Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks. www.arjun00.com.np

Group 'A'

Attempt __ALL__ questions. $[7\times(2+2)=28]$

1. a. For what values of 'k' the equation $x^2 - 2kx + 7k - 12 = 0$ has equal roots.

    b. Reduce $\frac{2+3i}{2-3i}$ in the form of $a + ib$.

2. a. If $A = \begin{bmatrix} 3 & 2 \\ 1 & 5 \end{bmatrix}$, find matrix 'x' such that $A - 3x = \begin{bmatrix} 3 & 5 \\ -8 & 2 \end{bmatrix}$.

    b. Use De-Moivre's theorem to compute:
    $\{2(\cos 12 + i\sin 12)\}^5$

3. a. Find the equation of the parabola whose vertex is at $(-1, 1)$ and diretrix $y = 3$.

    b. Deduce the equation of hyperbola in the standard form whose focus is at $(-7, 0)$ and eccentricity $\frac{7}{4}$.

4. a. If α, β, γ are the angles which a line makes the coordinate axes then prove that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$.

    b. Find the equation of the plane through the point $(3, -4, 5)$ and parallel to the plane $3x - 4y + 5z = 7$.

5. a. Show by vector method that the points $(1, -2, 3), (2, 3, -4)$ and $(0, -7, 10)$ are collinear.

    b. Find the area of the parallelogram whose adjacent sides are determined by the vectors $\vec{i} + \vec{j} + \vec{k}$ and $2\vec{i} + 3\vec{j} + \vec{k}$.

6. a. For what value of 'm' the vectors $\vec{i} - 2\vec{j} + 3\vec{k}$ and $3\vec{i} + m\vec{j} - 3\vec{k}$ will be orthogonal?

   b. Find 'x' if the mean of 5, 7, x, 18, 17 is 12.

7. a. Find the standard deviation of 5, 8, 12, 6, 9.

   b. Three coins are tossed at once. Find the probability of getting:
      a. exactly one tail   b. exactly two heads

Group 'B'

Attempt ALL questions.   [13×4=52]

8. If one root of the equation $x^2 + px + q = 0$ be the square of the other, prove that $p^3 + q^2 + q = 3pq$.

9. Find the inverse matrix of $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 0 \\ 0 & 1 & 2 \end{bmatrix}$

OR

Prove that: $\begin{vmatrix} 1+a_1 & a_2 & a_3 \\ a_1 & 1+a_2 & a_3 \\ a_1 & a_2 & 1+a_3 \end{vmatrix} = 1 + a_1 + a_2 + a_3$

10. Find the square root of $\dfrac{5+12i}{3-4i}$.

11. Find the equation of the parabola is standard form.

12. Find the eccentricity, the coordinates of the center and the foci of the ellipse: $x^2 + 4y^2 - 4x + 24y + 24 = 0$

13. Show that the line whose direction cosines are given by $\ell + m + n = 0, 2mn + 3n\ell - 5\ell m = 0$ are perpendicular to one another.

14. A variable plane is at a constant distance 3P from the origin and meets the axes in the points A, B, C. Prove that locus of the centroid of the $\triangle ABC$ is $\dfrac{1}{x^2} + \dfrac{1}{y^2} + \dfrac{1}{z^2} = \dfrac{1}{p^2}$.

15. Solve by using Cramer's rule:
    $5x - y + z = 4,$ $3x + 2y - 5z = 2,$ $x + 3y - 2z = 5$

OR

Minimize $z = 3x + 2y$ subject to the given system in inequalities:
$5x + y \geq 10, x + y \geq 6, x \geq 0, y \geq 0.$

16. Prove by vector method that:
    $\cos(A + B) = \cos A. \cos B - \sin A. \sin B$

17. Show that the three points whose position vectors are $7\vec{j} + 10\vec{k}$, $-\vec{i} + 6\vec{j} + 6\vec{k}$ and $-4\vec{i} + 9\vec{j} + 6\vec{k}$ form an isosceles right angled triangle.

18. Find the correlation coefficient between the two variables X and Y from the following data:

X	5	7	1	3	4
Y	2	3	4	5	6

19. The scores of two golfers for 10 rounds each are:

A	58	59	60	54	65	66	52	75	69	52
B	84	56	92	65	86	78	44	54	78	68

Which player may be regarded as the more consistent player?

20. If 20% of the electrical bulbs manufactured by a company are defective, find the probability that out of 4 bulbs chosen at random:

    a. 1   b. at most 2 bulbs will be defective

Good Luck !

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Special Scholarship/Regular Exam – 2082 Jestha

Program: Diploma in Engineering All	**Full Marks: 80**
Year/Part: I/II (2021/22) © A r j u n	**Pass Marks: 32**
Subject: Engineering Mathematics II	**Time: 3 hrs**

Candidates are required to ~~give their answer in their own words as far as practicable~~
The figures in the margin ind~~icate full marks~~

Attempt All questions. **Group 'A'** [7×(2+2)=28]

1. a. Find the value of k if the quadratic equation:
        $x^2 + kx + 64 = 0$ has equal roots.

    b. Express $\frac{2+\sqrt{-16}}{3-\sqrt{-25}}$ in the form $x + iy$.

2. a. If $A = \begin{bmatrix} 4 & 5 \\ 6 & 7 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 0 \\ -2 & 1 \end{bmatrix}$ Find $(AB)^T$.

    b. Prove that $(1 - w + w^2)^3 (1 + w - w^2)^3 = 64$

3. a. Find the focus, vertex and the equation of directrix of
        parabola $y^2 = 6y - 12x + 45$.

    b. Find the equation of ellipse with major axis 8 and minor axis
        is 6.

4. a. Find the direction cosines of the line which are equally
        inclined to the axes.

    b. Find the value of 'p' if the vectors, $\vec{i} + \vec{j} + \vec{k}$ and
        $2\vec{i} - p\vec{j} + 3\vec{k}$ are perpendicular.

5. a. Find the direction cosines of the line joining the points:
        $(4, 3, -5)$ and $(-2, 1, -8)$.

    b. Find the angle between the two vector $(-1, -1, -4)$ and
        $(-4, 2 - 4)$.

6. a. Find the area of Parallelogram determined by the vectors
        $\vec{i} + \vec{j} + \vec{k}$ and $-2\vec{i} + 3\vec{j} + \vec{k}$. www.arjun00.com.np

    b. Find the correlation coefficient between the two variables
        when $b_{xy} = 1.8$ and $b_{yx} = 0.35$.

7. a. If A and B are two independent events with $p(A) = \frac{2}{3}$ and $p(B) = \frac{3}{5}$. Find $p(A \cup B)$.

   b. Find M.D from mean from the following data:
      10 20 30 40 50.

Group 'B'

Attempt All questions. [13×4=52]

8. Form an quadratic equation whose roots are the reciprocal of the roots of $3x^2 - 5x - 2 = 0$

9. Prove that: $\begin{bmatrix} p+x & q & r \\ p & q+y & r \\ p & q & r+z \end{bmatrix} = xyz \left(1 + \frac{p}{x} + \frac{q}{y} + \frac{r}{z} \right)$.

OR

Solve the system of linear equations using Cramer's rule or Inverse matrix method: $2x + y + z = 3, -x + 2y + 2z = 1, x - y - 3z = 6$.

10. Optimize: $F = x + y$ subject to the constraints $2x + y \leq 14$, $x + 2y \leq 10, x, y \geq 0$.

11. Stare De' Moiver' theorem. Find the cube roots of unity using De' Moiver's theorem.

12. Find the length of transverse axis, conjugate axis, co-ordinate of foci, vertices, eccentricity of the hyperbola $3x^2 - 4y^2 = 36$.

OR

Find the equation of hyperbola with focus at (7, 0) and vertex at (5, 0).

13. Find eccentricity, the co-ordinate of foci and the Centre of the ellipse: $\frac{(x+2)^2}{16} + \frac{(y-5)^2}{9} = 1$

14. Find the equation of a plane through the points (-1, 1, -1) and (6, 2, 1) and perpendicular to the plane $2x + y + z = 5$.

OR

Find the direction cosines ℓ, m, n of two lines which are connected by the relation $4\ell + 3m - 2n = 0$ and $\ell m - mn + n\ell = 0$.

Cont. ......

15. Show that the angle between the two diagonals of a cube is $\cos^{-1}\left(\frac{1}{3}\right)$.

OR

Find the equation of the plane through the intersection of the planes $x + y + z = 6$ and $2x + 3y + 4z + 5 = 0$ and perpendicular to the plane $4x + 5y - 3z = 8$.

16. Show that the three points whose position vertices are $7\vec{j} + 10\vec{k}$, $-\vec{i} + 6\vec{j} + 6\vec{k}$ and $-4\vec{i} + 9\vec{j} + 6\vec{k}$ form an isosceles triangle.

17. Find the area of a triangle by using vector method, whose vertices are: $A(1, 2, 3)$, $B(2, 5, -1)$ and $C(-1, 1, 2)$.

OR

If $\vec{a} = 2\vec{i} + \vec{j} - \vec{k}$ and $\vec{b} = \vec{i} - 2\vec{j} + 3\vec{k}$ be two vectors, find: (a) $\vec{a} \times \vec{b}$

(b) Unit vector perpendicular to both $\vec{a}$ and $\vec{b}$

18. Find regression equation Y on X and X on Y from the following data

X	1	2	3	4	5
Y	1	3	5	7	9

19. Find CV from the following data.

X	0-10	10-20	20-30	30-40	40-50
f	3	7	11	9	5

20. A bag contains 3 white and 4 red balls. Three balls are drawn at random. What is the probability that: (a) all of them are white (b) two of them are red. (c) all of them of same color.

OR

If X follows the binomial distribution with mean 4 and variance 2. Find $p(x \geq 5)$.

Good Luck !

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Regular/Scholarship/Back Exam – 2081 Bhadra/Ashwin

Program:	Diploma in Engineering All	**Full Marks: 80**
Year/Part:	I/II (2021) ©Arjun	**Pass Marks: 32**
Subject:	Engineering Mathematics II	**Time: 3 hrs**

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt All questions.

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Group 'A' [7x(2+2)=28]

1. a. If the equation $x^2 + 2(k+2)x + 9k = 0$ has equal roots. Find k.

    b. Find the conjugate of $(1+i)^{-1}$

2. a. Express in rectangular (Cartesian) form of
       $2(\cos 45° + i \sin 45°)$

    b. Construct a 2×2 matrix A defined by $a_{ij} = i + 2j$.

3. a. Find the equation of parabola whose vertex is (2,3) and focus (5,3).

    b. Find the coordinates of vertices and focus of the ellipse $9x^2 + 16y^2 = 144$.

4. a. Find the direction cosines of a line joining the points $(3, -5, 4)$ and $(-6, 1, 2)$.

    b. Find the distance between two parallel planes
       $3x + 2y - 6z + 1 = 0$ and $6x + 4y - 12z + 9 = 0$.

5. a. If $\vec{a} = (3, -1, -4)$ $\vec{b} = (-2, 4, -3)$ and $\vec{c} = (-5, 7, -1)$
       find $|2\vec{a} + \vec{b} - \vec{c}|$.

    b. If $(\vec{a} + \vec{b}) = (\vec{a} - \vec{b})$ then prove that $\vec{a}$ and $\vec{b}$ are orthogonal.

6. a. Find the area of Parallelogram whose diagonal are represented by the vectors $\vec{i} + 2\vec{j} + 3\vec{k}$ and $-3\vec{i} - 2\vec{j} + \vec{k}$.

   b. Find the mode from the following data

x	0-10	10-20	20-30	30-40	40-50
f	12	22	20	34	23

7. a. Find the standard deviation of 4,6,10,12,18.

   b. The mean of a binomial distribution was found to be 12 and the standard deviation was found to be 3. Find p, q and n of the distribution.

<div align="center">

Group 'B'   [13x4=52]

</div>

8. If the roots of the quadratic equation $ax^2 + bx + c = 0$ be in the ratio 3:4, prove that $12b^2 = 49ac$.

9. Find the square roots of $-8 + 6i$

10. Solve by using cramer's or row equivalent matrix method for
    $x - y + 2z = 0$, $2x - 2y + z = -3$, $x - 2y + 3z = -1$.

11. Solve the linear programming problem using graphic method of maximize $z = x + y$ subject to the constraints $2x + y \leq 14$, $x + 2y \leq 10$, $x, y \geq 0$.

12. Prove that: $y^2 = 4ax$ (Standard form of parabola).

13. Find the centre, vertex, focus, equation of directrix and length of lactus rectum of $9x^2 + 4y^2 - 18x - 16y - 11 = 0$

14. Using the Vector method, prove that
    $\sin(A + B) = \sin A \cdot \cos B + \cos A \sin B$.

15. Show that the vectors are coplanar: $\vec{a} - 3\vec{b} + 5\vec{c}$, $\vec{a} - 2\vec{b} + 3\vec{c}$ and $-2\vec{a} + 3\vec{b} - 4\vec{c}$.

16. Find the equation of the plane which contains the lines of intersection of the planes $6x + 4y - 5z = 2$ and $x - 2y + 3z = 0$ and is perpendicular to the plane $3x - 2y + z = 5$.

17. Find the point where the line through $(1, 5, 11)$ and $(-1, -1, -1)$ meets yz-plane.

18. Find the quartile deviation and coefficient from the following data.

Class size	15-20	20-25	25-30	30-35	35-40	40-45	45-50
Frequency	15	33	56	65	42	37	28

19. Calculate the Karl Pearson's correlation coefficient of the data.

X	12	14	16	18	12	15	16	17
Y	1	5	7	3	9	4	3	4

20. Find the probability of getting three head in six tosses of a coin.

Good Luck !

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Special Scholarship Exam-2081 Jestha/Ashad,

Program: **Engineering All**   Full Marks: **80**

Year/Part: **I/II (2021)** © **Arjun**   Pass Marks: **32**

Subject: **Engineering Mathematics II**   Time: **3 hrs.**

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

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Group 'A'

Attempt ALL questions.   [7×(2+2)=28]

1. a) Determine the nature of roots of the equation $x^2 + 5x + 6 = 0$.

   b) If $z = 2 + i, w = 1 + 2i$, show that $\overline{z + w} = \overline{z} + \overline{w}$.

2. a) Find x if $AX = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$ where $A = \begin{pmatrix} 4 & 0 \\ 0 & 5 \end{pmatrix}$.

   b) Find the modulus of the complex number: $\frac{-1+2i}{1+3i}$.

3. a) Find the equation of parabola whose vertex at $(0, 0)$ and focus at $(0, 3)$.

   b) Find the equation of an ellipse whose foci $(0, \pm 5)$ and eccentricity $\frac{1}{3}$.

4. a) If α, β and γ are the angles which a line makes with the co-ordinate axes, the prove that $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 2$.

   b) Find the equation of the plane that makes intercepts $3, -1, 6$ on the co-ordinate axes.

5. a) If $\vec{a} = (2, -3)$ and $\vec{b} = (4, 2)$. Find the unit vector along $4\vec{a} - 3\vec{b}$.

   b) If $\hat{a} = (1, 2)$ and $\hat{b} = (3, 4)$, Find $2\hat{a} - 3\hat{b}$. Also find (i) its magnitude (ii) direction.

6. a) For what value of x is the pair of vector $x\hat{i} - 2\hat{j} + 4\hat{k}$ and $2\hat{i} - 7\hat{j} + \hat{k}$ orthogonal?

   b) A card is drawn at random from a well shuffled deck of 52 cards. What is the probability it is a spade?

7. a) If $n = 10, \sum x = 60, \sum y = 60, \sum x^2 = 400, \sum y^2 = 580$ and $\sum xy = 415$. Find the correlation coefficient between the two variables.

   b) The AM of 3, 7, 13, 15 and x is 12. Find x.

Cont. ....

Group 'B'

8. Prove that vector method: $\cos(A - B) = \cos A.\cos B + \sin A.\sin B$.

9. Optimize the function $F = 9x + 7y$, subject to $x + 2y =\leq 7$, $x - y \leq 4, x \geq 0, y \geq 0$.

10. State and prove De-Moivre's theorem for positive integer n. Express $\sqrt{3} + i$ in the polar form.

11. Solve the following system of equation Cramer's rule:
$2x - 3y - z = 4$
$x - 2y - z = 2$
$x - y + 2z = 9$

12. Show that the roots of the equation $(a^2 - bc)x^2 + 2(b^2 - ca)x + (c^2 - ab) = 0$ will be equal, if either $b = 0$ or $a^3 - b^2 + c^3 - 3abc = 0$.

13. Find the vertex, focus, direction and length of latus rectum of the parabola $y^2 = 6y - 12x + 45$.

14. Find the dc's l, m, n of two lines which are connected by the relations $4l + 3m - 2n = 0$ and $lm - mn + nl = 0$.

15. Find the equation of the plane through the intersection of the planes $x + 2y + 2z - 9 = 0$ and $4x - 3y + 12z + 15 = 0$ and passing through the origin.

16. Find the value of the determinant by using Sarrus rule: $\begin{vmatrix} 4 & 7 & 5 \\ 8 & 6 & 3 \\ 5 & 3 & 7 \end{vmatrix}$

17. Show by the vector method "The angle in a semi-circle is a right angle".

18. A problem in statistics is given to three students A, B, C whose chances of solving it are $\frac{1}{3}, \frac{1}{4}, \frac{1}{5}$ respectively, find the probability that the problem will be solved.

19. Calculate mean, standard deviation and C.V. from the following data:

Age:	0-10	10-20	20-30	30-40	40-50
No of Students:	7	12	24	10	7

20. Find the regression equation of x on y from the following data:

x	2	4	6	8	10	12
y	5	6	13	16	13	24

Good Luck!

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Regular/Back Exam-2080 Mangsir/Poush

AC

Program:	Engineering All	Full Marks: 80
Year/Part:	I/II (2021) © Arjun	Pass Marks: 32
Subject:	Engineering Mathematics II	Time: 3 hrs.

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

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Group 'A'

Attempt ALL questions. [7×(2+2)=28]

1. a. If the equation $x^2+2(k+2)x+9k=0$ has equal roots. Find k.

   b. Find the conjugate of the complex number $\frac{3+4!}{3-4!}$.

2. a. If $A = \begin{pmatrix} 2 & -1 \\ 0 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 1 \\ -2 & 4 \end{pmatrix}$. Find $(AB)^T$.

   b. If w be a cube roots of unity, prove that $(1-w+w^2)(1+w-w^2)=4$.

3. a. Find the equation of the parabola if vertex = (3, 2) and focus = (3, 4).

   b. Find the foci of the hyperbola $3x^2-4y^2=36$.

4. a. Find the direction cosines of a line which are equally inclined to the axes.

   b. Find the distance between the parallel planes $3x+2y-6z=1$ and $6x+4y-12z+9=0$.

5. a. If $\vec{a} = 2\vec{i} + 3\vec{j}$ and $\vec{b} = -\vec{i} + \vec{j}$ find the unit vector along $2\vec{a} - 3\vec{b}$.

   b. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$. Prove that $\vec{a}$ is perpendicular to $\vec{b}$.

6. a. Find the area of the triangle whose two sides are determined by the vectors:

   $2\vec{i} - \vec{j} + \vec{k}$ and $3\vec{i} + 4\vec{j} - \vec{k}$

   b. Two coins are tossed simultaneously. Find the probability of getting at least one head.

7. a. If mean and median of the given data are 3.5 and 4.5. Find mode.

b. If $n = 15$, $\sigma_x = 3.2$, $\sigma_y = 3.4$ and $\sum(x - \bar{x})(y - \bar{y}) = 122$.
Find the correlation coefficient between the two variables.

Group 'B'

Attempt ALL questions. [13×4=52]

8. Prove that quadratic equation $ax^2+bx+c=0$, $a\neq0$ cannot have more than two roots.

9. Prove that:
$$\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ yz & zx & xy \end{vmatrix} = (y - z)(z - x)(x - y)(xy + yz + zx)$$

OR

Solve by row equivalent matrix method or Cramer's rule:
$x+y+z=1$
$x+2y+3z=4$
$x+3y+7z=13$

10. Maximize $z=3x+5y$ subject to constraints $3x+2y\leq18$, $x\leq4$, $y\leq6$ and $x, y\geq0$.

11. Using De-Moivre's theorem. Find the fourth roots of unity.

OR

Define absolute value of a complex number. If z and w be two complex number then $|z+w| \leq |z| + |w|$.

12. Define parabola. Find the equation of the parabola in the standard form $y^2=4ax$.

13. Show that $x^2+4y^2-4x+24y+24=0$ represents the equation of an ellipse. Find center vertices focus and length of axes.

OR

Determine the equation of the hyperbola in the standard position with focus at $(-7, 0)$ and eccentricity $\frac{7}{4}$.
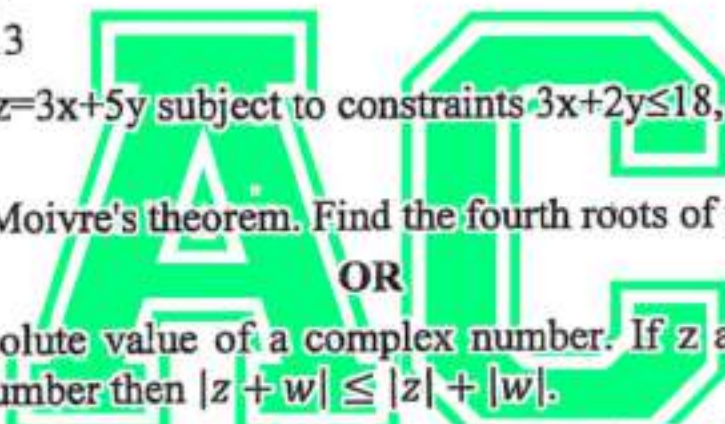
14. Find the equation of the plane through the points $(1, 2, 1)$, $(2, 2, 2)$ and $(0, 1, 0)$.

15. Find the ratio in which the yz plane divides the line joining $(4, 6, 7)$ and $(-1, 2, 5)$. Also find the coordinates of the point in the yz plane.

OR

Find the angle between two lines whose direction cosines are given by $l+m+n=0$ and $2lm+2ln-mn=0$.

16. Prove by vector method that:
$$\sin(A - B) = \sin A . \cos B - \cos A . \sin B$$

17. Prove that the three vectors $\vec{a} - 2\vec{b} + 3\vec{c}, -2\vec{a} + 3\vec{b} - 4\vec{c}$ and $-\vec{b} + 2\vec{c}$ are coplanar.

OR

If ABCDEF is a regular hexagon and O is its center, then show that:
$$\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF} = 6\overrightarrow{AO}$$

18. Find the coefficient from of variation from the following data:

Class	0-10	10-20	20-30	30-40	40-50
Frequency	2	4	6	7	3

19. Calculate Karl Pearson's coefficient of correlation from the following data:

Age of Husband	23	22	24	23	26	27
Age of Wives	20	18	20	21	21	22

20. A class consists of 40 boys and 60 girls. If two students are chosen at random, what will be the probability that (a) both are boys (b) both are girls (c) one boy and one girl?

OR

The incidence of occupation disease in an industry is such that the workmen have a 20% chance of suffering from it. What is the probability that out if six workmen four or more will contact the disease?

Good Luck !

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Regular/Back/Special Exam-2080, Mangsir/Poush

Program: Diploma in Engineering All

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Full Mark: 80

Year/Part: I/II (Old+Very Old Course)

Pass Mark: 32

Subject: **Engineering Mathematics II**

Time: 3 hrs.

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

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Group 'A'

Attempt All questions.

[3x(5+5)=30]

1. a) By using De-Moivres theorem find the cube root of i.

   b) If w be a cube root of unity, prove that:
   $$(2 + w + w^2)^3 + (1 + w - w^2)^8 - (1 - 3w + w^2)^4 = 1$$

2. a) Find the area of the triangle whose two sides are determined by the vectors $2\vec{i} + \vec{j} + \vec{k}$ and $3\vec{i} + 4\vec{j} - \vec{k}$.

   b) Find the equation of the plane through the points $(4, 5, 1)$, $(3, 9, 4)$ and $(-4, 4, 4)$

3. a) Solve by using Cramer's rule of Row equivalent matrix:
   $$x + 2y - 3z = 9$$
   $$2x - y + 2z = -8$$
   $$3x - y - 4z = 3$$

   b) Prove that:
   $$\begin{vmatrix} b+c & a & b \\ c+a & c & a \\ a+b & b & c \end{vmatrix} = (a+b+c)(a-c)^2$$

Group 'B'

Attempt All questions.

[10x5=50]

4. Sand is pouring from a pipe at the rate of 18 cm³/sec. The falling sand forms a cone on the ground in such a way that the height of the cone is one-sixth of the radius of the base. How fast is height of the cone increasing when its height is 3cm?

5. A man who has got 144 metres of fencing material wishes to enclose a rectangular garden. Find the maximum area he can enclose.

6. Find the Area bounded by the curve $y^2 = 16x$ and the line $y = 2x$.

OR

Find the area bounded by the curve $\frac{x^2}{16} + \frac{y^2}{9} = 1$

7. Prove that the line joining the points (1, 2, 3) and (-1, -2, -3) is perpendicular to the line joining the pints (-2, 1, 5) and (3, 3, 2).

8. Maximize and minimize $F = 9x + 7y$ subject to $x + 2y \leq 7$, $x - y \leq 4$, $x \geq 0$, $y \geq 0$.

9. A committee of 3 is to be formed from 6 men and 4 women. What is the probability that all three are women?

10. A company that produces 10% of its products are defective among such 6 products find the probability that one is defective

11. Calculate the quartile deviation and its coefficient from the following data:

Class	10-15	15-20	20-25	25-30	30-35	35-40	40-45
Frequency	2	4	6	7	3	1	5

12. Find the regression equation of y on x from the following data Also find the value of y when $x = 5$

X	2	4	6	8	10	12
Y	5	6	13	16	13	24

13. Show that the vectors: $\vec{i} + \vec{j} + \vec{k}, 2\vec{i} + 3\vec{j} - \vec{k}$ and $-\vec{i} - 2\vec{j} + 2\vec{k}$ are co-planar.

Good Luck!

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Regular/Back Exam-2079, Phagun/Chaitra

Program:	Engineering All	Full Marks: 80
Year/Part:	I/II (2021) © Arjun	Pass Marks: 32
Subject:	Engineering Mathematics II	Time: 3 hrs.

Candidates are required to give ~~their answers in their own words as far as practicable. The~~
figures in the margin indicate full ~~marks.~~

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Group 'A'

Attempt ALL questions. [7×(2+2)=28]

1. a. Form an equation, whose roots are thrice the roots of $3x^2-8x-4=0$

   b. If $a + ib = \sqrt{\frac{1+i}{1-i}}$, prove that $a^2+b^2=1$.

2. a. If $A = \begin{pmatrix} 1 & -2 & 3 \\ -1 & 2 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ 3 & 1 \\ 1 & 2 \end{pmatrix}$, find the matrix of AB–3I where I is a unit of matrix of order 2×2

   b. Express the complex number $-\sqrt{3} + i$ in polar form.

3. a. Fine equation of tangent and normal at point (4, 6) of the parabola $y^2=9x$.

   b. Find the center, vertices, eccentricity and length of latus rectum of the ellipse, $25x^2+4y^2=100$.

4. a. Find the ratio in which zx-plane divides the segment joining (2, 4, 8) and (1, 6, 7).

   b. Find angle between two planes: $3x+2y-6z=7$ and $2x+3y+2z-5=0$.

5. a. If $\vec{a} = (2,-1), \vec{b} = (-2,-3)$, find $2\vec{a} + 3\vec{b}$, its magnitude and unit vector along $2\vec{a} + 3\vec{b}$.

   b. If AC and BD are diagonals of a parallelogram ABCD, prove that $\vec{AB} + \vec{DC} = \vec{AC} + \vec{DB}$.

6. a Find unit vector perpendicular to each vectors: $\vec{i} + 3\vec{j} - 4\vec{k}$ and $2\vec{i} + \vec{j} - \vec{k}$

   b. Find the first and third quartile from: 2 ,5 ,7, 10, 20, 16.

7.   a.   Find standard deviation for data: 12, 14, 16, 18, 20

       b.   If mean and variance of a binomial distribution are 40 and 36, find the value of p, q and n.

Group 'B'

Attempt ALL questions.   [13×4=52]

8.   Prove the quadratic equation $ax^2+bx+c=0$ have not more than two roots.

9.   Sovle by using Cramer's rule or row equivalent matrix method for: $3x+5z=14$, $2x+y-3z=3$ and $x+y+z=4$

10.   Using De-Moivre's theorem. Find the square roots of $2 + 2\sqrt{3}i$.

11   Find extreme values of $G(x, y) = 10x+15y$ subject to: $x+2y\leq20$, $x+y\leq16$ and $x, y\geq0$

12.   Prove that the line $lx+my+n=0$ will touch the parabola $y^2=4ax$ if $ln=am^2$.

13.   Establish the standard equation of parabola.

14   Prove by vector method that: $\cos(A-B)=\cos A\cos B + \sin A\sin B$

15.   Find the equation of plane through the point $(2, -3, 1)$ and perpendicular to line joining the points $(3, 4, -1)$ and $(2, -1, 5)$.

16.   Prove that the vectors:
$5\vec{a} + 6\vec{b} + 7\vec{c}, 7\vec{a} - 8\vec{b} + 9\vec{c}$ and $3\vec{a} + 20\vec{b} + 5\vec{c}$ are coplanar.

17.   If $\vec{a} = 3\vec{i} + 4\vec{j}$ and $\vec{b} = \vec{i} - \vec{j} + \vec{k}$, show that $\vec{a} \times \vec{b}$ represents a vector which is perpendicular to both $\vec{a}$ and $\vec{b}$.

18.   Find the quartile deviation and its coefficient from the following data:

Class	10-15	15-20	20-25	25-30	30-35	35-40	40-45
Frequency	2	4	6	7	3	1	5

19.   By using product moment formula, calculate the coefficient of correlation:

Price (Rs.)	25	19	28	26	20	18	24	20	22	18
Sales (Unit)	60	54	66	70	53	?	62	51	65	50

Where average sales is 59 units?

20.   A binomial distribution consists of 5 independent trials. If the probabilities of 1 and 2 successes are respectively ¼ and ⅙, find the probability of success and failure in trial. Also, find P (r=3).

Good Luck !

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Regular/Back Exam-2079, Falgun/Chaitra

Program:	Diploma in Engineering All	Full Marks: 80
Year/Part:	I/II (Old +Very Old Course) ©Arjun	Pass Marks: 32
Subject:	Engineering Mathematics II	Time: 3 hrs.

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

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Group 'A'

Attempt All questions. [3×5=80]

1. Define vector product of two vectors. Find the area of triangle [5]
   whose two sides are determined by the vectors

$$2\vec{i} - \vec{j} + \vec{k} \text{ and } 3\vec{i} + 4\vec{j} - \vec{k}$$

2. Prove that Cos (A+B) = CosA. CosB - SinA. SinB by using [5]
   vector method.

3. State De-Movre's theorem. Use it to find the fourth roots of [5]

$$\frac{-1}{2} + i.\frac{\sqrt{3}}{2}$$

4. If z and w are two complex numbers, prove that: [5]

$$|z + w| \leq |z| + |w|$$

5. Maximize and minimize: $F = 9x + 20y$ subject to [5]
   $y - x \geq 1$; $y - x \leq 3, 2 \leq x \leq 5$.

6. Define transpose of a matrix. If the matrix: [5]

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}, \text{Show that } (AB)^T = B^T A^T.$$

7. Prove that: [5]

$$\begin{vmatrix} a - b - c & 2a & 2a \\ 2b & b - c - a & 2b \\ 2c & 2c & c - a - b \end{vmatrix} = (a + b + c)^3$$

Cont.........

8. Solve by using Cramer's rule or Row equivalent matrix method. [5]

$$5x - 3y = 20$$
$$2x + 3y = 8$$
$$x + y + z = 5$$

9. A closed cylindrical can is to be made so that its volume is 52 [5] cm^3. Find the dimensions if the surface area is to be minimum.

10. A spherical balloon is inflated at the rate of $10ft^3$/sec. At what rate is [5] the radius increasing when the radius is 1 ft?

11. Find the area bounded by the curve $y = x$ and $y = x^2$. [5]

12. Find the equation of the plane through (3, 4, 5) and parallel to the [5] plane $x + y + z = 3$.

13. Find the direction cosines of the line which is perpendicular to the [5] lines with direction cosines proportional to 3, -1, 1 and -3, 2, 4.

14. Calculate the quartile deviation and its coefficient. From the [5] following data:

Class	10-15	15-20	20-25	25-30	30-35	35-40	40-45
Frequency	2	4	6	7	3	1	5

15. Calculate coefficient of correlation between the variables X [5] and Y:

X	12	14	16	18	12	15	16	17
Y	1	5	7	3	9	4	3	4

16. A committee of 5 is to be formed out of a group of 7 men and [5] 6 women. Find the probability that in the committee there will be 3 men and 2 women.

Good Luck!

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Regular/Back Exam-2078, Magh/Falgun (Scholarship+Regular)

Program: Diploma in Engineering All   **Full Mark:** 80

Year: I/II (New+Old Course) © Arjun   **Pass Mark:** 32

Subject: Engineering Mathematics II   *Time: 3 hrs.*

Candidates are required t...
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Group 'A'

Attempt All questions.   [3x(5+5)=30]

1. a) Construct a 3x3 matrix whose elements are given by   [5]
   $a_{ij} = 3i - 2j$.

   b) Solve using row equivalent matrix method or Cramer's   [5]
   rule.

   $$x + y - z = 3$$
   $$2y + z = 10$$
   $$5x - y - 2z = -3$$

2. a) If Z and W are two complex numbers, prove that   [5]
   $|z| + |w| \geq |z + w|$

   b) State and prove De-Moivre's Theorem.   [5]

3. a) Using vector method, prove that   [5]
   $$Sin(A + B) = SinA.CoSB + CoSA.SinB$$

   b) Find the area of the parallelogram determined by the   [5]
   vectors $\vec{i} + \vec{j} + \vec{k}$ and $\overrightarrow{-2i} + \overrightarrow{3j} + \vec{k}$.

Group 'B'

Attempt All questions.   [10x5=50]

4. From the following table calculate the coefficient of correlation.   [5]

X	4	8	10	2	6
Y	8	7	5	11	9

Cont........

5. Find the local maxima and minima and points of inflection : **[5]**

   $f(x) = 2x^3 - 9x^2 - 24x + 3$

6. Find the area of a circle $x^2 + y^2 = a^2$. **[5]**

7. Calculate mean, standard deviation and C.V. from the following data : **[5]**

Age	0-10	10-20	20-30	30-40	40-50
No.of student	7	12	24	10	7

8. If the volume of the expanding cube is increasing at the rate of 24 cm³/min, how fast is the surface area increasing when the surface area is 216 cm²? **[5]**

9. Maximize and minimize $z = 12x + 3y$ subject to $x + y \geq 12$, $3x + 2y \geq 25$ and $x, y \geq 0$. **[5]**

10. A coin is tossed 5 times. Find the probability of getting **[5]**
    i) exactly 2 head   ii) no head

11. Prove that : **[5]**

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)$$

12. Find the equation of the plane through the intersection of the planes $x + y + z = 6$ and $2x + 3y + 4z + 5 = 0$ and perpendicular to the plane $4x + 5y - 3z = 8$. **[5]**

13. A chance that A, B and C can solve a problem is $\frac{1}{3}, \frac{1}{4}$ and $\frac{1}{5}$ respectively. Find the probability that the problem will be solved. **[5]**

Good Luck!

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Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Regular/Back Exam-2077, Chaitra

Program: Diploma in Engineering All   Full Marks: 80
Year/Part: I/II (New+Old Course) © Arjun   Pass Marks: 32
Subject: Engineering Mathematics II   Time: 3 hrs

Candidates are requir
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Group 'A'

Attempt All questions.

1. a) If $\hat{a}$ and $\hat{b}$ are unit vectors and θ be the angle between them prove that $\frac{1}{2}|\hat{a} - \hat{b}| = \frac{\sin\theta}{2}$. [5]

   b) State De-Moivere's theorem. Use it to find the cube roots of unity. [5]

2. a) Define direction cosine. Find the angle between the lines whose direction cosines are given by l_1, m_1, n_1 and l_2, m_2, n_2. 1+4=5]

   b) Find the projection of the line AB on CD if the co-ordinates of the points A, B, C, and D are (0, 5,, 0) (1, 2, 4), (-1, 3, 0) and (3, 5, 6) respectively. [5]

3. a) Solve by Cramer's rule or inverse matrix method of the equation $x + y - z = 3, 2y + z = 10$ and $5x - y - 2z = -3$. [5]

   b) Find the local Maxing and local Minima of the function $f(x) = 2x^3 - 3x^2 - 36x$ Also, find the point of inflection. [5]

Group 'B'

4. Find the area of the circle $x^2 + y^2 = 36$ using method of integration. [5]

5. A class consists of 60 boys and 40 Girls. If two students [5]
   are choosen at random what is the probability that :

   i) both are boys   ii) one boy and one girl.

6. Prove that : $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = (x-y)(y-z)(z-x)$ [5]

7. Show that by using vector method the angle between two [5]
   diagonals of a cube is $\theta = cos^{-1}\left(\frac{1}{3}\right)$.

8. If ω be the cube root of unity prove that : [5]

   $$(1-\omega)(1-\omega^2)(1-\omega^4)(1-\omega^8) = 9.$$

9. Maximize and minimize $F = 34x + 6y$ subject to $x + y \le$ [5]
   $6, x + y \ge 1, 1 \le x \le 3.$

10. Find the equation of the plane through the points [5]
    $(1, 2, 1), (2, 2, 2)$ and $(0, 1, 0)$

11. Find standard deviation and coefficient of variation (CV) [5]
    of of the data given below.

Class	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	4	6	8	10	4	3

12. Find the regression equation of y on x from the following [5]
    data:

X	2	4	6	8	10	12
Y	5	6	13	16	13	24

Also estimate the value of Y when X = 5.

13. Find the correlation coefficients between x and y of the [5]
    following data:

X	2	3	6	5	10	15	12	20	11
Y	19	17	17	10	17	15	13	14	12

Good Luck !

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur

Regular/Back Exam 2076, Shrawan/Bhadra

Program: Engineering All   © Arjun   Full Marks: 80

Year/ Part: I/II (New + Old Course)   Pass Marks: 32

Subject: Engineering Mathematic - II   Time: 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

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Group 'A'

Attempt All Questions. [3x(5+5)30]

1. (a) State and prove that De-Moivre's Theorem.

   (b) Prove that vector method $\cos(A-B) = \cos A.\cos B + \sin A.\sin B$.

2. (a) Prove that: $\begin{vmatrix} 1 & x & x^3 \\ 1 & y & y^3 \\ 1 & z & z^3 \end{vmatrix} = (x-y)(y-z)(z-x)(x+y+z)$

   (b) If $a-ib = \dfrac{1-ix}{1+ix}$. Prove that $a^2 + b^2 = 1$

3. (a) Calculate the arithmetic mean and standard deviation from the following data:

Marks:	0-4	4-8	8-12	12-16	16-20	20-24
No.of boys:	7	7	10	15	7	6

   (b) A Man who has 144 meters of fencing material wishes to enclose a rectangular garden. Find the maximum area he can enclose.

Group 'B'

Attempt All Questions. [5x10=50]

4. Using Cramer's rule or Row equivalent Matrix Method, solve:

$$x - 2y - 3z = 3$$
$$x + y - 2z = 7$$
$$2x - 3y - 2z = 0$$

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5. Find inverse: $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 5 & 4 \\ 6 & 9 & 7 \end{bmatrix}$

6. Find that the equation of the plane through the point $(2, 2, 1)$ and $(3, 1, 2)$ and perpendicular to the plane $x+2y+3z=5$.

7. Sand is pouring from a pipe at the rate of $18cm^3/sec$. The falling sand forms a cone on the ground in such a way that the height of the cone is one-sixth of the radius of the base. How fast is height of the sand cone increasing when its height is 3 cm?

8. Find the area of circle : $x^2 + y^2 = a^2$

9. ABCD is a parallelogram, G is the point of intersection of its diagonals and if O is any point. Show that:
$$\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} + \overrightarrow{OD} = 4\overrightarrow{OG}$$

10. Calculate the quartile deviation and its coefficient from the following data:

Class:	0-20	20-40	40-60	60-80	80-100
Frequency:	4	8	12	3	5

11. Find the regression equation of x on y from the following data:

X	2	4	5	6	8	11
Y	18	12	10	8	7	5

12. Suppose 3 people are selected at random from a group of 7 Men and 6 Women. What is the probability that 2 Men and 1 Women are selected?

13. Maximize : $F = 2x - y$
    Subject to:

$$X + Y \leq 5$$
$$X + 2Y \leq 8$$
$$X \geq 0$$
$$Y \geq 0$$

Good luck !

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur

Regular/Back Exam-2076, Shrawan/Bhadra

Program: Engineering All **Full Marks: 80**

Year/ Part: I/II(New + DME/DEE/DEX/IT Old Course) **Pass Marks: 32**

Subject: Mathematic - II © Arjun **Time: 3 hrs.**

Candidates are required to give their answers in their own words as far as practicable. T...

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Group A
Attempt All Questions.[3x(5+5)]

1. (a) Define scalar product of two vectors. If $\vec{a}$ and $\vec{b}$ are two vectors of unit length and θ is angle between them show that. $\frac{1}{2}\left|\vec{a} - \vec{b}\right| = \sin\frac{\theta}{2}$

   (b) Prove that $\cos(A+B) = \cos A.\cos B - \sin A.\sin B$ by using vector method.

2. (a) If $A=\begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}$, show that $A^2-2A-5I = 0$, Where ,I is the unit matrix of order 2X2 and 0 is the null matrix of order 2X2.

   (b) Fine the point where the line through (1,5,11) and (-1,-1,-1) meets yz – plane

3. (a) Solve the systems by using cramer's rule
$$x + 2y - 3z = 9$$
$$2x - y + 2z = -8$$
$$3x - y - 4z = 3$$

   (b) Prove that $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ yz & zx & xy \end{vmatrix} = (y - z)(z - x)(x - y)(yz + zx + xy)$

Group B
Attempt All Questions.[5x10]

4. If $x + iy = \sqrt{\frac{1+i}{1-i}}$ then prove that $x^2 + y^2 = 1$

5. If z and W are two complex numbers prove that
$|z + w| \le |z|+|w|$

6. Find the local maxima and local minima and point of inflection:
   $f(x) = 2x^3 - 9x^2 - 24x + 3$

7. A spherical balloon is inflated at the rate of $10 \text{ft}^3/\text{sec}$. At what rate is the radius increasing when radius is 1ft.?

8. Find the first four moments of the following data
   2,4,6,8,10

9. The mean and standard deviation of the binomial distribution are 40 and 6 respectively. Find the the valve of η, p, q.

10. A bag contains 5 white , 7 red and 8 black balls . If two balls are drawn one by one without replacement , what is the probability that both are white?

11. Find the area between the curve $y^2 = 4x$ and the line $y = x$

12. Use the method of summation to find the area bounded by: $y = e^x, x = 0 \text{ and } x = 1$.

13. Determine the maximum value of objectives function
    $z = 9x + 40y \text{ subject to } y - x \geq 1, y - x \leq 3, 2 \leq x \leq 5$.

Good luck !

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Regular/Back Exam-2074, Shrawan/Bhadra

Program: Diploma in Mechanical/Automobile/ Civil/   **Full Marks: 80**
Computer/Electrical/Electronics/Architecture
IT/ Electrical & Electronics / Engineering

Year/Part: I/II (New+Old course) © A r j u n   **Pass Marks: 32**

Subject: Engineering Mathematics-II   **Time: 3 hrs.**

Candidates are required to ...
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Group 'A'

empt **All** questions.   [3x(5+5)=30]

1. a. Prove by vector method: $\cos(A+B) = \cos A \cos B - \sin A \sin B$
   b. State De- Moivre's theroem and use it to find the cube roots of unity.

2. a. Find the equation of the plane through the intersection of the planes
       $x + y + z = 6$ and $2x + 3y + 4z + 5 = 0$. and perpendicular to the
       plane $4x + 5y - 3z = 8$

   b. Prove that: $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix} = abc(a - b)(b - c)(c - a)$

3. a. Solve by cramer's rules or Row equivalent matrix method.
      $x + y - z = 3$
      $2y + z = 10$
      $5x - y - 2z = -3$

   b. Find the local maxima, local minima and the points of inflection of
       the function:
       $f(x) = 2x^3 - 15x^2 + 36x + 5$

Group 'B'

Attempt **All** questions.   [10x5=50]

4. A spherical ball of salt dissolving in water decreases its volume at the rate
   of $0.75 \text{cm}^3/\text{min}$. Find the rate at which the radius of the salt is decreasing
   when its radius is 6cm.

5. Find the area bounded by the curve:
   $Y = x^2, x = 0, x = 1$ (use the limit of a sum)

                                                      P.T.O.

6. Find the area bounded by the y-axis, the curve $x^2 = 4(y - 2)$ and the line $y = 11$.

7. If Z and W are complex numbers show that :
$$|Z| + |W| \geq |Z + W|$$

8. Maximized and minimize:
$G = 2x + 3y$ Subject to $x + y \geq 12, 3x + 2y \geq 25, x \geq 0 \text{ and } y \geq 0$

9. State triangle law of vector addition. If ABCDEF is a regular hexagon, show that: $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF} = 6\overrightarrow{AO}$ where 0 is centre of hexagon.

10. Calculate the Karl Pearson's coefficient of correlation.

x	7	3	11	5	9
y	10	12	7	8	6

11. Find the direction cosines l,m,n, of two lines which satisfy the equations l+m+n=0 and 2lm-mn+2nl=0

12. A problem of mathematics is given to the three students A,B &C and the chances of solving it are 1/3, ¼ & 1/5 respectively. Find the probability that the problem will solve.

13. Find the standard deviation and coefficient of variation (C.V) from following data.

x	5	10	15	20	25
y	2	4	1	6	9

Good Luck!

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Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur

Regular/Back Exam-2073, Bhadra/Ashwin

Program: Diploma in Civil/Architecture/Mechanical/ Automobile/ Information Technology/ Computer / Electrical/ Electrical & Electronics/Electronics/ Geomatics/Engineering

Full Mark: 80

Year/Part: I/II (New Course)

Subject: Math II

© Arjun

Pass Mark:32
Time: 3 hrs.

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andidates are required to ~
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Attempt All questions
Group "A" [3x(5+5)=30]

1. a) Define Transpose of a matrix. If $A = \begin{pmatrix} 1 & 2 \\ 3 & 0 \end{pmatrix}$, $B = \begin{pmatrix} 2 & 1 \\ 1 & 2 \end{pmatrix}$, [1+4=5] verify that $(AB)^1 = B^1 A^1$.

   b) Prove that [5]

   $$\begin{bmatrix} a+b+2c & c & c \\ a & b+c+2a & a \\ b & b & c+a+2b \end{bmatrix} = 2(a+b+c)^3$$

2. a) Show that the line joining the points (1,2,2) and (4,5,6) is [5] perpendicular to the line joining (5,-3,4) and (7,-1,1).

   b) Find the equation of the plane containing the lines [5] through the origin with direction cosines proportional to 2,1,-2 and 5,2,-3.

3. a) Define absolute value of a complex number. [1+4=5]

   If $\frac{1-ix}{1+ix} = a - ib$. Prove that $a^2 + b^2 = 1$

   b) Apply De-moiver's theorem to compute the cube roots of [5] unity.

Group "B" [10X5=50]

4. Solve by using Cramer's Rule or ROW Equivalent Matrix [5] method:

   x+y-z=3

   2y+z=10

   5x-y-2z=-3

5. In any △ABC, Prove by vector method that [5]

   $$CosA = \frac{b^2 + c^2 - a^2}{2bc}$$

6. Using vector method find the area of triangle formed by the points A(1,1,1,), B(1,2,3) and C(2,3,4). **[5]**

7. Find local maxima and local minima of the function $f(x)=$ **[2+2+1=5]** $4x^3-15x^2+12x+3$. Also final point of inflection, if exists.

8. A 6 ft. tall man, walks away from 10ft. tall lamp post at the rate of 5 miles/hr. How fast does the end of his shadow move? **[5]**

9. Find the area of the circle $x^2+y^2=4$, using definite integral. **[5]**

10. If the mode of the following distribution is Rs. 24, find the missing frequency corresponding to the class 30-40. **[5]**

Expenditure (Rs.)	0-10	10-20	20-30	30-40	40-50
No. of student	14	23	27	?	15

11. find the two regression equestions from the following data: **[5]**

x:	1	2	3	4	5
y:	1	3	5	7	9

12. There are 10 electric bulbs in the stock of a shop out of which 4 are defectives. In how many ways can a selection of 6 bulbs be made so that 4 of them may be good bulbs? **[5]**

13. Minimize $z(x,y)=2x+5y$ subject to the given system of inequalities. **[5]**

$5x+y\geq 10$, $x+y\geq 4$, $x\geq 0,y\geq 0$. *(Use graph paper)*

Good Luck!

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Group - "A"   [3 x (5+5) = 30]

(a) The position vectors of the points P, Q, R, S are $\vec{i}+\vec{j}+\vec{k}$, $2\vec{i}+5\vec{j}$, $3\vec{i}+2\vec{j}-3\vec{k}$, $\vec{i}-6\vec{j}-\vec{k}$. Prove that the lines PQ and RS are parallel and find the ratio of their lengths.

(b) Using vector method, prove that $\sin(A-B) = \sin A \cos B - \cos A . \sin B$.

(a) Find the equation of the plane through the intersection of the planes $x+y+z=6$ and $2x+3y+4z+5=0$ and perpendicular to the plane $4x+5y-3z=8$.

(b) Find the ad-joint of matrix. $\begin{pmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$

Verify that this matrix and its ad-joint matrix are inverses of each other.

(a) In any matrix, define its cofactor. prove that.

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$$

(b) Use the row equivalent matrices to solve the system:

$x+y+z=6$, $2x+3y+5z=23$, $7x+5y-2z=11$.

Group - "B" [5 x 10 = 50]

4. If $z = a + ib$ and $w = c + id$ be two complex numbers. show that.

i) $\overline{z + w} = \bar{z} + \bar{w}$ ii) $\overline{zw} = \bar{z} \cdot \bar{w}$.

5. Using De-Moiver's theorem, find the square roots of $(4 + 4\sqrt{3}\,i)$.

6. If $x + y = a\,(a > 0)$ find the maximum value of $x^2 y$.

7. A point is moving along the curve $= 2x^3 - 3x^2$ in such a way that its $x =$ co-ordinate is increasing at the rate of 2cm/sec. Find the rate at which the distance of the point from the origin is increasing when the point is at $(2,4)$

8. Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

9. Use the method of summation to find the area bounded by

$y = 4ax^2$, $x = 0$, $x = a$.

10. While calculating the correlation coefficient between two variables x and y, the following results were obtained,

$n = 30, \Sigma x = 120, \Sigma x^2 = 600, \Sigma y = 90, \Sigma y^2 = 250, \Sigma xy = 356.$

It was however, later discovered at the time of checking that two pairs $(x = 8 \ and \ 12, y = 10 \ and \ 7)$ were copied wrongly, the corresponding correct values. $(x = 8 \ and \ 10, \ y = 12 \ and \ 8)$. Obtain the correct value of correlation coefficient.

11. A population consists of five numbers 2, 5, 6, 8, 9. Taking sample size of two, show that the mean of the sampling distribution of sample mean is equal to the population mean.

12. Define 'Binomial distribution'. If a dice is thrown 16 times, find the mean and the standard deviation for the binomial distribution of even numbers.

13. What is a convex polygonal region? Obtain the convex polygonal region satisfying the following inequalities, $y - x \geq 1$, $y - x \leq 4$, $1 \leq x \leq 6$

The End

Council for Technical Education and Vocational Training
Office of the Controller of Examinations
Sanothimi, Bhaktapur
Regular/ Back Exam-2071, Bhadra/Ashwin

Program: Diploma in Civil/ Electrical / Electrical & Electronics/Electronics/ Mechanical/ Automobile/ Computer /IT/ Geomatics Engineering (New Course)

Full Marks: 80

Pass Marks: 32

Year/Part: I/II

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Time: 3 hrs

Subject: Mathematics -II

Candidates are required to give their answers in their own words as far as practi 🌐 **www.arjun00.com.np** indicate full marks.

Group - "A" [3 x (5+5) =30]

1. (a) If a line makes angles $\alpha, \beta, \gamma, \delta$ with the four diagonals of a cube, show that $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma + \cos^2 \delta = 4/3$

    (b) Find the area of the parallelogram determined by the vectors $\vec{i} + \vec{j} + \vec{k}$ and $-2\vec{i} + 3\vec{j} + \vec{k}$.

2. (a) Find the direction cosines of two lines which satisfy the relations $2l + 2m - n = 0$ and $lm + mn + nl = 0$. Also find the angle between the two lines. [3+2=5]

    (b) When does a matrix have its inverse? If $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 0 & -1 \\ 0 & 3 & -1 \end{bmatrix}$ [1+4=5]

    Find is inverse.

3. (a) In any matrix, define its cofactor. Prove that. [1+4=5]

    $$\begin{bmatrix} a+x & b & c \\ a & b+y & c \\ a & b & c+z \end{bmatrix} = xyz \left(1 + \frac{a}{x} + \frac{b}{y} + \frac{c}{z}\right).$$

(b)   Slove by using Cramer's rule or row-equivalent matrix method.

$$x - 2y - z = 7$$
$$2x + y + z = 0$$
$$3x - 5y + 8z = 13.$$

Group - "B"   [5x10 =50]

4.   What are the cube roots of unity? Also show that

$$(1 - w + w^2)^4 + (1 + w - w^2)^4 = -16.$$

5.   Find the square root of $(-5 - 5i)$ by using De-moivre's theorem.

6.   Find the local maxima and minima and points of inflection:

$$f(x) = 2x^3 - 15x^2 + 36x + 5.$$

7.   A spherical ball of salt dissolving in water decrease its volume at the rate of 0.75 cm³/min. find the rate at which the radius of the salt is decreasing when its radius is 6 cm.

8.   Find the area enclosed by an ellipse with major axis 8 cm and minor axis 6 cm.

9.   Use the method of summation to find the area bounded by

$$y = e^x, \ x = 0, \ x = a \text{ and } x = axis.$$

10. Calculate the correlation coefficient between the two variables.

X:	25	19	28	30	18	24
Y:	58	52	65	70	51	62

11. A binomial distribution consist of 5 independent trails. If the probabilities of 1 and 2 successes are respectively $\frac{1}{4}$ and $\frac{1}{3}$ Find the probabilities of successes and failure in trial. Also find $p(r = 3)$.   [4+1=5]

12. Define sampling. Give the principles of sampling. A simple random sample of size 49 is drawn from a large sample. If the population standard deviation is 12, find the standard error of sample mean when the sample is drawn with replacement.   1+2+2=5

13. Maximized and minimize $G = 2x + 3y$ subject to

$$x + v \geq 12, 3x + 2y \geq 25 \text{ and } x, y \geq 0.$$

The End