Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	ENGINEERING TECHNOLOGY MATHEMATICS III
COURSE CODE	:	BWM 22003/BDU 21103
PROGRAMME	:	2 BDC/BDM
EXAMINATION DATE	:	DECEMBER 2013/JANUARY 2014
DURATION	:	3 HOURS
INSTRUCTION	:	A) ANSWER **ALL** QUESTIONS. B) ALL CALCULATIONS AND ANSWERS MUST BE IN **THREE (3)** DECIMAL PLACES.

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Evaluate $\int_0^2 \int_0^x \int_0^{x+y} xyz\, dzdydx.$

(8 marks)

(b) Use the cylindrical coordinate to evaluate $\int_{-3}^{3} \int_{-\sqrt{9-y^2}}^{\sqrt{9-y^2}} \int_0^{9-x^2-y^2} x^2\, dzdydx.$

(12 marks)

For Q2-Q5, please iterate until the stopping criteria has an error, $\varepsilon < 0.005$.

Q2 (a) An airfoil has non-uniform thickness. The thickness varies between the leading and trailing edges, $0 \le x \le 1$, following the equation

$$T = 3.1\sqrt{x} - 1.3x - 3.6x^2 + 2.7x^3 - x^4.$$

Given that the thickness is a maximum at $\frac{dT}{dx} = 0$. Find the location x where the thickness is maximum using bisection method.

Hint: Let $\frac{dT}{dx} = f(x)$ and the initial values $x_0 = 0.2$ and $x_1 = 0.4$.

(13 marks)

(b) Solve **Q2(a)** by using Newton-Raphson method.

(7 marks)

Q3 (a) Find the smallest eigenvalue for the matrix $A = \begin{pmatrix} 3 & 4 & 1 \\ 4 & 3 & 0 \\ 1 & 4 & 3 \end{pmatrix}$ by using Shifted Power method with initial eigenvector $v^{(0)} = (1 \quad 1 \quad 1)^T$.

(13 marks)

(b) Solve **Q3(a)** by using Inverse Power method.

(7 marks)

Q4 Syarikat Dinamik Satria wishes to produce three types of bridge screws: types *A*, *B* and *C*. During manufacturing process, a type-*A* screw requires 2 minutes on machine I, 1 minute on machine II and 2 minutes on machine III. A type-*B* screw requires 1 minute on machine I, 3 minutes on machine II and 1 minute on machine III. A type-*C* screw requires 1 minute on machine I and 2 minutes each on machine II and III. There are 3 hours available on machine I, 5 hours available on machine II and 4 hours available on machine III for processing the order.

(a) Construct a system of linear equations to describe this situation.

(10 marks)

(b) Hence, by using Gauss Elimination Method, determine the number of each type that Syarikat Dinamik Satria should make in order to use all of the available time.

(10 marks)

Q5 A certain lab experiment produced the following data shown in **Table Q5.**

Table Q5

x	$y(x)$
0	-100
20	280
40	1460
60	3440
80	6220

Predict $y(x)$ when $x = 70$ by using

(a) Lagrange polynomial interpolation

(10 marks)

(b) Newton divided-difference interpolation.

(10 marks)

- END OF QUESTION -

FINAL EXAMINATION

SEMESTER / SESSION: SEM I/ 20132014 PROGRAMME : 2 BDC/BDM

COURSE NAME :ENGINEERING TECHNOLOGY MATHEMATICS III

COURSE CODE : BWM22003/BDU21103

Cylindrical coordinates $\iiint_G f(x,y,z)dV = \int_{\theta=\theta_0}^{\theta=\theta_1}\int_{r=r_0}^{r=r_1}\int_{z=z_0}^{z=z_1} f(r,\theta,z)\,dz\,r\,dr\,d\theta$

Newton-Raphson method: $x_{i+1} = x_i - \dfrac{f(x_i)}{f'(x_i)}$

Lagrange polynomial:

$$P_n(x) = \sum_{i=0}^{n} L_i(x) f(x_i), i = 0,1,2,\ldots,n \text{ where } L_i(x) = \prod_{\substack{j=0 \\ j\neq i}}^{n} \frac{(x-x_j)}{(x_i-x_j)}$$

Newton's divided difference method

$$P_n(x) = f_0^{[0]} + f_0^{[1]}(x-x_0) + f_0^2(x-x_0)(x-x_1) + \ldots$$
$$f_0^{[n]}(x-x_0)(x-x_1)\ldots(x-x_{n-1})$$

Power Method for eigenvalue:

$$\boldsymbol{v}^{(k+1)} = \frac{1}{m_{k+1}} A\boldsymbol{v}^{(k)}, \qquad k = 0,1,2,.....$$