

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BSc DEGREE EXAMINATION DECEMBER 2017
(Fourth Semester)

Branch- **BIOTECHNOLOGY**

MATHEMATICS

Time : Three Hours

Maximum : 75 Marks

SECTION-A (20 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10x2 = 20)

- 1 Find the derivative of $2x^{3/2} - 3 \log x + 6$
- 2 Evaluate $\int (x^2 - 4x + 5) dx$
- 3 Solve $xy dx - xdy = 0$
- 4 Eliminate C from $y = cx + c^2$
- 5 Define slope and growth constant.
- 6 Define cell growth.
- 7 State Henri-Michaelis-Menten equation.
- 8 Define zero order kinetics.
- 9 Explain enzyme inhibition with an example.
- 10 State the unsteady-state energy balance equation.

SECTION - B (25 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks (5 x 5 = 25)

- 11 Find (i) $\frac{d}{dx} (\sin x \cos x)$ & $\frac{d}{dx} (x^2 - 4x + 4)$

OR ■

Evaluate (i) $\int x^e dx$ (ii) $\int \cos x dx$

- 12 a Solved $A \frac{dy}{dx} + y^2 = 0$

OR

b Solve $\frac{dy}{dx} + y \cos x = \sin 2x$

- 13 a At $t=3$ hours, the cell density was determined to be 2.6×10^8 cells/ml. If 3.5ml of culture are withdrawn at that time, the aliquot is centrifuged to pellet the cells, and the pellet is then resuspended in 7ml of tryphone broth, what is the new cell concentration?

OR

b What is the concentration of viable cells in the 100ml culture immediately following inoculation?

Cont...

14 a Given the reaction $E + S \xrightleftharpoons[k-1]{\quad} ES \xrightarrow{\quad} E + P$ where $K_j = 1 \times 10^2 \text{ Mx sec}^{-1}$

$K_{-1} = 1 \times 10^2 \text{ sec}^{-1}$, and $K_p = 3 \times 10^2 \text{ sec}^{-1}$, calculate (i) K_s and (ii) K_m

OR

b What fraction of V_{\max} is observed at $[S] = 5 \text{ km}$, $[S] = 6 \text{ km}$, $[S] = 9 \text{ km}$ and $[S] = 10 \text{ km}$?

15 a Write down the general mass balance equation and its terms.

OR

b 1.5kg salt is dissolved in water to make 100 litres. Pure water runs into a tank containing this solution at a rate of 5 per min, salt solution overflows at the same rate. The tank is well mixed. Assume the density of salt solution is constant and equal to that of water. Find the total mass balance.

SECTION - C (30 Marks)

Answer any **THREE** Questions

ALL Questions Carry **EQUAL** Marks (3 x 10 = 30)

16 Evaluate: $J = \int \frac{1}{3x^2 + x - 2} dx$

$$A/3x^2 + x - 2$$

17 Solve: (i) $(x + 1)^y + 1 = 2e^{-y}$
 $\frac{dy}{dx}$,

$$(ii) (2x - 4y + 3)^y + (x - 2y + 1) = 0$$

18 Discuss about plotting cell growth data on a semi log graph.

19 An enzyme was assayed at an initial substrate concentration of $2 \times 10^5 \text{ M}$. In 6 min half of the substrate had been used. The K_m for the substrate is $5 \times 10^5 \text{ M}$. Calculate (i) K (ii) V_{\max} and (iii) the concentration of product produced by 15 min.

20 An electric heating coil is immersed in a stirred tank. Solvent at 15°C with heat capacity $2.1 \text{ KJ kg}^{-1} \text{ } ^\circ\text{C}^{-1}$ is fed into the tank at a rate of 15 kgh^{-1} . Heated solvent is discharged at the same flow rate. The tank is filled initially with 125 kg cold solvent at 10°C the rate of heating by the electric coil is 800 W . Calculate the time required for the temperature of the solvent to reach 60°C .

Z-Z-Z

END