Faculty of Engineering – Shoubra Engineering and Management of Construction Sites Department Duration : 2 hours		Final Exam Course: Mathematics 1 Code: EMP 101 Date: January , 2019

The exam consists of one page   No. of questions: 4   Answer **All** questions   Total Mark: 40

Question 1

(a)Find **y`** from the following : 6

(i) $y = 3^x - \cos x$ (ii) $y = x^3 . \log x$ (iii) $y = \sin 3x - \ln x$

(iv) $y = \frac{3}{4} + (1 + x^3)^{-4}$ (v) $y = x . \tan x$ (vi) $y = x + \frac{1}{(x+\ln x)^5}$

(b) Write the Maclurin's expansion of : $f(x) = x \cos 2x$. 2

(c) Determine the maximum and minimum points of : $f(x) = 2x^3 - 3x^2 + 1$ 3

Question 2

(a)Find the limits : (i) $\lim_{x\to\pi} \frac{\pi - x}{1 + \cos x}$ (ii) $\lim_{x\to 0} \frac{\sin 2x}{x^2 + x}$ (iii) $\lim_{x\to\infty} \frac{x^3 + 1}{3^x + x}$ 3

(b)Verify the mean value theorem for $f(x) = x^3 + x - 1$, in the interval [0, 1]. 3

(c)Find the integrals: 6

(i) $\int (x - 4^x)\, dx$ (ii) $\int (x^2 + 3)^2\, dx$ (iii) $\int (x^3 - \cos 3x)\, dx$

(iv) $\int (x^5 + 5^x)\, dx$ (v) $\int (\frac{1}{x^2} + \sin x)\, dx$ (vi) $\int 4x^3 . (2 + x^4)^{-5}\, dx$

Question 3

(a) If $A = \begin{bmatrix} 3 & -3 & 2 \\ 1 & -2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 & 4 \\ 0 & 3 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & 1 \\ 0 & 2 \\ 2 & 1 \end{bmatrix}$ 4

Find, if possible, A + B, A + C, A.B , A^t.B, |B| , |C.B|.

(b) Find the eigenvalues and the eigenvectors of the matrix $A = \begin{bmatrix} \frac{1}{2} & 1 \\ 1 & 2 \end{bmatrix}$. 4

Also, write Hamilton equation and find A^{-1} if exists.

Question 4

(a)Solve the linear systems : 3

(i) 2x + y + z = 6, – x + 2y – 3z = – 3, x + 2y – 2z = 2.

(ii) 2x + y + 3z = 6, x – 2z = 3, – x – y – 5z = 3.

(b)Using the binomial theorem, expand : (i) $\frac{1}{2-3x}$ (ii) $\frac{x}{x^2-3x-4}$ 3

(c)If $z_1 = 2 + 2i$, $z_2 = -3 - i$. Find $z_1 + z_2$, $z_1 . z_2$, $(z_1 + z_2)^{11}$, $\sqrt[5]{z_1 + z_2}$. 3

Good Luck   *Dr. Mohamed Eid*