



K19U 3006

Reg. No. :

Name :

I Semester B.Sc. Hon's (Mathematics) Degree (Reg./Supple./Imp)

Examination, November - 2019

(2016 Admission Onwards)

BHM 102 : FOUNDATIONS OF MATHEMATICS

Time : 3 Hours

Max. Marks : 60

SECTION - A

Answer any **Four** questions out of **Five** questions. Each question carries 1 mark. (4×1=4)

1. Define a function.
2. Define Partition of a set.
3. Explain the converse of a statement.
4. Define a sphere.
5. Give an example of a countable set.

SECTION - B

Answer any **Six** questions out of **Nine** questions. Each question carries 2 marks. (6×2=12)

6. Give an example of a function.
 - a) Which is neither injective nor surjective and
 - b) Which is injective but not surjective.
7. Define the least upper bound property of an ordered set.
8. When we can define got where $f : A \rightarrow B$ and $g : D \rightarrow C$.
9. When we say that two points in the plane are equivalent. Find the equivalence class also.

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10. Define a cylinder.
11. What is the locus of Hyperboloid of two sheets.
12. Define the polar plane of a point.
13. How many normals can be drawn to a central quadric.
14. What is the intersection of the cylinder $x^2 + y^2 + 2gx + 2fy + c = 0$ with the plane $z=0$.

SECTION - C

Answer any **8** questions out of **12** questions. Each question carries **4** marks. **(8×4=32)**

15. Given $f: R \rightarrow R$ by $f(x) = 3x^2 + 2$ and $g: R \rightarrow R$ by $g(x) = 5x$. Find fog and gof.
16. Show that subset of a countable set is countable.
17. Show that the set $Z_+ \times Z_+$ is countably infinite.
18. Let $a > 0$ be a real number. If $a > 0$, then show that $\frac{1}{a} > 0$.
19. Show that the square of an odd integers is also an odd integer.
20. State lub property and g l b property.
21. Find the centre and radius of the sphere $x^2 + y^2 + z^2 - 6x + 8y - 10z + 1 = 0$.
22. Show that the semiretical angle of a right circular cone, having three mutually perpendicular tangent planes is given by $\tan^{-1}(\sqrt{\frac{1}{2}})$.



23. Find the points of intersection of the line $\frac{-1}{3}(x+5) = y-4 = \frac{1}{-}(3-11)$ with the central conicoid. $12x^2 + 7y^2 + 7z^2 = 7$.
24. Find the equation of the sphere through the circle $x^2 + y^2 + z^2 = 9$, $2x+3y+4z=5$ and the point $(1,2,3)$.
25. Find the equation of the sphere which touches the sphere $x^2 + y^2 + z^2 - x + 3y + 2z - 3 = 0$. at $(1, 1, -1)$ and passes through the origin.
26. Prove that the equation $x^2 - 2y^2 + 3z^2 - 4xy + 5yz - 6zx + 8x - 19y - 2z - 20 = 0$ represents a cone with vertex $(1, -2, 3)$.

SECTION - C

Answer any **Two** questions out of **Four** questions. Each question carries **6** marks. **(2×6=12)**

27. Let B be a non-empty set. Then show that the following are equivalents.
 - a) B is countable.
 - b) There is a surjective function $f: Z_+ \rightarrow B$.
 - c) There is an injective function $g: B \rightarrow Z_+$.
28. Find the equation of a sphere passing through four points $(4, -1, 2)$, $(0, -2, 3)$, $(1, -5, -1)$ and $(2, 0, 1)$.
29. Find the equation of a right circular cylinder with radius 2 and axis passing through the point $(1, 2, 3)$ and has direction cosines proportional to 2, -3, 6.
30. What are the equations relating spherical coordinates of a point to cartesian and cylindrical coordinates. Also find a spherical coordinate equation for the sphere $x^2 + y^2 + (z-1)^2 = 1$.