Note:-
   1. All Questions are compulsory.
   2. Numbers on the right indicate full marks.

Section A

Q.1. Select and write the correct answer. **(4)**

1. If $f(x) = \lfloor x \rfloor$ for x $\in$ (–1, 2) then f is discontinuous at

   A) x = –1, 0, 1, 2,   B) x = –1, 0, 1

   C) x = 0, 1   D) x = 2

2. $f(x) = \dfrac{(16^x - 1)(9^x - 1)}{(27^x - 1)(32^x - 1)}$, for x $\neq$ 0 = k, for x = 0 is continuous at x = 0, then 'k'

   A) $\dfrac{8}{3}$ B) $\dfrac{8}{15}$

   C) $-\dfrac{8}{15}$ D) $\dfrac{20}{3}$

Q.2. Answer the following. **(3)**

1. Examine whether the function is continuous at the points indicated against them.

   $$f(x) = \dfrac{x^2 + 18x - 19}{x - 1}, \text{ for x} \neq 1$$

   $$= 20 , \quad\quad\quad \text{for x = 1, at x = 1}$$

2. Examine whether the function is continuous at the points indicated against them.

   f(x) = x^3 – 2x + 1, if x $\leq$ 2

       = 3x – 2   if x > 2, at x = 2

3. Examine the continuity of

   f(x) = $x^3 + 2x^2 – x – 2$ at x = –2

Section B
Attempt any Four

Q.3 Examine the continuity of **(2)**

   $$f(x) = \dfrac{x^2 - 9}{x - 3}, \quad \text{for x} \neq 3$$

   $$= 8 \quad\quad\quad \text{for x = 3}$$

Q.4 Discuss the continuity of the following functions at the point or on the interval indicated against **(2)** them. If the function is discontinuous, identify the type of discontinuity and state whether the discontinuity is removable. If it has a removable discontinuity, redefine the function so that it becomes continuous.

$f(x) = x^2 + 2x + 5, \quad$ for $x \leq 3$

$\quad = x^3 - 2x^2 - 5, \quad$ for $x > 3$

Q.5 Solve using intermediate value theorem. Show that $5^x - 6x = 0$ has a root in $[1, 2]$ **(2)**

Q.6 Show that there is a root for the equation $2x^3 - x - 16$ between 2 and 3. **(2)**

Q.7 Show that there is a root for the equation $x^3 - 3x = 0$ between 1 and 2. **(2)**

Q.8 Which of the following functions has a removable discontinuity? If is has a removable **(2)** discontinuity, redefine the function so that it becomes continuous.

$f(x) \ = \ 3x + 2, \quad$ for $-4 \leq x \leq -2$

$\quad = \ 2x - 3,$ for $-2 < x \leq 6$

Section C
Attempt any Two

Q.9 Identify discontinuities for the following functions as either a jump or a removable **(3)** discontinuity.

$f(x) = x^2 + 3x - 2,$ for $x \leq 4$

$\quad = 5x + 3, \quad$ for $x > 4$

Q.10 Find $f(a)$, if f is continuous at $x = a$ where, **(3)**

$f(x) \ = \ \dfrac{1 + \cos(\pi x)}{\pi(1 - x)^2},$ for $x \neq 1$ and at $a = 1$

Q.11 Test the continuity of the following functions at the points or interval indicated against them. **(3)**

$f(x) = \dfrac{x^2 + 8x - 20}{2x^2 - 9x + 10},$ for $0 < x < 3; x \neq 2$

$\quad = \ 12$ for $x = 2$

$\quad = \dfrac{2 - 2x - x^2}{x - 4}$ for $3 \leq x < 4$ at $x = 2$

Section D
Attempt any One

Q.12 Find a and b if following functions are continuous at the points or on the interval indicated **(4)** against them.

$f(x) = \dfrac{4\tan x + 5\sin x}{a^x - 1} \quad$ for $x < = 0$

$\quad = \dfrac{9}{\log 2}, \qquad\qquad$ for $x = 0$

$\quad = \dfrac{11x + 7x \cdot \cos x}{b^x - 1}$, for $x > 0$

Q.13 Discuss the continuity of the following functions at the points indicated against them. **(4)**

If f(x) = $\dfrac{4^{x - \pi} + 4^{\pi - x} - 2}{(x - \pi)^2}$ for x $\neq \pi$,

is continuous at x = π, then find f(π).