

Roll No.

2K5-BS-1

B.T.E. EXAMINATION, SEPTEMBER 2020

APPLIED MATHEMATICS-II

Time Allotted: Three hours

Maximum Marks: 100

- NOTE: 1. This Question Paper, comprising of 7 questions in all, is divided into 2 Parts- Part A and Part B. Part A contains 2 questions while Part B contains 5 questions.
2. Question No. 1 contains 14 questions each of 2 marks while Question No. 2 contains 8 questions each of 4 marks.
3. Each question of Part B carries 20 marks.

Part A

Q. 1 Attempt any 10 questions from the following:

2 × 10 = 20

- (i) Find $\int \tan(2 - 3x) dx$.
- (ii) Evaluate $\int_1^{\sqrt{2}} x e^{x^2} dx$
- (iii) Fill in the blank: If $\int f(x) dx = F(x) + C$, then $\int f(ax + b) dx = \dots\dots\dots$, where a and b are constants; $a \neq 0$.
- (iv) Evaluate $\int_1^4 (\sin^2 \sqrt{x} + \cos^2 \sqrt{x}) dx$.
- (v) Obtain $\int \frac{1}{\sqrt{a^2 - x^2}} dx$.
- (vi) Compute $\Gamma(4)\Gamma\left(\frac{5}{2}\right)$.
- (vii) Find $L[\cos 3t]$.
- (viii) Evaluate $L^{-1}\left\{\frac{2}{s^2 - 4}\right\}$.
- (ix) If $L\{f(t)\} = F(s)$, what is $L\{e^{at}f(t)\}$?
- (x) If A and B are sets, draw the Venn diagram for $(A \cap B)'$.
- (xi) Write the set $A = \{x \mid x \text{ is a prime number of a single digit}\}$ in the roster form.
- (xii) If $A = \{1, 3, 5, 8, 9\}$ and $B = \{5, 7, 9\}$, write $A - B$.
- (xiii) Write the period of the function $f(x) = \tan(3x)$.
- (xiv) Sort out odd functions: $\sin 2x$, $\cos x - x^2$, $\tan x + x$, x^4 .

Q. 2 Attempt any 5 questions of the following:

4 × 5 = 20

- (i) Find $\int \sin^3 x dx$.
- (ii) Evaluate $\int_0^a \sqrt{a^2 - x^2} dx$.
- (iii) Find $\int \frac{1}{\sqrt{x^2 - 4x + 3}} dx$.
- (iv) Find the Fourier coefficient a_n in the Fourier expansion of the function $f(x) = x^2$ defined in the interval $[-\pi, \pi]$.
- (v) Write the formula for the Fourier series of a periodic function defined in the interval $[-\pi, \pi]$.
- (vi) Find the Laplace transform of $\cos^2 t$.

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- (vii) Find the inverse Laplace transform of $\frac{1}{s^2 - 6s + 5}$.
- (viii) If $A = \{x \mid x \text{ is a rational number}\}$ and $B = \{x \mid x \text{ is an irrational number}\}$, then write $A \cup B$ and $A \cap B$.

Part-B

20 × 3 = 60

Attempt any 3 questions from the following:

Q. 3(a) Applying Simpson's one third rule, obtain an approximate value of the definite

integral $\int_0^1 \frac{1}{1+x^2}$ taking 4 intervals of equal width.

(b) Evaluate $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$.

Q. 4(a) Evaluate $\int_0^{\infty} \frac{x^3}{(a^2 + x^2)^{7/2}} dx$.

(b) Find $\int \frac{\cos x}{(1 - \sin x)(2 - \sin x)} dx$.

Q. 5(a) Find the Fourier series for the function $f(x) = \begin{cases} -1, & -\pi \leq x < 0 \\ 1, & 0 \leq x \leq \pi \end{cases}$.

(b) Obtain the Fourier expansion of $f(x) = x - x^2$ defined in the interval $[-\pi, \pi]$.

Q. 6(a) Find $L\{e^{3t} \sin^2 t\}$.

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

Q. 7(a) If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ be the universal set, $A = \{1, 3, 6, 7, 9, 10\}$, $B = \{2, 3, 5, 8, 9\}$, Find $(A \cup B)'$ and $(A \cap B)'$.

(b) In a class of 80 students, 65 have opted for Mathematics and 50 for Biology. If each student of the class has opted for at least one of these subjects, determine how many students have opted for (i) both the subjects (ii) only Mathematics not Biology and (iii) only Biology not Mathematics.

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