STRUCTURED (100 MARKS)

INSTRUCTION: This section consists of **SIX (6)** questions. Answer **FOUR (4)** questions only.

QUESTION 1

a) **Table 1(a)** shows the grade scored by 128 students for a mathematic test.

GRED	NUMBER OF STUDENTS	PERCENTAGE
A	12	9.38
B	33	25.78
C	34	26.56
D	33	25.78
E	16	12.50

Table 1(a)

From the data, draw :

   i.   a bar chart   (5 marks)

   ii.   a pie chart   (8 marks)

b) The data below shows the weight, in kg, of 30 students in a primary school.

20	22	23	38	24	38	25	25	26	27
40	28	29	29	29	29	30	30	24	31
31	32	32	36	34	36	36	24	31	40

   i.   Build a frequency distribution table using **Table 1(b)** as a guide.   (6 marks)

Class	Tally	Frequency
20 – 23		
24 – 27		
28 – 31		
32 – 35		
36 – 39		
40 - 43		
Total		

Table 1 (b)

   ii.   Draw a histogram based on your frequency distribution table.   (6 marks)

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EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

MATHEMATICS, SCIENCE & COMPUTER DEPARTMENT

FINAL EXAMINATION

DECEMBER 2011 SESSION

B3001: ENGINEERING MATHEMATICS 3

DATE : 25 APRIL 2012 (WEDNESDAY)
DURATION : 2 HOURS (2.30 PM – 4.30 PM)

This paper consists of **EIGHT (8)** pages including the
front page and appendix.
This paper consists of **SIX (6)** questions.
Answer **FOUR (4)** questions only.

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THE CHIEF INVIGILATOR

QUESTION 3

a) The values of x and y are shown in **Table 3(a)**:

x	0	4	8	12	16	20
y	1	0.99	0.96	0.91	0.85	0.77

Table 3(a)

Calculate $\int_0^{20} y\,dx$, using the Trapezoidal Rule.   (5 marks)

b) Solve $\int_a^4 (2 + x^{-2})\,dx$, by using:

   i.   the Trapezoidal Rule , given n = 4 and a = 2.   (9 marks)

   ii.   the Simpson Rule, given n = 4 and a = 1 .   (11 marks)

QUESTION 2

a) **Table 2(a)** shows the daily expenses for 50 students at ABC College .

Expenses (RM)	5	10	15	20	25	30	35	40
Frequency	6	3	10	12	9	6	3	1

Table 2 (a)

From the data above, calculate:

   i)   the mean   (4 marks)

   ii)   the variance   (5 marks)

   iii)   the standard deviation   (2 marks)

b) **Table 2(b)** shows the wages for 100 workers in an electronic factory.

Wages (RM)	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70
Frequency	8	13	17	21	18	11	7	5

Table 2 (b)

From the data above:

   i)   construct a histogram and find the mode.

                                                 (5 marks)

   ii)   draw a "less than" ogive and find the 3rd quartile, 5th decile
          and 90th percentile.   (9 marks)

QUESTION 5

(a)   If $A = \begin{bmatrix} 3 & -2 \\ -5 & 9 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 1 \\ 0 & -2 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}$, find :

    i. B^T (1 mark)

    ii. $C + 2A$ (3 marks)

    iii. $-2 (B + 2C)$ (3 marks)

(b)   If $B = \begin{bmatrix} 3 & 6 & 7 \\ 5 & 4 & -2 \\ 9 & 1 & -7 \end{bmatrix}$, find :

    i.   the determinant of B   (2 marks)

    ii.   the minor of B   (3 marks)

    iii.   the cofactor of B   (3 marks)

(c)   Solve the following linear simultaneous equations using the Cramer's Rule:

$$-x + 4y + z = 2$$
$$x - 2y + z = 1$$
$$3x + y + 2z = 4$$

(10 marks)

QUESTION 4

a) Bijak Book Store launched a sale for exercise books from January 2009 to December 2009. Bijak Book Store sold 500 exercise books in January 2009 and its sales increased constantly by 50 exercise books every subsequent month.

    i)   Determine the number of exercise books sold by Bijak Book Store in June.

(3 marks)

    ii)   Bijak Book Store sold 1000 books in a certain month. What month was it?

(3 marks)

b) Given that Bijak Book Store earns a profit of 8 cents from each of the exercise books sold. Find the total profit gained by Bijak Book Store in 2009.
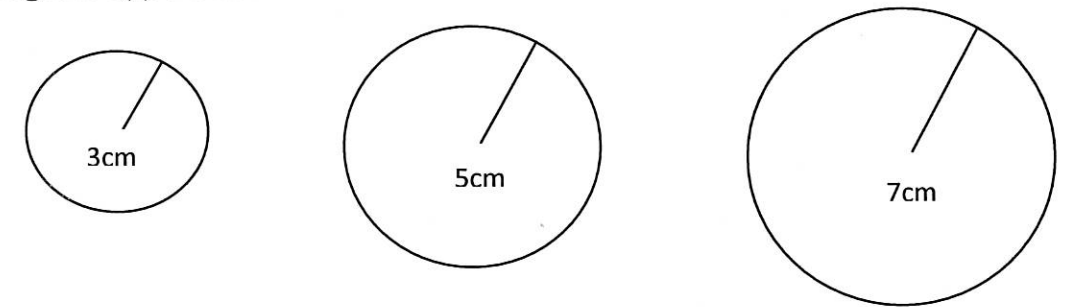
(4 marks)

c) **Diagram 4(c)** shows three circles:

DIAGRAM 4(c): The circumferences of the circles form an arithmetic progression.
(Let circumference = $2\pi r$)

The terms of the progression are in ascending order:

    i)   write down the first three terms of the progression.

(4 marks)

    ii)   find the common difference of the progression.

(2 marks)

d) The first three terms of a geometric progression are x, 12, 36. Find:

    i)   the value of x

(2 marks)

    ii)   the sum from the third term to the tenth term.

(7 marks)

FORMULA OF ENGINEERING MATHEMATICS 3 (B3001)

1. Mean

$$\bar{x} = \frac{\sum x}{N} = \frac{\sum fx}{\sum f}$$

Median $= L + \left[\dfrac{\dfrac{N}{2} - F}{f_m}\right] c$

2. Mode $= L + \left[\dfrac{d_1}{d_1 + d_2}\right] c$

3. Quartile, $Q_k = L + \left[\dfrac{\dfrac{k}{4}N - F}{f_{QK}}\right] c$

4. Decil, $D_k = L + \left[\dfrac{\dfrac{k}{10}N - F}{f_{DK}}\right] c$

5. Percentile, $P_K = L + \left[\dfrac{\dfrac{k}{100}N - F}{f_{PK}}\right] c$

6. Mean Deviation

   i. $E = \dfrac{\sum |x - \bar{x}|}{n}$

   ii. $E = \dfrac{\sum |x - \bar{x}| f}{n}$

7. Variance.

   i. $s^2 = \dfrac{\sum (x - \bar{x})^2}{n}$

   ii. $s^2 = \dfrac{\sum_{i=l}^{n} x_i^2 - n\bar{x}^2}{n}$

   iii. $s^2 = \dfrac{\sum (x - \bar{x})^2 f}{n}$

   iv. $s^2 = \dfrac{\sum fx^2}{\sum f} - \left[\dfrac{\sum fx}{\sum f}\right]^2$

8. Standard Deviation

$$s = \sqrt{variance}$$

Arithmetic Progression

9. $T_n = a + (n-1)d$

10. $S_n = \dfrac{n}{2}[2a + (n-1)d]$

11. $T_n = \dfrac{T_{n-1} + T_{n+1}}{2}$

Geometric Progression

12. $T_n = ar^{n-1}$

13. $S_n = \dfrac{a(1 - r^n)}{1 - r} @ \dfrac{a(r^n - 1)}{r - 1}$

14. $T_n = \sqrt{T_{n-1} \times T_{n+1}}$

Matrix

15. Inverse of Matrix

   i. $A^{-1} = \dfrac{Adjoin(A)}{|A|} = \dfrac{C_a^t}{|A|}$

   ii. Cofactor, $C = (-1)^{i-j} M_{ij}$

Area of Irregular Shape

16. Trapezoidal Rule

   i. $\displaystyle\int_a^b f(x)dx = \dfrac{h}{2}(y_0 + 2y_1 + 2y_2 + \dots + 2y_{n-1} + y_n)$

   ii. $\displaystyle\int_a^b f(x)dx = h\left(\dfrac{1}{2}f(a) + f(x_1) + \dots + f(x_{n-1}) + \dfrac{1}{2}f(b)\right)$

17. Simpson's Rule

   i. $\displaystyle\int_a^b ydx = \dfrac{h}{3}(f_0 + 4f_1 + 2f_2 + 4f_3 + \dots + 4f_{n-1} + f_n)$

   ii. $\displaystyle\int_a^b f(x)dx = \dfrac{h}{3}\big(f(a) + 4\Sigma f(odd\ number) + 2\Sigma f(even\ number) + f(b)\big)$

QUESTION 6

(a) Given the linear simultaneous equations as follows:

$$2x_1 - 2x_2 + 4x_3 = 10$$
$$x_1 + 5x_2 - 4x_3 = 25$$
$$3x_1 - x_2 - 2x_3 = 13$$

   i. change the set of equations into matrix form, $Ax = b$

   (1 mark)

   ii. find $A = LU$ using the Doolittle's Method

   (7 marks)

   iii. find the value of x_1, x_2 and x_3

   (9 marks)

(b) Solve the root of the equation $2x^3 - 5x = 0$ by using the Simple Iteration Method and give your answer correct to 4 decimal places. The first approximation of this root is 1.5.

   (8 marks)

7. **VARIANCE:**

i. $S^2 = \dfrac{\sum (x - \bar{x})^2}{n-1}$

ii. $S^2 = \dfrac{\sum x^2 - n(\bar{x})^2}{n-1}$

iii. $S^2 = \dfrac{\sum (x - \bar{x})^2 f}{n-1}$

iv. $S^2 = \dfrac{\sum x^2 f - n(\bar{x})^2}{n-1}$

ARITHMETIC PROGRESSION

10.   i. $S_n = \dfrac{n}{2}\left[2a + (n-1)d\right]$

    ii. $S_n = \dfrac{n}{2}\left[a + l\right]$

16. **TRAPEZOIDAL RULE**

$$\int_a^b f(x)\,dx = \frac{h}{2}\left[y_{first} + y_{last} + 2(y_{others})\right]$$

17. **SIMPSON'S RULE**

$$\int_a^b f(x)\,dx = \frac{h}{3}\left[y_{first} + y_{last} + 2(y_{odd}) + 4(y_{even})\right]$$