Council for Technical Education and Vocational Training

**Office of the Controller of Examinations**

Sanothimi, Bhaktapur

**Regular/Back/Scholarship Exam – 2081 Chaitra/Baishakh**

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

**Year/Part:** I/I (2021) — **Pass Marks: 32**

**Subject:** Engineering Mathematics I — **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.*



## Group 'A'

**Attempt ALL questions.** **[7×(2×2)=28]**

1. a. Let $\cup = \{a, e, i, o, u\}, A = \{a, e, i\}$ and $B = \{e, i, o\}$ then show that $\overline{A \cup B} = \bar{A} \cap \bar{B}$.

   b. Rewrite $-4 \leq x \leq -1$ with using absolute value sign.

2. a. Prove that: $tan^{-1}\sqrt{x} = \frac{1}{2}cos^{-1}\left(\frac{1-x}{1+x}\right)$

   b. If $2cosA = sinB : sinC$ show that the triangle is isosceles.

3. a. In any triangle ABC show that $sinA + sinB + sinC = \frac{S}{R}$.

   b. Evaluate: $\lim_{x \to \infty} \frac{4x^2+5x+7}{3x^2+2x+3}$

4. a. Find $\frac{dy}{dx}$; when $y = \sqrt{3x^2 + 5x + 7}$

   b. Find $\frac{dy}{dx}$; when $y = \log(sin4x)$

5. a. Evaluate: $\int \frac{2x+5}{x-3}\, dx$

   b. How many numbers of three different digits greater than 500 can be formed from the integers 1, 2, 3, 4, 5, 6?

6. a. If $a^x = b^y = c^z$ and $a, b, c$ be in GP then prove that $x, y, z$ are in HP.

   b. If $x = y - \frac{y^2}{2!} + \frac{y^3}{3!} + \cdots \infty$ show that $y = x - \frac{x^2}{2} + \frac{x^3}{3} - \cdots \infty$.



*Cont. .....*

7. a. Find the distance between two parallel line $3x+4y+5=0$ and $6x+8y+24=0$.

b. Find the angle represented by $2x^2+7xy+3y^2=0$.

## Group 'B'

**Attempt ALL questions.** **[13×4=52]**



8. Let f:R→R and g:R→R defined as $f(x)=3x-2$ and $g(x)=2x+1$ respectively then find:

a. fog(x) b. gof(x) c. $g^{-1}(x)$

**OR**

If $x = log_{2a}a,\ y = log_{3a}2a,\ z = log_{4a}3a$ prove that $2yz=1+xyz$.

9. Prove that: $cot^{-1}3 + cosec^{-1}\sqrt{5} = \frac{\pi}{4}$

**OR**

Prove that: $tan^2x = secx - 1$

10. In any ΔABC show that $sin\frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{bc}}$.

**OR**

If (a+b+c)(b+c-a)=3bc show that A=60°.

11. Evaluate: $\lim_{x\to\theta} \frac{xsin\theta-\theta sinx}{x-\theta}$

**OR**

Evaluate: $\lim_{x\to 0} \frac{tan2x-sin2x}{x^3}$

12. Find from first principle; the derivative of $sin2x$ **OR** $log(ax+b)$.

13. Integrate: (any **ONE**)

a. $\int \frac{dx}{x^2\sqrt{9-x^2}}$ b. $\int e^x sinx\ dx$

14. Sum to $n$ terms of the series: 8+88+888+...

15. Sum to infinity: $\frac{1.2}{1!} + \frac{2.3}{2!} + \frac{3.4}{3!} + \cdots$

16. Prove that: $n_{C_r} + n_{C_{r-1}} = {}^{n+1}C_r, 1 \le r \le n$

17. Find the equation of the circles through the points (2, 3), (3, 1) and (–3, –1).



*Cont. .....*

18. If P is the length of perpendicular drawn from the origin on the line $\frac{x}{a}+\frac{y}{b}=1$ then prove that $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{p^2}$.

**OR**

Find the equations of the bisectors of the angles between the lines $4x-3y+1=0$ and $12x-5y+7=0$ and hence verify that the bisectors are at right angles.

19. Prove that the straight lines joining the origin to the points of intersection of the line $\frac{x}{a}+\frac{y}{b}=1$ and the curve $x^2+y^2=c^2$ are at right angles if $\frac{1}{a^2}+\frac{1}{b^2}=\frac{2}{c^2}$.

**OR**

Prove that $ax^2+2hxy+by^2=0$ always represents pair of straight line passing through origin.

20. Find $\frac{dy}{dx}$: (any **ONE**)

a. $x^2+y^2=sinxy$

b. $x^3y^4=(x+y)^7$

***Good Luck !***

Council for Technical Education and Vocational Training

**Office of the Controller of Examinations**

Sanothimi, Bhaktapur

**Back Exam – 2081/2082 Chaitra/Baishakh**

**Program:** Engineering All

**Year/Part:** I/I (2013)

**Subject:** Engineering Mathematics I

**Full Marks: 80**

**Pass Marks: 32**

**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.*



## Group 'A'

**Attempt ALL questions.** **[3×(2×5)=30]**

1. a. Evaluate: $\lim_{x\to\theta}\frac{x\sin\theta-\theta\sin x}{x-\theta}$

   b. If $\cos^{-1}x+\cos^{-1}y+\cos^{-1}z=\pi$ prove that $x^2+y^2+z^2+2xyz=1$.

2. a. In any $\Delta ABC$; prove that $\cos A=\frac{b^2+c^2-a^2}{2bc}$

   b. Prove that: $r_1r_2+r_2r_3+r_3r_1=s^2$

3. a. Find sum to infinity: $1+2x+3x^2+4x^3+\ldots\ldots\infty$

   b. Solve for $n$ the equation: $c(n+2, 4)=6c(n, 2)$

## Group 'B'

**Attempt ALL questions.** **[10×5=50]**

4. Form a quadratic equation whose roots are twice the roots of $5x^2+7x+9=0$.

5. Find the condition that $lx+my+n=0$ will be tangent to the circle $x^2+y^2+2gx+2fy+c=0$.

6. Find the eighth term in the expansion of $\left(3x^2-\frac{1}{2x}\right)^{12}$

7. If a, b, c be in AP, b, c, a in HP then show that c, a, b are in GP.

8. Find $\frac{dy}{dx}$ (any **ONE**)

   a. $x^2+y^2=\tan xy$

   b. $y=\frac{1}{\sqrt{3x+2}-\sqrt{3x-3}}$



*Cont. .....*

9. Find the differential coefficient of any **ONE** by first principle:

   a. $\sin^2 x$

   b. $\frac{1}{\sqrt{3x+5}}$

10. Integrate: (any **ONE**)

   a. $\int \frac{dx}{\sqrt{x^2-a^2}}$

   b. $\int \frac{3x+2}{x+3} dx$

11. Find the equation of the straight line through the point (2, 3) and parallel to the straight line $4x-3y=10$.

12. Find the angle represented by $ax^2+2hxy+by^2=0$.

13. Define one to one function. If $g(x)=2x$ and $fog(x)=6x-2$ then find the value of $x$ such that $(gof)(x)=10$.

***Good Luck !***

Council for Technical Education and Vocational Training

# Office of the Controller of Examinations

Sanothimi, Bhaktapur

## Regular/Back/Scholarship Exam - 2080/2081, Chaitra/Baishakh

| | | |
|---|---|---|
| **Program:** | **Diploma in Engineering All** | **Full Marks: 80** |
| **Year/Part:** | **I/I (2021)** | **Pass Marks: 32** |
| **Subject:** | **Engineering Mathematics I** | **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.*



### Group 'A'

**Attempt ALL questions.** [7×(2+2)=28

1. a. Define power set of a set. If $s = \{1,2\}$, find its power set.
   b. Prove that: $\log(1+2+3) = log1 + log2 + log3$
2. a. Find the general solution of $cos4\theta = cos2\theta$
   b. Prove that: $\sin(2\sin^{-1}x) = 2x\sqrt{1-x^2}$
3. a. Prove that: $\tan^{-1}\left(\frac{2x}{1+x^2}\right) = 2\tan^{-1}x$
   b. Define indeterminate form of limit with example.
4. a. Evaluate: $\lim_{x\to 2}\left(\frac{x^2-3x+2}{x-2}\right)$
   b. Find the limit of: $\lim_{\theta\to 0}\frac{sinp\theta}{\theta}$
5. a. Find $\frac{dy}{dx}$ of $y = ax^4 + 6x^3 + cx^2$
   b. Establish the relation:
      i. A.M > G.M > H.M
      ii. $(G.M)^2$ = A.M×H.M for the numbers 9 and 36
6. a. How many numbers between 4000 and 5000 can be formed with the digits 2, 3, 4, 5, 6, 7?
   b. Show that: $\frac{1}{1!}+\frac{2}{2!}+\frac{3}{3!}+\cdots = e$
7. a. Find the equation of straight line passing through (2,1) and perpendicular to the line $2x + y = 5$
   b. Find the equation of the straight line whose perpendicular distance from the origin $p = 3$ and $\alpha = 120°$

*Cont. .....*

## Group 'B'

**Attempt ALL questions.** [13×4=52]

8. Define composite function. If $f(x) = 3x + 4$ and $g(x) = 2x + 2$ then prove that $fog(x) = gof(x)$ and find $f^{-1}og(-2)$

**OR**

If $x = log_{2a}(a)$, $y = log_{3a}(2a)$, $z = log_{4a}(3a)$, prove that $1 + xyz = 2yz$

9. Show that: $x^2 + y^2 + z^2 + 2xyz = 1$ if
$$\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = \pi$$

10 In any triangle ABC, prove that : $\frac{a+b}{c} sin\frac{c}{2} = cos\frac{A-B}{2}$

11. Find the sum to infinity: $1 - 3a + 5a^2 - 7a^3 + \ldots\ \ldots\ \ldots, |a| < 1$

12. From 5 boys and 4 girls a committee of 5 is to be formed. In how many ways can this committee be done 80 as to include at least one girl?

13. If the coefficient of x in the expansion of $\left(x^2 + \frac{k}{x}\right)^5$ is 270, find k.

14. Prove that the equation of the straight line through the point $(acos^3\theta, asin^3\theta)$ and perpendicular to the line $xsec\theta + ycosec\theta = a$ is $xcos\theta - ysin\theta = acos2\theta$

15. Find the center and radius of the circle:
$x^2 + y^2 - 12x - 4y = 9$

16. P and Q are two points on the line $x - y + 1 = 0$ and are at distance 5 from the origin. Find the area of the triangle OPQ.

17. Show that : $\lim_{x\to 0} \frac{|x|}{x}$ does not exist.

**OR**

Evaluate : $\lim_{x\to\theta} \frac{xcos\theta - \theta cosx}{x - \theta}$

18. Find the derivative from first principle of $cosx$ or $x^2 - 2$

19. Find $\frac{dy}{dx}$: (any **ONE**)

a) $y = \tan(5x^2 + 6)$ b) $xy = \log(x^2 + y^2)$

20. Integrate: (any **ONE**)

a) $\int (2x + 3)\sqrt{3x + 1}\, dx$ b) $\int sin^3x\, cosx\, dx$

c) $\int x\, logx\, dx$

*Good Luck!*

Council for Technical Education and Vocational Training

**Office of the Controller of Examinations**

Sanothimi, Bhaktapur

# Regular Scholarship Exam – 2080 Poush

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

**Year/Part:** I/I (2021) | **Pass Marks: 32**

**Subject:** Engineering Mathematics I | **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.*



## Group 'A'

**Attempt ALL questions.** **[7×(2×2)=28]**

1. a. If $n(A) = 37, n(B) = 50$ *and* $ACB$ then find $n(A \cup B)$ and $n(A \cap B)$.

   b. Prove that: $log_a x^2 - 2log_a \sqrt{x} = log_a x$

2. a. Solve: $cos5\theta - cos3\theta = 0$

   b. Prove that: $\sin(2sin^{-1}x) = 2x\sqrt{1-x^2}$

3. a. Prove that: $sinA + sinB + sinC = \frac{S}{R}$

   b. Evaluate: $\lim_{x\to 2} \frac{x^2-5x+6}{x^2-x-2}$

4. a. Find $\frac{dy}{dx}$ when $y = \frac{1}{\sqrt[3]{x^2-2x+1}}$.

   b. Integrate: $\int \frac{2x+3}{x+1} dx$

5. a. Integrate: $\int sin^2 x \; dx$

   b. Find the sum of the series: 1+4+7+10+… to 40 terms.

6. a. In how many ways can eight people be seated in a row of eight seats if two people insist on sitting next to each other?

   b. Expand $(2a + b)^5$ by the binomial theorem.

7. a. Find the equation of the circle with center at the point $(-1, 2)$ and passing through the point $(5, -8)$.

   b. Find the single equation represented by the lines $x - y = 0$ and $x + y = 0$.

**Cont. .....**

## Group 'B'

**Attempt ALL questions.** [13×4=52]

8. Let $f: R \to R$ and $g: R \to R$ be defined by $f(x) = x^2 + 1$ and $g(x) = x^5$. Find $f^{-}(x), fog(x)$ and $gof(x)$.

**OR**

Prove that: $x^{logy-logz} . y^{logz-logx} . z^{logx-logy} = 1$

9. Solve $\sqrt{3}sinx - cosx = \sqrt{2}$ for $0 \leq x \leq 2\pi$.

10. If $tan^{-1}x + tan^{-1}y + tan^{-1}z = \frac{\pi}{2}$, then prove that $xy + yz + zx = 1$.

11. A function $f(x)$ is define as follows:

$$f(x) = \begin{cases} 2x+3 & \text{for } x<1 \\ 4 & \text{for } x=1 \\ 6x-1 & \text{for } x>1 \end{cases}$$

Is the function continuous at $x = 1$? If not, how can you make it continuous?

12. Find $\frac{dy}{dx}$ from first principles of $y = \sqrt{tanx}$.

13. **Evaluate:** $\int \frac{1}{1-cosx} dx$

14. Find $\frac{dy}{dx}$ when $x^2 + y^2 = \sin(xy)$.

15. Find the sum of: 4+44+444+..... to n terms.

16. Find the sum of the series: 1+(1+2)+(1+2+3)+ ..... to n terms.

17. A person has 12 friends of whom 8 are relatives. In how many ways can he/she invite 7 friends so that 5 of them may be relatives?

18. Prove that the three lines $x + 3y = 5, 2x - y = 3$ and $7x + 5y - 17 = 0$ are concurrent. Also, find the point of concurrency.

19. Find the equation of the two lines represented by the equation $2x^2 + 3xy + y^2 + 5x + 2y - 3 = 0$. Find their points of intersection and also the angle between them.

20. Find the equation of tangent and normal to the circle $x^2 + y^2 - 3x + 10y - 15 = 0$ at $(4, -11)$.

***Good Luck !***

Council for Technical Education and Vocational Training

# Office of the Controller of Examinations

Sanothimi, Bhaktapur

## Back/Scholarship Exam-2080/2081, Chaitra/Baishakh

**Program:** Diploma in Engineering All — **Full Marks: 80**

**Year/Part:** I/I (2013, 2014, 2015, 2016, 2017, 2018) — **Pass Marks: 32**

**Subject:** Engineering Mathematics I — **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*



### Group 'A'

**Attempt ALL questions.** [(5×2)×3=30]

1. a. Evaluate: $\lim_{x\to 0}\frac{\tan 2x-\sin 2x}{x^3}$

   b. Test the continuity or discontinuity at x=2 if a function is defined by: $f(x)=\begin{cases}2x+5 & for \quad x\le 2\\ 3x+1 & for \quad x>2\end{cases}$

2. a. If the quadratic equation $ax^2+bx+c=0$ and $bx^2+cx+a=0$ have a common root, then prove that $a+b+c=0$ or $a=b=c$.

   b. If $a^x=b^y=c^z$ and a, b, c are in GP then prove that x, y, z are in HP.

3. a. In any triangle ABC if $a^4+b^4+c^4=2c^2(a^2+b^2)$ prove that C=45° or 135°.

   b. If $\cos^{-1}x+\cos^{-1}y+\cos^{-1}z=\pi$ then prove that $x^2+y^2+z^2+2xyz=1$.

   **OR**

   Find the general solution of $\tan\theta+\tan 2\theta=\tan 3\theta$.

### Group 'B'

Attempt any TEN questions. [10×5=50]

4. Find the derivative by using definition: (any ONE)

   a. $y=e^{ax+b}$ b. $\cos^2 x$

5. Find $\frac{dy}{dx}$ for: (any ONE)

   a. $x^2+y^2=3xy$ b. $x=a^2\tan t$ and $y=2a\sec t$

Cont. .....

6. Integrate: (any **ONE**)

a. $\int \frac{1}{x^2\sqrt{x^2-a^2}}dx$

b. $\int_1^2 \frac{\sin(\log x)}{x}dx$

7. Find the coefficient of $x^5$ in the expansion of $\left(x^2+\frac{1}{x}\right)^{10}$

8. Find the sum to n terms:
$1.2^2+2.3^2+3.4^2+\ldots\ldots$

9. A committee of 5 is to be formed out of 6 gents and 4 ladies. In how many ways this can be done when at most two ladies are included?

10. Find the equation of sides of an equilateral triangle whose vertex is $(-1, 2)$ and base is $y=0$.

11. If P is the length of perpendicular dropped from origin on the line $\frac{x}{a}+\frac{y}{b}=1$ then prove that $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{p^2}$.

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

13. Find the coordinates of the point of intersection of the line $x-y=1$ and the circle $x^2+y^2=25$.

14. If $\frac{\log x}{y-z}=\frac{\log y}{z-x}=\frac{\log z}{x-y}$ then prove that $x^x.y^y.z^z=1$.

***Good Luck !***

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

**Regular/Back/Scholarship Exam-2080, Baishakh / Jestha**

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

*Candidates are required to give their*
*figures in the margin indicate full mar*



**Group 'A'**

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

1. a) If $U = \{x: x \text{ is a vowel of English Alphabet}\}, A = \{a, e, i\}, B = \{e, i, o\}$ Verify that $\overline{A \cap B} = \overline{A} \cup \overline{B}$.

   b) Let $f: R \to R$ and $R \to R$ be defined by $f(x) = x^3+1$ and $g(x) = x + 5$, Find $(i) fog(x)$ $(ii) gof(x)$

2. a) Solve : $Cos2x - sinx = 0$

   b) Evaluate : $tan^{-1}3 + tan^{-1}\frac{1}{3}$.

3. a) If $2cosA = sinB : sinC$, Prove that the triangle is isosceles.

   b) Evaluate : $\lim_{x \to a} \frac{\sqrt{2x}-\sqrt{x+a}}{x-a}$

4. a) Find $\frac{dy}{dx}$ when $x^2 + y^2 = a^2$.

   b) Integrate : $\int cos^2 x \, dx$

5. a) Evaluate : $\int_0^1 \frac{dx}{x+2}$.

   b) Find the sum of infinite geometric series:
   $1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \cdots$

6. a) In how many ways can the letters of the word "MISSISSIPPI" be Arranged?

   b) Prove that : $\frac{2}{3!} + \frac{4}{5!} + \frac{6}{7!} + \cdots = \frac{1}{e}$

7. a) Find the angle bet$^n$ the lines :
   $2x - y + 3 = 0$ and $x + y - 2 = 0$

   b) Find the equation of circle with centre (3,4) and touching the $x-axis$.

***Cont.....***

## Group 'B'

**Attempt All questions.** **[13×4=52]**

8. If $\frac{\log x}{y-z} = \frac{\log y}{z-x} = \frac{\log z}{x-y}$ prove that $x^x y^y z^z = 1$.
9. Solve: $tanx + tan2x + \sqrt{3}tanx\ tan2x = \sqrt{3}$.
10. If $(a+b+c)(b+c-a) = 3bc$, show that A = 60°.
11. Let $f(x) be\ defined\ by\ f(x) = \begin{cases} 2x+1 & for\ x<1 \\ 2x & for\ x=1 \\ 3x & for\ x>1 \end{cases}$

    i) Does $\lim_{x \to 1} f(x) exist$? ii) Is $f(x)$ continuous at $x = 1$?
12. Find derivatives of $cosx$ by definition.
13. Find $\frac{dy}{dx}$ $when\ x = \frac{1-t^2}{1+t^2}, y = \frac{2t}{1+t^2}$.
14. Compute the integral : $\int e^{sin2x} 2x\ dx$.
15. If $a^x = b^y = c^z$ and a, b, c, are in GP prove that x, y, z are in H.P.
16. Solve for $n : C(n+2, 4) = 6xC(n, 2)$.
17. Find the term independent of $x$ in the expansion of $\left(x^2 - \frac{1}{x^2}\right)^{10}$.
18. Find the equations of bisectors of the angles between the lines $4x - 3y + 1 = 0\ and\ 12x - 5y + 7 = 0$ and hence verify that the bisectors are right angles.
19. Prove that the straight lines joining the origin to the points of intersections of the lines $\frac{x}{a} + \frac{y}{b} = 1$and the curve $x^2 + y^2 = c^2$ are at right angles if $\frac{1}{a^2} + \frac{1}{y^2} = \frac{2}{c^1}$.
20. Find the equation of tangent to the circle $x^2 + y^2 - 2x - 4y - 4 = 0$, Perpendicular to the line $3x - 4y = 1$.

***Good Luck!***

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

**Program: Diploma in Engineering All** | **Full Marks: 60**
**Year/Part: I/I (Old + Very Old)** | **Pass Marks: 24**
**Subject: Engineering Mathematics I** | **Time: 3 hrs.**

*Candidates are required to give thei*
*in the margin indicate full marks.*



**Group'A'**

**Attempt All questions.** **[(5×2)×3=30]**

1. a) State and prove cosine law.
   b) If $\frac{R}{\gamma} = \frac{4}{3}$, Prove that Cos A + Cos B + Cos C = $\frac{7}{4}$.

2. a) Evaluate : $\lim_{x \to \theta} \frac{x\sin\theta - \theta\sin x}{x-\theta}$.

   b) Test the continuity of : $f(x) = \begin{matrix} 3x+2 & for & x<1 \\ 7 & for & x=1 \\ 6x-1 & for & x>1 \end{matrix} \}at\ x = 1.$

   If the function is not continuous at x=1, How can you make it Continuous ?

3. a) Find the condition that the general equation of second degree $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ always the pair of straight line.
   b) The sum of three number in AP is 36. When the number are increased by 1, 4, 43 respectively, the resulting numbers are in GP. Find the numbers.

**Group'A'**

**Attempt Any Ten questions.** **[10×5=50]**

4. Find derivative of first principle method of : (any **ONE**)
   a. $Sinx$ b. $x + \sqrt{x}$

5. Find $\frac{dy}{dx}$ : (any **ONE**)
   a. $x^2 + y^2 = 2x^2 + 3xy$ b. $\begin{matrix} x = a^2 tant \\ y = 2asect \end{matrix}$

6. Integrate : (any **ONE**)
   a. $\int e^{ax} \sin bx\, dx$ b. $\int \frac{e^x - 1}{e^x + 1}$

***Cont.....***

7. Show that the number of ways in which the letters of the word 'ARRANGE' can be arranged so that no two R's comes together is 900.

8. Find the middle term in the expansion of $(1+x^2)^{10}$.

9. Show that :

$$\frac{2}{3!}+\frac{4}{5!}+\frac{6}{7!}+\cdots=\frac{1}{e}$$

**OR**

$$loge^2=\frac{1}{1.2}+\frac{1}{3.4}+\frac{1}{5.6}+\cdots$$

10. Find the equation of straight line through the point (2, 3) and Perpendicular to $4x+5y+3=0$.

11. Find the equation of tangent and normal to the circle $x^2+y^2-2x4y+3=0$ at (2, 3).

12. If the roots of the equation $lx^2+nx+x+n=0$ be in the ratio p:q.

Prove that : $\sqrt{\frac{p}{q}}+\sqrt{\frac{q}{p}}+\sqrt{\frac{n}{l}}=0$

13. Find the equation of parabola vertex (2, 3) and focus (6, 3).

14. If $\frac{\log x}{y-z}=\frac{\log y}{z-x}=\frac{\log z}{x-y}$ prove that $x^x y^y z^z=1$.

***Good Luck!***

*Council for Technical Education and Vocational Training*

**Office of the Controller of Examinations**

Sanothimi, Bhaktapur

**Regular Exam-2079, Ashad**

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

**Year/Part: I/I (2021 New Course)** **Pass Marks: 32**

**Subject: Engineering Mathematics I** **Time: 3 hrs**

*Candidates are required to give the*
*figures in the margin indicate full*



**Group'B'**

**Attempt All questions** [7×(2+2)=28]

1. a) If A = {2, 3, 4, 5, 6, 7}, B = {4,5,6,7,8} and c = {1,2,3,4,5}, find
   i) (A ∪ B) ∩ C ii) (A ∩ B) ∪ C
   b) Rewrite $|2x-1| \leq 5$ without using absolute value sign.
2. a) Prove that: $sin(2sin^{-1}x) = 2x\sqrt{1-x^2}$.
   b) In any ΔABC, show that. $c(a\,cosB - b\,cosA) = a^2 - b^2$
3. a) If $\frac{CosA}{a} = \frac{CosB}{b}$, prove that the triangle is an isosceles.
   b) Evaluate: $\lim_{x\to 2} \frac{x^2-5x+6}{x^2-x-2}$.
4. a) Find $\frac{dy}{dx}$; when $y = \frac{1}{\sqrt{ax^2+bx+c}}$.
   b) Find $\frac{dy}{dx}$ when $= cos\,(sin\sqrt{3x+5})$.
5. a) Integrate: $\int \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right) dx$.
   b) The sum of an infinite G.S. is 15 and the first term is 3.Find the common ratio.
6. a) In how many ways can the letters of the word "MATHEMATICS" be arranged?
   b) Find the seventh term in the expansion of $\left(3x^2 - \frac{1}{2x}\right)^{12}$.
7. a) Find the distance between the parallel lines $3x+4y-5=0$ and $6x+8y+17=0$.

***Cont.....***

b) Find the angle betⁿ two lines represented by

$x^2 - 2xy\,cot\theta - y^2 = 0.$

## Group 'B'

**Attempt All questions.** **[13×4=52]**

8. If $\frac{\log x}{y-z} = \frac{\log y}{z-x} = \frac{\log z}{x-y}$ prove that $x^x y^y z^z = 1.$

**OR**

Let $f: R \longrightarrow R, g: R \longrightarrow R$ which are defined by $f(x) = x^3 + 1$ and $g(x) = x^5$ respectively then find

a) $fog(x)$ b) $gof(x)$ c) $f^{-1}(x)$

9. Solve: $tan^2x = secx + 1.$

**OR**

Solve: $sin^{-1}\frac{2a}{1+a^2} - cos^{-1}\frac{1-b^2}{1+b^2} = 2tan^{-1}x.$

10. If $a^4 + b^4 + c^4 = 2a^2(b^2 + c^2)$ prove that $A = 45°$ or $135°$.

**OR**

Solve the $\Delta ABC$, if $b = \sqrt{3}$, $c = 1$ and $A = 30°$.

11. Evaluate: $\underset{x \longrightarrow \theta}{Lt} \frac{x\tan\theta - \theta\tan x}{x-\theta}$.

**OR**

A function $f(x)$ is defined as follows.

$$\int(x) = \begin{cases} 2x+1 & for\ x < 1 \\ 2 & for\ x = 1 \\ 3x & for\ x > 1 \end{cases}$$

Is the function continuous at $x = 1$? If not, how can it be made continuous at $x = 1$?

12. Find from first principle, the derivatives of $\sqrt{tanx}$ or $\frac{1}{\sqrt{4-5x}}$.

13. Integrate (**any one**)

a) $\int \frac{dx}{x^2\sqrt{9-x^2}}$ b) $\int sec^3\ x\ dx$



*Cont.....*

14. Prove that the AM, GM and HM between any two unequal positive numbers satisfy the relation.

i) $(GM)^2 = AM \times HM$ ii) $AM > GM > HM$

**OR**

Find the sum to infinity $1 - 3x + 5x^2 - 7x^3 + \ldots\ldots(|x| < 1)$.

15. From 6 gentleman and 4 ladies, a committee of 5 is to be formed. In how many ways can this be done as to include at most two ladies?

16. Prove that: $\frac{1.2}{1!} + \frac{2.3}{2!} + \frac{3.4}{3!} + \cdots \infty = 3e$.

17. Find the equations of the bisectors of the angles between the lines $4x - 3y + 1 = 0$ *and* $12x - 5y + 7 = 0$. Also show that bisectors are at right angle.

18. Find the separate equations represented by $2x^2 + xy - 3y^2 + 9x + 26y - 35 = 0$. Also find the angle between them.

**OR**

Prove that the straight lines joining the origin to the point of intersection of the line $\frac{x}{a} + \frac{y}{b} = 1$ and the curve $x^2 + y^2 = c^2$ are at right angles if $\frac{1}{a^2} + \frac{1}{b^2} + \frac{2}{c^2}$.

19. Find the equation of circle passing through the points (3,-2) and (-2, 0) whose centre lies on the line $2x - y = 3$.

20. Find $\frac{dy}{dx}$ (any one)

i) $x^2 y^2 = tanxy$ *ii)* $x^y . y^x = a$

***Good Luck!***

*Council for Technical Education and Vocational Training*

**Office of the Controller of Examinations**

Sanothimi, Bhaktapur

**Back Exam-2079, Ashad**

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

**Year/Part: I/I (Old + Very Old )** **Pass Marks: 32**

**Subject: Engineering Mathematics I** **Time: 3 hrs**

*Candidates are required to give their*
*figures in the margin indicate full mar*



**Group'B'**

**Attempt All questions.** [5×2)× 3=30]

1. a) State and prove cosine law.

   b) If $tan^{-1}x + tan^{-1}y + tan^{-1}z = \pi$, prove that $x + y + z = xyz$.

2. a) Prove that $\lim_{n\to\infty} \frac{sin\theta}{\theta} = 1$

   b) Test the continuity of :

$$f(x) = \begin{cases} 2x & for \quad x \leq 3 \\ 3x - 3 & for \quad x > 3 \end{cases} at\ x$$

3. a) Prove that the straight lines joining the origin to the point of intersection of the line $\frac{x}{a} + \frac{y}{b} = 1$ and the curve $x^2 + y^2 = c^2$ are at right angles if $\frac{1}{a^2} + \frac{1}{b^2} + \frac{2}{c^2}$.

   b) Find the equation of the straight line through the point (2, 3) and equation of perpendicular to the line $2x + 3y + 4 = 0$.

**Group 'B'**

**Attempt Any Ten questions.** **[10×5=50]**

4. Find the sum of squares of first n natural numbers.

5. Find the term free form x in the expansion of $\left(2x - \frac{1}{x}\right)^{10}$.

***Cont.....***

6. Prove that : $1 + \frac{1+3}{2!} + \frac{1+3+5}{3!} + \frac{1+3+5+7}{4!} + \cdots\cdots = 2e.$

7. Prove that every quadratic equation cannot have more than two roots.

8. In how many ways a committee of 6 members can be selected from 7 boys and 6 girls consisting of 4 boys and 2 girls.

9. Find the equation of circle in diameter form.

10. Find the equation of the parabola whose vertex is at (-2, 0) and directrix $x = 1$.

11. Sketch the graph : $y = 2^{\pm x}$

12. Find form first principle, the derivative $\frac{1}{\sqrt{x}}$.

13. Find $\left(\frac{dy}{dx}\right)$ : *(Any One )*

    i) $x^2+2hxy+by^2 = 0$

    ii) $x^2 + y^2 = sec\, xy^2$

14. Integrate: **(Any One)**

    a) $\int \frac{x^2\, dx}{(1+x^2)^2}$.  b) $\int e^{ax} cosbx\, dx$

15. Evaluate : $\int_0^{\pi/2} (1 + Cosx)^2\, sinx\, dx$

***Good Luck!***

*Council for Technical Education and Vocational Training*

**Office of the Controller of Examinations**

Sanothimi, Bhaktapur

**Regular/Back Exam-2078, Bhadra**

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

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

**Subject: Engineering Mathematics I** **Time: 3 hrs**

*Candidates are required to give th*
*figures in the margin indicate full*



**Group'A'** **[10×3=30]**

**Attempt All questions.**

1 a) Define in circle. In any triangle ABC, establish the relation $r = \frac{\Delta}{s}$ where the symbols have their usual meanings.

b) Find the general solution of $\cos\theta + \cos3\theta + \cos5\theta = 0$

**OR**

Prove that: $tan^{-1}x - tan^{-1}y = tan^{-1}\frac{x-y}{1+xy}$

2. a) Define continuity of a function at a given point. Test the continuity of the function at a given point where

$$f(x) = \begin{bmatrix} 3+2x & for & \frac{-3}{2} \le x \le 0 \\ 3-x^2 & for & 0 < x \le 3/2 \end{bmatrix} \text{ at } x = 0$$

**OR**

Evaluate the limit of lim of $\lim_{x \to \theta} \frac{x\sin\theta - \theta\sin x}{x-\theta}$

b) Find from first principle the derivatives of $y = tanx$ or $y = e^{ax}$.

3 a) What is homogenous equation of second degree? Prove that the homogenous equation of second degree represent a pair or straight line through the origin.

b) Find the equation of the straight line through the point (2, 3) and perpendicular to the line $5x - 2y = 8$.

***Cont.....***

## Group 'B'

**Attempt <u>All</u> questions.** [10×5=50]

4. Sum to n terms of 7+77+777+.....

5. From a group of 6 gentlemen and 4 ladies, a committee of 5 is to be formed. In how many ways can this be done so as to include at most 2 lady?

6. Find the middle term (s) in the expansion of $(1+\frac{x}{2})^{15}$.

7. Prove that every quadratic equation cannot have more than two roots.

8. Find the equation of the circle through the intersection of the circles $x^2+y^2-8x-2y+7=0$ and $x^2+y^2-4x+10y+8=0$ and passes through the point (-1,-2).

9. Find $\frac{dy}{dx}$: (**<u>Any One</u>**)

   (a) $x^3+y^3=3xy^2$ b) $x=Tant, y=sint\ cost$

10. Integrate : (**<u>Any One</u>**)

    i) $\int x^2\ sinx\ dx$ ii) $\int e^{ax} cosbx\ dx$

11. Find the vertex, focus, equation of directrix and length of latus rectum of the parabola : $y^2-4y-4x-8=0$.

12. Let $f: R \rightarrow R$ and $R \rightarrow R$ be defined by $f(x)=x^3+1$ and $g(x)=x+5$, Find $(i) fog(x)$ $(ii) gof(x)$

**OR**

*If* $\frac{log\ x}{y-z}=\frac{\log y}{z-x}=\frac{log\ z}{z-y}$, prove that $x^2.y^y.z^z=1$

13. Prove that the angle between two straight *lines* $y=m_1x+c_1$ and $y=m_2x+c_2$ is $\tan\theta=\pm\left(\frac{m_1-m_2}{1+m_1m_2}\right)$. Also, prove that the two lines are parallel and perpendicular to each other if $m_1=m_2$ and $m_1\times m_2=-1$ respectively.

***Good Luck!***

*Council for Technical Education and Vocational Training*

**Office of the Controller of Examinations**

Sanothimi, Bhaktapur

# Regular/Back Exam-2076, Falgun/Chaitra

**Program: Diploma in Engineering All** | **Full Marks: 80**

**Year/Part: I/I (New + Old)** | **Pass Marks: 32**

**Subject: Engineering Mathematics** | **Time: 3 hrs**

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*Candidates are required to give th*
*figures in the margin indicate full*



## Group 'A' [5x2)x3=30]

**Attempt All questions.**

1. a) In any triangle ABC, If $a^4+b^4+c^4+-2c^2(a^2+b^2)=0$; prove that $\angle c = 45°$ or $135°$.

   b) Prove that $2Tan^{-1}\,1/_3 + Tan^{-1}\frac{1}{7} = \frac{1}{4}\pi$.

   OR

   Find the general solution of the equation $\sin^2\theta - 2\cos\theta + \frac{1}{4} = 0$.

2. a) Evaluate: $\lim_{x \to y} \frac{xTany - ytanx}{x-y}$

   b) Test the continuity of $f(x) = \frac{x^2-64}{8-x}$ at $x = 8$.

3. a) Show that lines joining the origin to the point of intersection of the line $fx - gy = \lambda$ and $x^2 + hxy - y^2 + gx + fy = 0$ are at right angles for all values of $\lambda \neq 0$.

   b) Find the eg$^n$ of a straight line passing through (-2,-3) and making angle 45° with the line 2x-3y+5=0

## Group 'B' [10×5=50]

**Attempt Any Ten Questions**

4. Find the sum of n terms of the series 1+11+111+1111+.....
5. Show that the quadratic equation $ax^2 + bx + c = 0$ can not have more than two roots.
6. Find the middle term in the expansion of $(x + \frac{2}{2x^2})^{12}$.

***Cont.....***

7. Prove that $1 + \frac{1}{3.2^2} + \frac{1}{5.2^4} + \frac{1}{7.2^6} + \ldots\ldots\ldots\ldots = \log_e 3$.

8. Find, from first principle, the derivative of

$f(x) = \frac{1}{\sqrt{x}}$ or $f(x) = Tan\ 4x$.

9. Find $\frac{dy}{dx}$ (Any one)

i) $x^3+y^3 = 3xy^2$ ii) $x^2 + y^2 = Tan\ xy$

10. Evaluate: $\int \frac{dx}{x^2\sqrt{x^2-4}}$.

11. Evaluate $\int_0^{\pi/4} Tan^3 x dx$.

12. Find the equation of a circle which touches both axes and radius is 4.

13. Find the equation of the parabola whose vertex is at (-1, 2) and directrix x=4.

14. From 6 gentlemen and 4 ladies a committee of 5 is to be formed. In how many ways can this be done so as to include at least one lady.

15. Define inverse of a function. In which condition does the inverse of function exist? If $f(x) = x^2 - 3$ find $f^{-1}(x)$.

***Good Luck!***