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BTECH
(SEM III) THEORY EXAMINATION 2023-24
MATHEMATICS-IV

TIME: 3HRS

M.MARKS: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

2 x 10 = 20

Qno.	Question	Marks	CO
a.	Write the form of Partial differential equation from the equation $z = f(x^2 + y^2)$ by eliminating the arbitrary function.	2	1
b.	Calculate P.I of $(D^2 - 3DD' + 2D'^2)z = \sin(x - 2y)$	2	1
c.	Discuss the nature of the following partial differential equation $4 \frac{\partial^2 u}{\partial x^2} - 3 \frac{\partial^2 u}{\partial x \partial t} - 5 \frac{\partial^2 u}{\partial t^2} = 0$	2	2
d.	Write down the two dimensional wave equation .	2	2
e.	Write the formula for rank correlation in the case of tied ranks.	2	3
f.	Explain kurtosis?	2	3
g.	Write Statement of Baye's theorem.	2	4
h.	If $P(A) = 1/5$ and $P(B) = 1/6$ find $P(AB)$.	2	4
i.	What is the difference between t- test and F- test?	2	5
j.	Discuss the term Statistical Quality Control.	2	5

SECTION B

2. Attempt any three of the following:

10 x 3 = 30

a.	Solve the solution of partial differential equation $r + s - 2t = \sin(2x - 5y)$	10	1
b.	Calculate the temperature in a bar of length 2 whose ends are kept at zero and lateral surface insulated if the initial temperature is $\sin \frac{\pi x}{2} + 3 \sin \frac{5\pi x}{2}$.	10	2
c.	The two lines of regression are given by $x + 2y - 5 = 0$, $2x + 3y - 8 = 0$ and $\sigma_y^2 = 12$. Then calculate (i) the mean values of x and y (ii) variance of x (iii) the coefficient of correlation between x and y	10	3
d.	In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and S.D of 60 hours. Calculate the number of bulbs likely to burn for More than 2150 hours, (b) less than 1950 hours (c) more than 1920 hours but less than 2160 hours	10	4
e.	A sample of 20 items has mean 42 units and S.D. 5 units. Discuss that it is a random sample from a normal population with mean 45 units. t for 19 degree of freedom at 5% level of significance is 2.09.	10	5

SECTION C

3. Attempt any one part of the following:

10 x 1 = 10

a.	Determine the solution of Cauchy problem $u_x + u_y = x + y$; $u(x,0) = 0$.	10	1
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b.	Use Charpit's method to evaluate the solution of $(p^2 + q^2)y = qz$	10	1
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4. Attempt any one part of the following: 10 x 1 = 10

a.	Determine the solution of the equation: $4 \frac{\partial u}{\partial x} + \frac{\partial u}{\partial t} = 3u; u(x,0) = 2e^{-2x}, \text{ when } t = 0$	10	2
b.	Determine the solution of one dimensional heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ where the boundary conditions are $u(0,t) = 0, u(l,t) = 0, (t > 0)$ and the initial condition $u(x,0) = 3 \sin \frac{\pi x}{l}; l$ being the length of the bar.	10	2

5. Attempt any one part of the following: 10 x 1 = 10

a.	Examine the least square fit of the $y = a + bx$ the following data:	10	3																
<table border="1"> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>f(x)</td> <td>2</td> <td>4</td> <td>10</td> <td>15</td> </tr> </table>		x	0	1	2	3	f(x)	2	4	10	15								
x	0	1	2	3															
f(x)	2	4	10	15															
b.	Obtain the rank correlation co-efficient for the following data.	10	3																
<table border="1"> <tr> <td>x</td> <td>77</td> <td>80</td> <td>75</td> <td>88</td> <td>92</td> <td>99</td> <td>70</td> </tr> <tr> <td>y</td> <td>99</td> <td>55</td> <td>67</td> <td>69</td> <td>88</td> <td>90</td> <td>60</td> </tr> </table>		x	77	80	75	88	92	99	70	y	99	55	67	69	88	90	60		
x	77	80	75	88	92	99	70												
y	99	55	67	69	88	90	60												

6. Attempt any one part of the following: 10 x 1 = 10

a.	A bag X contains 2 white and 3 red balls and a bag Y contains 4 white and 5 red balls. One ball is drawn at random from one of the bags and is found to be red. Calculate the probability that it was drawn from bag Y.	10	4												
b.	Data was collected over a period of 10 years, showing number of deaths from horse kicks in each of the 200 army corps. The distribution of deaths was as follows:	10	4												
<table border="1"> <tr> <td>No. of Deaths</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>Frequency</td> <td>109</td> <td>65</td> <td>21</td> <td>2</td> <td>3</td> </tr> </table>		No. of Deaths	0	1	2	3	4	Frequency	109	65	21	2	3		
No. of Deaths	0	1	2	3	4										
Frequency	109	65	21	2	3										
Fit the Poisson Distribution function corresponding to the data and calculate the theoretical frequency.															

7. Attempt any one part of the following: 10 x 1 = 10

a.	The following table gives a classification of sample of 160 plants of their flower colour and flatness of leaf.	10	5
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		Flat leaves	Coloured leaves	total							
	White flower	99	36	135							
	Red flower	20	5	25							
	total	119	41	160							
	Test whether the flower colours is independent of flatness of leaves. [The value of $\chi^2_{0.05} = 3.841$ for 1d.f]										
b.	Following is the data of defective of 10 samples of size 100 each. Construct np-chart and explain your findings.					10	5				
	Sample no.	1	2	3	4	5	6	7	8	9	10
	No. of defectives	2	5	0	14	3	0	1	0	18	8

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