

COUNCIL FOR TECHNICAL EDUCATION AND VACATIONAL TRAINING
OFFICE OF THE CONTROLLER OF EXAMINATIONS

SANOTHIMI BHAKTAPUR

Regular Exam- 2066

Subject : Mathematics II (New course)

Full marks: 80

Level : Diploma

Pass marks: 32

Year/Part/II

Time: 3 hrs

Program: IT/ Electrical/Mathematical/Electronics Engg.

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

Group "A" [(5+5)x3=30]

Attempt ALL questions:

1. a. If $\vec{a} = (2, 0)$, $\vec{b} = (3, -1)$, find $3\vec{a} + \vec{b}$, $|3\vec{a} + \vec{b}|$ and unit vector along $3\vec{a} + \vec{b}$. For what value of k the vectors $2\vec{i} + 3\vec{j}$ and $k\vec{i} - \vec{j}$ will be orthogonal?
- b. Find cube roots of i by using De-Moivre's theorem

OR

Find the square roots of the complex number $8 + 6i$

2. a. Find the local maxima, local minima and point of inflection of $f(x) = x^3 - 12x + 8$
- b. Define direction cosines of a line. Prove that:
 $l^2 + m^2 + n^2 = 1$ and thus show that $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 2$, where symbols have their usual meaning.
3. a. Calculate the median and 50th percentile from the following frequency distribution.

Class	0-10	0-20	0-30	0-40	0-50
Frequency	5	13	28	44	50

What relation did you get between the median and 50th percentile from your calculation ?

- b. The probabilities that a contractor will get a plumbing contract is $\frac{2}{3}$ and the probability that he will get an electric contract is $\frac{4}{9}$. If the probability of getting at least one contract is $\frac{4}{5}$, what is the probability that he will get both the contract ?

OR

If 20% of the electric bulbs manufactured by a company are defective, find the probability that out of 4 bulbs chosen at random, at most 2 bulbs will be defective.

Group "B" [10x5 = 50]

Attempt any TEN questions:

4. Using vector method, prove that :

$$\cos(A+B) = \cos A \cos B - \sin A \sin B.$$

5. Define vector product of two vectors. Find the area of the parallelogram determined by the vectors:

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

6. Maximize $F = x+y$ subject to the constraints

$$2x + y \leq 20, 2x + 3y \leq 24, x \geq 0, y \geq 0.$$

7. Use the method of summation to find the area bounded by the curve $y=x^2$ between $x=0$ and $x=1$.

8. Show that :
$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)$$

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OR

Solve the following system of equations using Cramer's rule or row equivalent matrix method :

$$x - y + 2z = 0, x - 2y + 3z = -1, 2x - 2y + z = -3.$$

9. The following are the marks obtained by a group of students in 6 different papers in an examination.

Paper No.	I	II	III	IV	V	VI
Marks of group A	10	18	25	35	40	46
Marks of group B	15	17	27	23	26	30

Determine which group is more consistent.

10. The radius of a circle is increasing uniformly at the rate of 0.3 cm per sec. At what rate is the area increasing when the radius is 10 cm?
11. A man who has 144 ft of fencing material wishes to enclose a rectangular garden. Find the maximum area he can enclose
12. Find the area between the curves : $y^2 = 4ax$ and $x^2 = 4ay$.

OR

Find the area bounded by the circle $x^2 + y^2 = a^2$.

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