2021
MATHEMATICS – HONOURS
SEMESTER-6
INTERNAL ASSESSMENT
Full Marks of each Course: 10

The figures in the margin indicate full mark .
Symbols and notations used here carry their usual meaning.
Candidates are required to give their answers in their own words as far as practical.

Course: CC13 (Metric Space & Complex Analysis)

Choose the correct alternative with proper justification: 5x2=10

1. Usual Metric on R (Set of all real numbers)

(i) may be bounded (ii) must be bounded

(iii) is unbounded (iv) may be both bounded and unbounded

2. An infinite subset of an infinite discrete metric space

(i) is compact (ii) is not compact

(iii) may or may not be compact (iv) is closed only

3. $D = \{z \in C : |Im(Z)| < a\}$ is

(i) domain (ii) region (iii) domain, but no region (iv) region, but not domain

4. The function $e^{\bar{Z}}$ is

(i) everywhere analytic (ii) nowhere analytic (iii) analytic except z=0 (iv) analytic at only z=0

5. $\int_{|z|=2} \frac{1}{z^2+1} dz$ is

(i) 0 (ii) 1 (iii) 2 (iv) not integrable

Course: CC14 (Numerical Methods)

Choose the correct alternative with proper justification: 5x2=10

6. The numbers 0.002745 and 2.995 when rounded off to three significant digits become
   (i) 0.003 and 2.99 respectively.
   (ii) 0.00275 and 3.00 respectively.
   (iii) 0.00274 and 3.00 respectively.
   (iv) 0.00275 and 2.99 respectively.

7. What is the degree of the first order forward difference of a polynomial of degree 3. Justify your answer.
   (i) 3 (ii) 2 (iii) 1 (iv) 0

8. If Δ and ∇ are the forward and backward difference operators respectively, then $\Delta - \nabla$ is equivalent to
   (i) $-\Delta\nabla$ (ii) $\Delta\nabla$ (iii) $\Delta + \nabla$ (iv) $\frac{\Delta}{\nabla}$

9. Degrees of precision of Trapezoidal rule and Simpson's one-third rule are
   (i) 1 and 1 respectively.
   (ii) 3 and 1 respectively.
   (iii) 3 and 3 respectively.
   (iv) 1 and 3 respectively.

10. For a system of equations
   $a_{11}x_1 + a_{12}x_2 = b_1$
   $a_{21}x_1 + a_{22}x_2 = b_2$
   a sufficient condition for convergence of the Gauss Seidel iteration process is
   (i) $|a_{12}a_{21}| = |a_{11}a_{22}|$
   (ii) $|a_{12}a_{21}| > |a_{11}a_{22}|$
   (i) $|a_{12}a_{21}| < |a_{11}a_{22}|$
   (iv) $|a_{11}| + |a_{22}| < |a_{12}| + |a_{21}|$

Course: DSE-A2 (Differential Geometry)

Choose the correct alternative with proper justification: 5x2=10

11. In the Riemannian space V_3 with metric $ds^2 = 2(dx^1)^2 + 3(dx^2)^2 + 4(dx^3)^2 - 2dx^2dx^3 - 4dx^1dx^3 - 6dx^1dx^2$ the angle between two contravariant vectors $\left(1, 0, 0, \frac{1}{c}\right)$ and $\left(-1, -1, 0, \frac{1}{c}\right)$ is
   (i) $cos^{-1}(\frac{c^2+1}{\sqrt{c^2-1}\sqrt{c^2-2}})$
   (ii) $cos^{-1}(\frac{c^2-1}{\sqrt{c^2+1}\sqrt{c^2-2}})$
   (iii) $cos^{-1}(\frac{c^2+2}{\sqrt{c^2-1}\sqrt{c^2-2}})$
   (iv) $cos^{-1}(\frac{c^2+1}{\sqrt{c^2-1}\sqrt{c^2+2}})$

12. Contraction of a tensor of type (m, n) produces a tensor of type
   (i) (m+1, n+1) (ii) (n, m) (iii) (m-1, n-1) (iv) (m, n-1)

13. The number of independent components of Christoffel's symbols in V_n are
   (i) n(n+1) (ii) n(n-1) (iii) $\frac{n^2(n+1)}{2}$ (iv) 0

14. For an Einstein space $V_n (n > 4)$ the scalar curvature is always
   (i) 1 (ii) 0 (iii) -1 (iv) constant

15. If the intrinsic derivative of a vector A along a curve C vanishes at all points of C. Then the magnitude of A is

(i) 1 (ii) -1 (iii) Constant (iv) 0

Course: DSE-B2 (Point Set Topology)

Choose the correct alternative with proper justification: 5x2=10

16. In Graphical Method of LPP if the cost line coincide with a side of the region of basic feasible solutions we get

(i) Unique optimum solution (ii) Unbounded optimum solution
(iii) No feasible solution (iv) Infinite number of optimum solution

17. If the value of the objective function z can be increased or decreased indefinitely, such solution is called

(i) Bounded Solution (ii) Alternative optimal solution

(iii) Unbounded solution (iv) None of these

18. The Area of feasible region of the following constraints $x+3y\geq 3$, $x\geq 0$, $y\geq 0$ is

(i) Bounded (ii) Unbounded (iii) Convex (iv) Concave

19. Which of the following methods is not used to find an Initial Feasible Solution in a Transportation Problem?

(i) North-West Corner Method (ii) Matrix Minima Method
(iii) VAM (iv) Hungarian Method

20. A Convex Polyhedron is the set of all convex combinations of

(i) An infinite number of points (ii) Finite number of points
(iii) Exactly 8 points (iv) None of these