KUMARAGURU
college of technology
character is life

Register Number:……

M.TECH DEGREE EXAMINATIONS: JUNE 2017

(Regulation 2015)

Second Semester

BIO TECHNOLOGY

P15MAT201 : Applied Mathematics for Biotechnologists

COURSE OUTCOMES

CO1: Form and solve the ordinary differential equations of certain types

CO2: Acquire the knowledge in Laplace transforms and its properties.

CO3: Discover the equations of curve fit and compute various statistical measures.

CO4: Analyze sample data and interpret the same for population.

CO5: Analyze the experimental design based on one-way, two-way and Latin squares.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Assertion (A): Standard form of linear differential equation of second order with variable coefficients is y'' + p(x)y'+ q(x)y = F(x). CO1 [K_3]

   Reason (R): Differential equation is said to be non-homogeneous if F(x)≠0.

   a) Both A and R are Individually true and R is the correct explanation of A
   b) Both A and R are Individually true but R is not the correct explanation of A
   c) A is true but R is false
   d) A is false but R is true

2. In Randomised Block Design, if the number of rows are 4 and the number of columns are 3 , then the degrees of freedom for residual is CO5 [K_3]

   a) 6
   b) 3
   c) 12
   d) 4

3. Probability of accepting a lot when it is bad is called CO4 [K_2]

   a) Consumer's risk
   b) Hypothesis risk
   c) Statistical risk
   d) Producer's risk

4. Match List I with that of List II CO2 [K_3]

List I	List II
A. L(k)	i. s/s^2-a^2
B. L(coshat)	ii. a/s^2+a^2
C. L(sinat)	iii. k/s
D. L(cosat/t)	iv. does not exists

	A	B	C	D
a)	ii	i	iii	iv
b)	iii	iv	ii	i
c)	ii	iv	iii	i
d)	iii	i	ii	iv

5. Assertion (A):L(tsin2t) = $-4/(s^2+4)^3$ CO2 [K_3]

Reason (R):If L[f(t)]=X(s), then L[tf(t)]= -(d/ds)X(s)

a) Both A and R are Individually true and R is the correct explanation of A

b) Both A and R are Individually true but R is not the correct explanation of A

c) A is true but R is false

d) A is false but R is true

6. For an n x n Latin square, the total degrees of freedom is CO5 [K_2]

a) n – 1

b) $n^2 - 1$

c) n – 2

d) (n–2) (n–3)

7. Consider the following statements CO1 [K_3]

1. An ODE contains one dependent variable and one independent variables.
2. The order of differential equation is the degree of the highest derivative occurring in it.
3. The number of arbitrary constants involved in the general solution of second order differential equation is two.
4. If the auxiliary equation is of n^{th} degree, then the complementary function contains n+1 constants.

Which of these are false?

a) 1,3

b) 2,4

c) 2,3

d) 1,2

8. A relative measure of dispersion, known as CO3 [K_2]

a) coefficient of variation

b) Standard deviation

c) coefficient of correlation

d) Mean deviation

9. If the correlation coefficient is zero, then the two regression lines CO3 [K_2]

a) are parallel to each other

b) meet at 45

c) coincide with each other

d) are perpendicular to each other

10. Select the correct sequence for testing the hypothesis CO4 [K_2]

1. Set up a null hypothesis and a alternative hypothesis.
2. Make a decision whether to accept or reject null hypothesis.
3. Determine a suitable test statistic.
4. Set up a suitable level of significance.

a) 2-3-4-1

b) 1-3-2-4

c) 1-2-3-4

d) 1-4-3-2

PART B (10 x 2 = 20 Marks)

11. Solve $\left(D^2+a^2\right)y=\cos ax$ CO1 [K_2]

12. Find the particular integral of the differential equation $\left(D^2+1\right)y=x^3$. CO1 [K_2]

13. Find the Laplace transform of cos3tcos2t. CO2 [K_2]

14. Find the inverse Laplace transform of $\frac{1}{s(s+3)}$ CO2 [K_3]

15. A cycler pedals from his house to his college at a speed of 10 mph and back from college to his house at 15 mph. Find the average speed. CO3 [K_3]

16. Write the normal equations to fit a parabola. CO3 [K_2]

17. In a random sample of 500 people eating lunch at a college cafeteria on various Fridays, it was found that 160 preferred vegetarian food. Find 95% confidence interval for the actual proportion of people who eat vegetarian food on Fridays at this cafeteria. CO4 [K_3]

18. Discuss the various tests of significance for cases when the size of sample is large. CO4 [K_2]

19. Explain basic principles of experimental design. CO5 [K_3]

20. Compare Randomised Block Design and Latin Square Design. CO5 [K_3]

PART C (6 x 5 = 30 Marks)

21. Solve the differential equation $(1+x)^2\frac{d^2y}{dx^2}+(1+x)\frac{dy}{dx}+y=2\sin\log(1+x)$ CO1 [K_2]

22. Evaluate the integral using Laplace Transform $\int_0^\infty te^{-2t}\sin 3t\,dt$ CO2 [K_3]

23. Using Convolution Theorem, find the inverse Laplace Transform of CO2 [K_2]

$$\frac{s^2}{\left(s^2+a^2\right)\left(s^2+b^2\right)}$$

24. Find the measures of central tendency to the given data: CO3 [K_2]

2, 5, 7, 11, 18, 9, 2, 10, 7, 2.

25. The weight gains in pounds under two systems of feeding of calves of 10 pairs of identical twins is given below. Discuss whether the difference between the two systems of feeding is significant. CO4 [K_3]

Twin pair	1	2	3	4	5	6	7	8	9	10
System A	43	39	39	42	46	43	38	44	51	43
System B	37	35	34	41	39	37	37	40	48	36

26. An experiment was designed to study the performance of 4 different detergents for cleaning fuel injectors. The following 'cleanness' readings were obtained with a specially designed equipment for 12 tanks of gas distributed over 3 different models of CO5 [K_3]

engines. Test at the 0.01 level of significance whether there are differences in the detergents or in the engines.

Detergent	Engine 1	Engine 2	Engine 3
A	45	43	51
B	47	46	52
C	48	50	55
D	42	37	49

Answer any FOUR Questions

PART D (4 x 10 = 40 Marks)

27. Four machines A, B, C and D are used to produce a certain kind of cotton fabric. Samples of size 4 with each unit as 100 square meters are selected from the outputs of the machines at random and the number of flaws in each square meters is counted with the following result. Do you think that there is a significance difference in the performance of the four machines? Test at 1% level of significance. CO5 [K_3]

A	B	C	D
8	6	14	20
9	8	12	22
11	10	18	25
12	4	9	23

28. Solve the system of differential equation $\frac{dx}{dt}+y=e^t; x-\frac{dy}{dt}=t$. CO1 [$K_3$]

29. Find the Laplace Transform of the "triangular wave" function CO2 [K_3]

$$f(t)=\begin{cases} t, 0<t<a \\ 2a-t, a<t<2a \end{cases} \text{ where } f(t+2a)=f(t).$$

30. The theory predicts that the proportion of beans in the four groups A, B, C and D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and118. Do the experimental results support the theory? CO4 [K_3]

31. Calculate the two regression equations of X on Y and Y on X from the data given below, taking the deviations from actual means of X and Y CO3 [K_3]

Price (Rs)	10	12	13	14	15	16
Amount Demanded	40	38	43	45	43	37

Estimate the likely demand when the price is Rs.20.

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