KUMARAGURU
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M.TECH DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2014)

Second Semester

BIOTECHNOLOGY

P14MAT201: Applied Mathematics For Biotechnologists

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

Answer all the Questions
PART A (10 x 1 = 10 Marks)

1. The degree of $\dfrac{d^2y}{dx^2} + 2\left(\dfrac{dy}{dx}\right)^2 + y = 0$ is   [K₁]

   a)   0   b)   1

   c)   2   d)   3

2. $L\left[\dfrac{1}{t}f(t)\right] =$ [K₁]

   a) $\displaystyle\int_{s}^{\infty} L\big[f(t)\big]\,ds$ b) $\displaystyle\int_{0}^{\infty} L\big[f(t)\big]\,ds$

   c) $\displaystyle\int_{s}^{0} L\big[f(t)\big]\,ds$ d) $\displaystyle\int_{-\infty}^{\infty} L\big[f(t)\big]\,ds$

3. The Inverse Laplace transform of $\dfrac{1}{(s+1)(s+2)}$ is   [K₃]

   a) $e^{-t} - e^{-2t}$ b) $e^{-t} + e^{-2t}$

   c) $-e^{-t} + e^{-2t}$ d) $-e^{-t} - e^{-2t}$

4. [K₂]

List I	List II
A. Geometric mean of regression coefficients	i. Co-efficient of variation
B. Square of standard deviation	ii Co-efficient of correlation
C. A.M. of absolute values of deviations from the mean	iii Variance

	D. The ratio between S.D. and mean expressed as a percentage	iv Mean deviation

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

5. Assertion (A): If $b_{xy} = 0.75$, and $b_{yx} = 0.9$, then $r_{xy} = 0.8216$ [K₃]

   Reason (R): Correlation Coefficient is the arithmetic mean of the regression coefficients.

   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. The principle behind fitting a curve by the method of least squares is   [K₂]

   a) To minimize the sum of the residuals
   b) To minimize the sum of squares of the residuals
   c) To minimize the product of squares of the residuals
   d) To minimize the product of the residuals

7. Which of the following statements are true   [K₂]

   1. The square root of standard deviation is called variance
   2. Chi – square test is used to test independence of two attributes
   3. The two regression coefficients have to lie between -1 and +1
   4. Student's t – test can be used to test difference of means of two small samples

   a) 2,3
   b) 2,4
   c) 1,2,3
   d) 1,2,4

8. The mean lifetime of a sample of 100 light tubes is 1580 hours with S.D. 90 hours.   [K₃]

   Assertion (A): We reject the hypothesis that the mean lifetime of the tubes is 1600 hours.

   Reason (R): The value of the test statistic is 3.4 which is greater than the critical value 1.96

   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.

9. The test used in ANOVA is   [K₂]

   a) t – test
   b) F – test
   c) χ^2 – test
   d) normal test

10. Two way classification is also called [K₁]

   a) completely randomized design   b) randomized block design

   c) Latin square design   d) standard design

PART B (10 x 2 = 20 Marks)

11. Form the differential equation from the primitive $y = Ae^{-3x} + Be^{-2x}$ [K₃]

12. Identify the particular integral of $\dfrac{d^2 y}{dx^2} + 4y = \sin 2x$. [K₄]

13. State the existence conditions of Laplace transform [K₂]

14. Obtain the inverse Laplace transform of $\log\left(\dfrac{s+2}{s^2}\right)$ [K₃]

15. The average marks secured by 50 students was 44. Later on, it was discovered that a score 36 was misread as 56. Find the correct average marks secured by the students. [K₃]

16. The mean weight of a student in a group of six students is 119 lbs. The individual weights of five of them are 115,109,129,117 &114. What is the weight of the 6th student? [K₃]

17. Define type I and type II errors. [K₂]

18. Find the 95% confidence limits for the population mean, if the mean of the sample of 60 items was found to be 145 with a SD of 40. [K₃]

19. What are the three basic principles of design of experiments? [K₂]

20. State two differences between CRD and RBD. [K₂]

PART C (10 x 5 = 50 Marks)

21. Obtain the general solution of $(D^2 + 2D + 1) y = e^{-x} + 3$ [K₃]

22. Solve the equation $x^2 \dfrac{d^2 y}{dx^2} + x \dfrac{dy}{dx} + y = 4\sin(\log x)$ [K₄]

23. Determine the Laplace transform of $e^t \sinh 2t \cos t$ [K₃]

24. Identify the function f(t) by finding the inverse Laplace transform of $\dfrac{14s + 10}{49s^2 + 28s + 13}$ [K₄]

25. Calculate median and mode for the following data: [K₅]

Class:	0-10	10-20	20-30	30-40	40-50
Frequency:	10	14	19	17	13

26. Fit a parabola by the method of least squares to the following data. Also estimate y at x = 6. [K₅]

x	1	2	3	4	5
y	5	12	26	60	97

27. A simple sample of heights of 6400 English men has a mean of 170 cm and a S.D of 6.4 cm, while a simple sample of heights of 1600 Americans has a mean of 172 cm and a S.D of 6.3cm. Do the data indicate that Americans are on the average, taller than the Englishmen? [K4]

28. The following table gives the number of aircraft accidents that occur during the various days of a week. Test whether the accidents are uniformly distributed over the week. [K4]

Day	Sun	Mon	Tue	Wed	Thu	Fri	Sat
No. of accidents	14	16	8	12	11	9	14

29. What is analysis of variance and what are the assumptions made in it? [K2]

30. Give the format of ANOVA table for one factor experiment and LSD experiment. [K2]

PART D (2 x 10 = 20 Marks)

31. Find the Laplace Transform of the "triangular wave" function f(t), [K5]

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

32. An experiment was designed to study the performance of 4 different detergents for cleaning fuel injectors. The following 'cleanness' readings were obtained with specially designed equipment for 12 tanks of gas distributed over 3 different models of engines : [K5]

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

Perform a two way ANOVA to test at the 0.05 level of significance whether there are differences in the detergents or in the engines.

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