Diploma in Civil Engineering / Diploma in Electrical and Mechanical Engineering

Term-End Examination

June, 2011
03763

BET-021 : MATHEMATICS-II

Time : 2 hours *Maximum Marks : 70*

Note : *Question No. 1 is **compulsory**. Attempt any four questions out of the remaining questions no. 2 to 7. Use of calculator is permitted.*

1. (a) Select the correct answer. 7x1=7

    (i) $\lim\limits_{x \to 7} \dfrac{\sin 7x}{x}$ is equal to :

    (A) $\dfrac{1}{7}$ (B) 7

    (C) 0 (D) -7

    (ii) Sin hx is equal to :

    (A) $\dfrac{e^{-x} - e^{x}}{2}$ (B) $\dfrac{e^{x} + e^{-x}}{2}$

    (C) $\dfrac{e^{x} - e^{-x}}{2}$ (D) $\dfrac{e^{x} - e^{-x}}{2i}$

(iii) Which function is continuous for all $x \in R$?

    (A) $\tan x$ (B) $\sec x$

    (C) $\csc x$ (D) $\cos x$

(iv) $\int Cosec^2 x \, dx$ is equal to :

    (A) $-\cot x + c$

    (B) $\cot x + c$

    (C) $\csc x \, Cot \, x + c$

    (D)   None of these

(v) $\int_0^8 x^{4/3} \, dx$ is equal to :

    (A) $\dfrac{3}{7} (2)^{7/3}$ (B) $\dfrac{3}{7} (2)^7$

    (C) $\dfrac{3}{7} (2^3)^7$ (D) $\dfrac{3}{7} (2^2)^{7/3}$

(vi) $\left(\sqrt{3} + i\right)^n$ equal to :

    (A) $2^n \left\{ \cos\left(\dfrac{n\pi}{6}\right) + i \, \sin\left(\dfrac{n\pi}{6}\right) \right\}$

    (B) $2^{n+1} \cos\dfrac{n\pi}{6}$

    (C) $2^{n+1} i \, \sin \dfrac{n\pi}{6}$

    (D)   None of these

(vii) If $A = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ then A^2 is equal to :

(A) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

(b) Fill in the blanks.   7x1=7

(i) Let $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \end{bmatrix}$ and

$B = \begin{bmatrix} 2 & 3 & 0 \\ -1 & 2 & 5 \end{bmatrix}$, than $A - B$ is equal to _____ .

(ii) If $\begin{vmatrix} x & 3 \\ 3 & x \end{vmatrix} = 0$ then $x = $ _____ .

(iii) $\displaystyle\lim_{x \to 2} \frac{x^3 - 8}{x - 2}$ is equal to _____ .

(iv) If $y = e^{mx}$ then $\dfrac{d^n y}{dx^n} = $ _____ .

(v) Can Rolle's theorem be applied to $f(x) = \tan x$ in $[0, \pi]$, _____ ?

(vi) $\displaystyle\int_{-1}^{1} e^{|x|}\, dx = $ _____ .

(vii) The median of 5, 8, 9, 12, 15, 16, 18, 19, 23, 25, is _____ .

2. **(a)** Differentiate $\dfrac{\log x}{1 + x \, \log \, x}$ with respect to x.   **7+7**

     (b) Find the maximum profit that a company can make, if the profit function is given by; $p(x) = 41 + 24x - 18x^2$.

3. **(a)** Evaluate $\int e^x (1 + x) \, \log \left(x e^x \right) dx$.   **7+7**

     (b) Evaluate $\int_{-\pi}^{\pi} (\cos \, px - \sin \, qx)^2 \, dx$, where p and q are integers.

4. **(a)** Show that :   **7+7**

$$\frac{(1 + i)\left(1 + \sqrt{3} \, i\right)}{1 - i} = -\sqrt{3} \, i$$

     (b) Discuss the continuity of the function $f(x)$ at $x = 1$.

$$f(x) = \begin{cases} 1 + x^2, & 0 \le x \le 1 \\ 1 - x, & x > 1 \end{cases}$$

5. **(a)** Let $A = \begin{bmatrix} 2 & -3 & 3 \\ 2 & 2 & 3 \\ 3 & -2 & 2 \end{bmatrix}$ find A^{-1} and Adj A.   **7+7**

     (b) If $A = \begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ and A^2 is a unit matrix of order 2×2 then prove that $\alpha^2 + \beta\gamma = 1$.

6. (a) Find the median from the following table.   **7+7**

Marks	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
No. of Students	15	20	25	24	10	33	71	51

(b) Find the mean and standard deviation of the following.

Series	Frequency	Series	Frequency
15 - 20	2	45 - 50	20
20 - 25	5	50 - 55	17
25 - 30	8	55 - 60	16
30 - 35	11	60 - 65	13
35 - 40	15	65 - 70	11
40 - 45	20	70 - 75	5

7. (a) Expand $\begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}$.   **7+7**

(b) Show that $\int_0^\infty \dfrac{dx}{1 + x^2} = \dfrac{\pi}{2}$.