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BACHELOR OF VOCATION
Automotive Manufacturing
Automotive Mechatronics
Subject: Applied Mathematics
Subject Code: BSC-101
Semester: First
September 2020
Theory (External): 70 Marks
Time: 03 hours

INSTRUCTIONS TO THE STUDENTS

1. Read the questions carefully and write the answers in the answer sheets.

2. Wherever necessary, the diagram drawn should be neat and properly labelled.

3. This questions paper comprises of 6 questions out of which student need to attempt any 3 questions.

4. All questions carry equal marks.

5. The time allotted will be 3 hours for examinations including time of downloading of question paper to emailing of answer books to the concerned Dean/IC.

ESSAY TYPE QUESTIONS

1. (i) Find the domain D of each of the following real valued functions of a real variable:
   a) $f(x) = \dfrac{1}{x-2}$
   b) $f(x) = \sqrt{25 - x^2}$
   c) $f(x) = x^2 - 3x - 4$
   d) $f(x) = x^2$, where $0 \le x \le 2$
   e) $f(x) = \dfrac{1}{x^2+5x+6}$

   (ii) Let $S = \{1,2,3, ... ,8,9\}$ and let R be the relation on $A \times A$ defined by $(a, b)R(c, d)$ whenever $a + d = b + c$, then
   a) Prove that R is an equivalence relation.
   b) Find the equivalence class of $(2, 5)$.

2. (i) Prove that
   a) $\dfrac{\sin x + \sin 3x}{\cos x + \cos 3x} = \tan 2x$
   b) $\cos(\dfrac{3\pi}{4} + x) - \cos\left(\dfrac{3\pi}{4} - x\right) = -\sqrt{2}\sin x$

   (ii) (a) Prove that $(\cos x - \cos y)^2 + (\sin x - \sin y)^2 = 4\sin^2\left(\dfrac{x-y}{2}\right)$

   (b) Using Sine formula find the area of the triangle whose two corresponding sides are 35cm and 28cm making an angle of 60^0.

3. (i) Find inverse of the matrix $\begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$ by adjoint method.

   (ii) Solve the following simultaneous equations using Cramer's rule
   $3x + y = 1$
   $2x = 11y + 3$

4. (i) If $\cos y = x \cos a + y$, with , prove that $\frac{dy}{dx} = \frac{\cos^2(a+y)}{\sin a}$

(ii) Differentiate $\tan^{-1}\left(\frac{\sin x}{1+\cos x}\right)$ with respect to x.

5. (i) Discuss the continuity of the function f defined by
$$f(x) = \begin{cases} x + 2, & if \ x \leq 1 \\ x - 2, & if \ x > 1 \end{cases}$$

(ii) Find the derivative of $(5x^3 + 3x - 1)(x - 1)$ with respect to x.

6. (i) Calculate the integral $\int \frac{x+2}{2x^2+6x+5} dx$.

(ii) Find the value of $\int \frac{x \cos^{-1} x}{\sqrt{1-x^2}} dx$.

*****END OF PAPER*****