n of an arbitrary collection of open sets, open. Justify your answer.

t $S = \left\{1, -1, \frac{1}{2}, \frac{-1}{2}, \frac{1}{3}, \frac{-1}{3}, \ldots\right\}$ is neither open nor closed.

convergent sequence is bounded.

nce $\left(\frac{1}{n}\right)$ converges to zero.

) converges to x, then sequence $(|x_n|)$ converges to $|x|$.

$\frac{3n+1)(n-2)}{n(n+3)} = 3$.

ers $z_1 + z_2$ and $z_1 - z_2$ vectorially, given $z_1 = 2i$, $z_2 = \frac{2}{3} - i$.

formula to derive $\cos 3\theta = \cos^3\theta - 3\cos\theta\sin^2\theta$.

roots of $2i$ and express in rectangular co-ordinates.

$2z + 3| > 4$ and determine whether it is a domain.

$(8 \times 2 = 16)$

Part C

Answer any **six** *questions.*
Each question carries 4 marks.

rties of R, the set of real numbers that makes it into a complete ordered field.

terior of a set S is the largest open subset of S.

ts of real numbers. Show that $S \subset T \Rightarrow S^1 \subset T^1$ where S^1 and T^1 are the derived

of two closed sets is a closed set.

quence $S_n = 1 + \frac{1}{2} + \ldots + \frac{1}{n}$ cannot converge.

y number x, $\lim \frac{x^n}{n!} = 0$.

$\frac{3 + 2\sqrt{n}}{\sqrt{n}} = 2$.

$n^{\frac{1}{n}}\Big) = 1$.

$(-16)^{\frac{1}{4}}$ and express in rectangular co-ordinates.

$(6 \times 4 = 24)$

Part D

Answer any **two** *questions.*
Each question carries 15 marks.

32. (a) Show that the set of rational numbers is not order complete.

    (b) Show that a set is closed if and only if its complement is open.

33. (a) Show that the set of real numbers in [0, 1] is uncountable.

    (b) Show that a sequence cannot converge to more than one limit.

34. (a) Show that sequence $[r^n]$ converges iff $-1 < r \leq 1$.

    (b) Show that (S_n), where $S_n = \left(1 + \frac{1}{n}\right)^n$ is convergent and the limit lies between 2 and 3.

35. (a) State and prove Cauchy's general principle of convergence.

    (b) Show that the sequence (S_n), where $S_n = \frac{1}{1!} + \frac{1}{2!} + \ldots + \frac{1}{n!}$ is convergent.

$(2 \times 15 = 30)$

E 8159 (Pages : 3) Reg. No..............................

Name..............................

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2019

Fifth Semester

Core Course—MATHEMATICAL ANALYSIS

(Common for Model I and Model II B.Sc. Mathematics and B.Sc. Computer Applications)

[2013 to 2016 Admissions]

Time : Three Hours Maximum : 80 Marks

Part A

Answer **all** *questions.*
Each question carries 1 *mark.*

1. Find the infimum and supremum of $\left\{-2, \frac{-3}{2}, \frac{-4}{3}, \frac{-5}{4}, \ldots, -\frac{n+1}{n}, \ldots\right\}$ and which of these belong to the set.
2. State Dedekind's form of completeness property of R.
3. Define an open set. Is the set $\left\{\frac{1}{n}. \, n \in \mathrm{N}\right\}$ is open.
4. Define limit point of a set. Also find the derived set of Q, the set of rationals.
5. Define a countable set. Is the set of all ordered pairs of integers countable.
6. Give an exampe of a sequence which oscillates finitely.
7. Define a Cauchy sequence. Give an example.
8. Give examples of sequence (a_n) and (b_n) such that $(a_n + b_n)$ converges to zero, $\left(\frac{a_n}{b_n}\right)$ converges to – 1, but (a_n) and (b_n) are divergent.
9. Find the value of $(1-i)^4$.
10. Find the principal argument of the number $-1-i$.

(10 × 1 = 10)

Part B

Answer any **eight** *questions.*
Each question carries 2 *marks.*

11. Show that the greatest member of a set, if it exists, is the supremum of the set.
12. Show that a non-empty finite set is not a '*nbd*' of any point.

Turn over