

BACHELOR OF VOCATION
Automotive Mechatronics
Subject: Applied Mathematics
Subject Code: ZBSC-101
Semester: Second
July 2021
Theory (External): 70 Marks
Time: 03 Hours

199
2. Prove that:

$$\frac{(\sin 3x + \sin 5x) + (\sin 7x + \sin 9x)}{(\cos 3x + \cos 5x) + (\cos 7x + \cos 9x)} = \tan 6x$$

3. Solve the following equations by crammer's rule

$$\begin{aligned} x + 2y + 3z &= 3 \\ 2x + 3y + 4z &= -2 \\ x + 2y + z &= 2 \end{aligned}$$

4. Differentiate the following with respect to x :

- $y = \sqrt{\tan(x^2 + x + 1)}$
- $y = \sqrt{x \cos x^2} + \frac{x}{\sin x}$

5. Find the value of

- $\int \frac{2x}{(x^2+1)(x^2+3)} dx$;
- $\int \frac{\tan^4 \sqrt{x} \sec^2 \sqrt{x}}{\sqrt{x}} dx$.

6. In a group of 200 patients with a skin disorder, 120 had been exposed to the chemical C_1 , 50 to chemical C_2 and 30 to both the chemicals C_1 and C_2 . Find the number of individuals exposed to the chemical C_1 only. Also, find the number of individuals exposed to either chemical.

7. (i) Find the values of x and y from the following equation:

$$2 \begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} y & 6 \\ 1 & x \end{bmatrix} = \begin{bmatrix} 7 & 0 \\ -1 & 3 \end{bmatrix}$$

(ii) If $A = \begin{bmatrix} 1 & -2 & 3 \\ -4 & 2 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \\ 2 & 1 \end{bmatrix}$, then find AB and BA , if exist. Also, show that $AB \neq BA$.

8. Find $\frac{dy}{dx}$, if $xy \cos x + \sin xy - y = 100$.

==END OF PAPER==

Instructions to the Students

1. This Question paper consists of two Sections. All sections are compulsory.
2. Section A comprises 10 questions of objective type in nature. All questions are compulsory. Each question carries 2 marks.
3. Section B comprises 8 essay type questions out of which students need to do any 5. Each question carries 10 marks.
4. Read the questions carefully and write the answers in the answer sheets provided.
5. Do not write anything on the question paper.
6. Wherever necessary, the diagram drawn should be neat and properly labelled

Roll Number									

SECTION -A (SHORT/OBJECTIVE TYPE QUESTIONS)
(10x2=20 Marks)

A. Which of the following correctly evaluates the definite integral

$$\int_1^2 x^3 + 2x^2 - \frac{5}{x} dx$$

- a) $\frac{101}{12}$
- b) $\frac{100}{12} + 5 \log 1$
- c) $\frac{101}{12} - 5 \log 2$
- d) None of the above

B. $\frac{d}{dx} \cos \sqrt{x}$

- a) $\sqrt{x} \sin \sqrt{x}$
- b) $-\frac{\sin \sqrt{x}}{2\sqrt{x}}$
- c) $\frac{1}{\sqrt{x}} \sin \sqrt{x}$
- d) $\frac{1}{2\sqrt{x}} \sin \sqrt{x}$

C. $\int \tan 2\theta d\theta$

- a) $\frac{1}{2} \log \sin 2\theta + c$
- b) $-\frac{1}{2} \log \cos 2\theta + c$
- c) $2 \sec 2\theta + c$
- d) $\tan 2\theta \sec 2\theta + c$

D. If $f(x) = x^2 \sin x$ then $f'(0) = ?$

- a) -1
- b) 0
- c) 1
- d) None of the above

E. Calculate $\frac{d}{dx} \log \tan x$.

F. What is the order of the matrix BA , if exists? If order of the matrix A is 3×4 and order of the matrix B is 4×5 ?

G. If $A = \begin{bmatrix} 2 & -1 \\ 3 & -2 \end{bmatrix}$, then calculate A^2 .

H. Choose the correct formula

- a) $\cos 2A = 2 \cos A \sin A$
- b) $\cos 2A = \cos^2 A + \sin^2 A$
- c) $\cos 2A = \left(\frac{2 \tan A}{1 + \tan^2 A} \right)$
- d) $\cos 2A = \frac{1 - \tan^2 A}{1 + \tan^2 A}$

I. If $\frac{1}{8!} + \frac{1}{9!} = \frac{x}{10!}$, Then the value of x is

- a) 30
- b) 50
- c) 70
- d) 100

J. If $U = \{1,2,3, \dots, 10\}$, $A = \{1,3,5,10\}$ and $B = \{3,8,10\}$. Then calculate $(A \cup B)'$.

SECTION -B (ESSAY TYPE QUESTIONS)
(5x10=50 Marks)

- I. (i) What is the number of ways of choosing 4 cards from a pack of 52 playing cards? In how many of these
 - I. two are red cards and two are blacks;
 - II. cards are of same colour?
- (ii) Find the value of a if the 17th and 18th terms of the expansion $(a + 2)^{50}$ are equal.