at})$ is

- (a) $\frac{1}{s+a}$ (b) $\frac{1}{s-a}$
(c) $\frac{s}{s+a}$ (d) $\frac{s}{s-a}$

6. The value of $L^{-1} \left[\frac{1}{s^2} \right]$

- (a) 0 (b) t
(c) s (d) $\frac{1}{s}$

Page 2 Code No. : 30354 E



7. The value of $L^{-1}\left[\frac{s^2 - a^2}{(s^2 + a^2)^2}\right]$ is

- (a) $t \sin at$ (b) $t \sin t$
(c) $t \cos at$ (d) $t \cos t$

8. If $L[f(t)] = F(s)$, then $F'(s)$ is

- (a) $L[f'(t)]$ (b) $L[tf(t)]$
(c) $L[-tf(t)]$ (d) 0

9. The function $\sin x$ is periodic with period

- (a) π (b) 2π
(c) 3π (d) 0

10. Which one of the following is an odd function?

- (a) x^2 (b) $x^2 + 1$
(c) $e^x + e^{-x}$ (d) $\sin x$

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Express $\cos 8\theta$ in terms of $\sin \theta$.

Or

(b) Expand $\sin^7 \theta$ in a series of sines of multiples of θ .

Page 3 Code No. : 30354 E

12. (a) Separate into real and imaginary parts $\tanh(1+i)$.

Or

(b) Find $\text{Log}(1-i)$.

13. (a) Find $L(\sin^3 2t)$.

Or

(b) Find $L^{-1}\left[\frac{s}{(s^2 - 1)^2}\right]$.

14. (a) Evaluate $\int_0^{\infty} te^{-3t} \cos t \, dt$.

Or

(b) Find $L^{-1}\left[\frac{1}{(s-1)(s+3)(s^2+1)}\right]$.

15. (a) Obtain the Fourier series for the function $f(x) = e^x$ from $x = [0, 2\pi]$.

Or

(b) Find the half range sine series of $f(x) = 1$ in $[0, l]$.

Page 4 Code No. : 30354 E
[P.T.O.]



PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Show that $\cos \frac{\pi}{9} \cdot \cos \frac{2\pi}{9} \cdot \cos \frac{4\pi}{9} = \frac{1}{8}$.

Or

(b) Expand $\sin^4 \theta \cos^2 \theta$ in a series of cosines of θ .

17. (a) Sum to infinity the series $c \sin \alpha + \frac{c^2}{2!} \sin 2\alpha + \frac{c^3}{3!} \sin 3\alpha + \dots$.

Or

(b) Separate into real and imaginary parts $\tan^{-1}(x + iy)$.

18. (a) Prove that $L(t^n) = \frac{\Gamma(n+1)}{s^{n+1}}$ and hence deduce that $L(t^2) = \frac{2}{s^3}$.

Or

(b) Find $L^{-1} \left[\frac{1}{(s+1)(s^2+2s+2)} \right]$.

19. (a) Solve $\frac{d^2 y}{dt^2} + 2 \frac{dy}{dt} - 3y = \sin t$ given that $y = \frac{dy}{dt} = 0$ when $t = 0$.

Or

(b) Solve $\frac{dx}{dt} + y = \sin t$, $\frac{dy}{dt} + x = \cos t$ given $x(0) = 2$ and $y(0) = 0$.

20. (a) Prove that

$$|\sin x| = \frac{2}{\pi} - \frac{4}{\pi} \left(\frac{\cos 2x}{3} + \frac{\cos 4x}{15} + \dots \right).$$

Or

(b) Obtain Fourier series expansion of $f(x) = (\pi - x)^2$ in $[0, 2\pi]$ and deduce that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$.

