Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
July, 2017

Level : B. E.
Year : II

Course : MATH 205
Semester : I

Exam Roll No. :
Registration No.:

Time: 30 mins.

F. M. : 20
Date : JUL 0 6 2017

SECTION "A"
[10Q. × 1 = 10 marks]

Fill in the blank space (s) by writing the most appropriate word(s) or symbol(s).

1. If a change of rectangular axes (x, y) to (x_1, y_1) be made by transferring the origin to the point (α, β), then (x, y) = ...

2. The equation of the directrix of the $\frac{1}{r} = 1 + e\cos\theta$ is ....

3. The number of arbitrary constants in the general equation of the plane is ....

4. The equation of a sphere having (x_1, y_1, z_1) and (x_2, y_2, z_2) as end points of a diameter is ....

5. For any spherical triangle ABC, $\sin\frac{A}{2}$ = ...

6. Two lines $\frac{x-x_1}{a_1} = \frac{y-y_1}{b_1} = \frac{z-z_1}{c_1}$ and $\frac{x-x_2}{a_2} = \frac{y-y_2}{b_2} = \frac{z-z_2}{c_2}$ are coplanar if ....

7. If the axes be turned through an angle θ sothat the expression $x^2 + xy + y^2$ may not contain xy term, then θ = ...

8. The equation of the tangent plane to the sphere $x^2 + y^2 + z^2 - 4x + 2y - 4 = 0$ at the point $(4, -2, 2)$ is ....

9. The equation of the tangent of the conic $\frac{1}{r} = 1 + e\cos\theta$ at the point θ_1 is ....

10. The arc of a great circle drawn from a pole of a great circle to any point in its circumference is a ....

SECTION "B"
[10Q. × 1=10]

Fill in the blank space(s), DO NOT TICK, by selecting the most appropriate answers from among the given ones.

11. The conic $\frac{1}{r} = 1 + e\cos\theta$ represents a parabola if ....
[e = 0; e = 1; e < 1; e >1]

12. The smallest radius of the sphere passing through (1,0,0),(0,1,0) and (0,0,1) is ....

[$\sqrt{\frac{3}{5}}$; $\sqrt{\frac{3}{8}}$; $\sqrt{\frac{2}{3}}$; $\sqrt{\frac{5}{12}}$]

13. The equation of x-axis in space are ....

[$x = 0, y = 0$; $x = 0, z = 0$; $x = 0$; $y = 0, z = 0$]

14. If any line form an angle α, β, γ and δ with the diagonal of cube then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma + \sin^2\delta$ = ...

[8/3; -8/3; 4/3; -4/3]

15. The equation $12x^2+10y^2-23xy-25x+26y-14= 0$ represents...........

[Ellipse; Hyperbola; Parabola; Straight lines]

16. Equation of a line passing through (0, 0, 0) and parallel to Y-axis is ....

[$\frac{x}{0} = \frac{y}{1} = \frac{z}{1}$; $\frac{x}{0} = \frac{y}{1} = \frac{z}{0}$; $\frac{x}{0} = \frac{y}{0} = \frac{z}{1}$; $\frac{x}{1} = \frac{y}{0} = \frac{z}{1}$]

17. A triangle formed by three arcs of great circles of a sphere on its surface is called ....

[Spherical angle; Spherical triangle; Pole; Angular distance]

18. If the lines $x = ay + b, z = cy + d$ and the line $x = a_1y + b_1, z = c_1y + d_1$ are perpendicular to each other, then aa_1+cc_1+3 = ...

[2; -2; 0; 1]

19. If the line $\frac{x-1}{1} = \frac{y-2}{1} = \frac{z-k}{2}$ lies exactly on the plane 2x-4y+z=7, then the value of k is ....

[7; -7; 0; 13]

20. The centre and radius of the sphere $x^2 + y^2 + z^2 + 2x + 2y + 2z + 1 = 0$..............

[$(-1,-1,-3)$; 1 $(-1,-1,-1)$; 2 $(-1,-1,-1)$; $\sqrt{2}$ $(0,1,1)$; 1]

KATHMANDU UNIVERSITY
End Semester Examination [C]
July, 2017

JUL 0 6 2017

Level : B. E.
Year : II
Time : 2 hrs. 30 mins.

Course : MATH 205
Semester : I
F. M. : 55

SECTION "C"

[4Q. × 7=28 marks]

1. Define center of a conic. Find the coordinates of the centre of the conic $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ and transform the equation of the conic referred to the centre as origin. [1+3+3]

2. Find the length of an arc **ab** of a small circle, if an arc **AB** of a corresponding great circle is given. For any spherical triangle ABC, prove that $\sin\frac{A}{2} = \sqrt{\frac{\sin(s-b)\sin(s-c)}{\sin b \sin c}}$. [4+3]

3. When will two given lines be coplanar? Write the condition for two straight lines in symmetrical form to be coplanar. Prove that the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $4x - 3y + 1 = 0 = 5x - 3z + 2$ are coplanar. [1+2+4]

OR

Find the condition that the lines $\frac{x-x_1}{l} = \frac{y-y_1}{m} = \frac{z-z_1}{n}$ may lie in the plane $ax + by + cz + d = 0$. Show that the line $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$ lies in the plane$3x + 4y - 5z + 3 = 0$. [4+3]

4. A plane passing through fixed point (a, b, c) and cuts the axes in A, B, C. Prove that the locus of the centre of the sphere OABC is $\frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 2$. Also define plane section and great circle of a sphere. [5+1+1]

SECTION "D"

[9Q. × 3=27 marks]

5. Find the transformed equation of the curve $9x^2 + 4y^2 + 18x - 16y = 11$ if the origin is shifted at (-1,2) but the direction of axes are not changed.

6. If PSP' and QSQ' are two perpendicular focal chords of a conic $\frac{l}{r} = 1 + e\cos\theta$, prove that $\frac{1}{PP'} + \frac{1}{QQ'}$ is constant, where S is the focus.

OR

Find the condition that the pair of lines, whose equation is $Ax^2 + 2Hxy + By^2 = 0$ may be conjugate diameters of the conic $ax^2 + 2hxy + by^2 = 1$.

7. Find the equation of the chord of the conic $\frac{l}{r} = 1 + e\cos\theta$ joining the points whose vectorial angles are $\frac{\pi}{6}$ and $\frac{\pi}{2}$.

8. Show that the shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-3}{5} = \frac{z-4}{6}$ is $\frac{1}{\sqrt{6}}$.

9. Define Spherical triangle. For any spherical triangle ABC, prove that $a + b + c < 2\pi$.

10. The plane $x + 3y + 5z = 7$ is rotated through a right angle about its intersection with the plane $x - 2y - 6z = 8$. Find the equation in its new position.

11. Obtain the equation of the sphere having the circle $x^2 + y^2 + z^2 + 10y - 4z - 8 = 0$, $x + y + z = 3$ as a great circle.

12. Find the distance of the point (1,-2,3) from the plane $x - y + z = 5$ measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$.

13. Find the centre of the conic section $2x^2 + 5xy - 3y^2 - x - 4y + 6 = 0$ and its equation when transformed to the centre.