PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)_____

BSc DEGREE EXAMINATION MAY 2017
(Fourth Semester;

Branch - BIOTECHNOLOGY

MATHEMATICS

Time: Three Hours ' v Maximum: 75 Marks

SECTION-A120 Marks)
Answer ALL questions
ALL questions carry EQUAL marks (10 x 2 * 20)

1 Define an even function with an example.
2 Differentiate $(ax + b)^3$ with respect to x. '
3 Obtain a differential equation of first order by eliminating c from y - cx + c -
4 Find the degree and order of the differential equation $\left(\frac{d^2y}{dx^2}\right)^{\backslash 2} + \left(\frac{dy}{dx}\right)^{2} = X$. **vdx;**
5 Give the description of lag phase in cell division.
6 Write down the equation for exponential growth of the dell.
7 State Henri - Michaelis - Menten equation.
8 Define zero-order kinetics.
9 Write down the; restrictions which are common in unsteady - state mass - balance problems.
10 Write down the general unsteady state mass balance equation.

SECTION - B (25 Marks)
Answer ALL Questions
ALL Questions Carry EQUAL Marks (5 x 5 = 25)

11 a Find $\frac{dy}{dx}$ if (i) $y = \frac{x}{2}$ (ii) $y = 4x^2 - 9x + 3$.

OR

b Evaluate $\int_0^2 (x^2 - 4x + 5)dx$.

12 a Eliminate 'a' and 'b' from $xy = ae^x + be^{-x}$

OR

b Solve : $\frac{dy}{dx} + \left(\frac{1-y^2}{1-x^2}\right)^{1/2} = 0$.

13 a What is the concentration of viable cells in the 100-ml culture immediately following inoculation?

OR

b How many total viable cells are present in the 100-ml culture?

14 a ErStimate k, the first-order rate constant, for an enzyme preparation with a Vmax of 4-6 p moles x litre*1 x min'1 under the given experimental, conditions $k_m = 2 \times 10^{*6}$m.

OR

b An enzyme was assayed at an initial substrate concentration of 10* m. The k_m for the substrate is $2 \times 10^{*5}$ m. At the end of 1 min, 2% of the substrate had been converted to product. What percent of the substrate will.be converted to product at the end of 3'min? What will be the product and substrate concentrations after 3 min?

15 a State any five conditions assumed in the system in solving unsteady - state energy balances.'

. OR ,

b Derive unsteady - state energy balance equations for total energy system.

SECTION - C (30 Marks)

Answer any THREE Questions

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

16 Find the maxima and minima of the function $f(x) = 2x^3 - 21x^2 + 36x - 20$.

17 Solve : $(D^2 - 5D + 4)\, y = 0$, given that $y = 0$ at $x = 0$ and $\frac{dy}{dx} = 3$ at $x = 0$.

18 . For the following data, draw a graph by plotting the , logarithm of OD550 versus time.

Hours after Inoculation	OD_{550}	Cells / mL
0	0.008	2.1×10^7
1	0.020 .	4.5 x 10"
' 2 .	0.052	. 1.0 x 10*
3 .	0.135 .	^{r}, 2.6×10^8
. 4 *	. 0.200 .	4:0 x 10*
5-	0.282	5.8 x 10*
6	'0.447	9.6 x 10*
7	0.661	' 1.5 x 10^ '
8	1.122	.. 2.0 x 10^y

19 The equilibrium constant for the reaction S ^ P is 5. Suppose we have a mixture of [s] = 2 x 10*4 m; [p] = 3x 10'4 m, k_{m5} = 3 x 10'5m, v^ = 2 p moles x liter[1] x min"[1]; Vm^ = 4 p moles x litre'[1] x min'[1], (i) In which direction will the reaction proceed on addition of an appropriate enzyme? (ii) At what initial velocity will the reaction start towards equilibrium? • .

20 1.5 kg salt is dissolved in water to make 100 litres. Pure water runs into a tank containing this solution at a rate of 5/min'[1]; salt solution over flows at the same rate. The tank is well mixed. How mush salt is in the tank at the end of 15 min? Assume that the density of salt solution is constant and equal to that of water.

Z-Z-Z END