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1B4M21529 (Pages : 2) Reg. No:.............................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester B.Sc Degree Examination, March/April 2021

BMT4B04 – Linear Algebra

(2019 Admission onwards)

Time: 2 ½ hours Max. Marks : 80

PART A

Answer all questions. Each question carries 2 marks.
Maximum mark from this section is 25.

1. Find k if $\begin{bmatrix} k & 1 & 1 \end{bmatrix}\begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 2 \\ 0 & 2 & -3 \end{bmatrix}\begin{bmatrix} k \\ 1 \\ 1 \end{bmatrix} = 0$
2. Give an example for a system of equations with two equations and having infinite number of solutions
3. Define a) Row equivalent Matrices b) Elementary Matrices
4. Show by an example , a matrix as a transformation from R^3 to R^2
5. Use the arrow technique to evaluate the determinant $\begin{vmatrix} -1 & 1 & 2 \\ 3 & 0 & -5 \\ 1 & 7 & 2 \end{vmatrix}$.
6. Show that a singleton set with a nonzero element is always linearly independent.
7. Find the wroskian of the functions $f_1(x) = 1$, $f_2(x) = \sin x$, $f_3(x) = \sin(2x)$
8. Define a) Basis of a vector space b) Dimension of a vector space.
9. Write a basis for P_n, the vector space of polynomials of degree $\leq n$. What is its dimension.
10. Which is the standard basis of R^3. Give an example for an infinite dimensional vector space.
11. Show that the vectors of the form (a , 1 , 1) does not form a subspace of R^3
12. State the Plus/Minus theorem .
13. Find the inverse of the matrix $\begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix}$.
14. Show that the product of two matrices is symmetric if and only if the matrices commute.
15. Show that the matrices A and $P^{-1}AP$ have the same determinant.

PART B

Answer all questions. Each question carries 5 marks.
Maximum mark from this section is 35.

16. Define a Vector Space and give two examples
17. Show that the intersection of subspaces of a vector space is again a subspace.
18. Express the vector V = (1, -2, 5) in R^3 as a linear combination of the vectors u_1= (1, 1, 1) , u_2= (1, 2, 3) and u_3= (2, -1, 1)
19. Check whether the vectors u_1 = (1, 1, 2) , u_2 = (2 , 3 , 1) and u_3 = (4, 5, 5) in R^3 are linearly independent or linearly dependent.
20. Use the inversion algorithm to find the inverse of the matrix $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$
21. Consider the bases B = { (2, 1, 1) , (2, -1, 1) (1, 2,1) } and B' = { (3, 1, -5) , (1, 1, -3) (-1, 0, 2) } for R^3 . Find the transition matrix from B to B'
22. Find the matrix P that diagonalises the matrix A = $\begin{bmatrix} 1 & 0 \\ 6 & -1 \end{bmatrix}$
23. Show that, If A is an invertible matrix then $A^T A$ is also invertible

PART C

Answer any TWO questions. One question carries 10 marks.

24. State the Rank-Nullity theorem for matrices. Verify it for the matrix $\begin{bmatrix} 1 & 1 & 1 \\ -1 & 0 & 1 \\ 1 & 2 & 3 \\ 1 & -1 & 3 \end{bmatrix}$
25. Show that the set $\{1 , t-1 , (t-1)^2 , \ (t-1)^3\}$ is a basis for P_3(t) , the vector space of all polynomials of degree less than or equal to 3. Find the coordinates of the vector V = $3t^3$- $4t^2$ + 2t – 5 relative to this basis.
26. If W is a subspace of a finite dimensional vector space V then prove that
    a) W is finite dimensional
    b) dim(W) ≤ dim (V)
    c) W = V if and only if dim (W) = dim (V)
27. Find the eigen values and the corresponding eigen vectors of the matrix

    A = $\begin{bmatrix} 3 & -1 & 1 \\ 7 & -5 & 1 \\ 6 & -6 & 2 \end{bmatrix}$

(2 x 10 = 20 Marks

1B4M21530 (Pages : 1) Reg. No:........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester B.Sc Degree Examination, March/April 2021

BMT4C04 – Mathematics – 4

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

PART A

Answer all questions. Each question carries 2 marks.
Maximum mark from this section is 20.

1. Find the order and degree of the differential equation $\frac{d^3y}{dx^3} = ((1 + (\frac{dy}{dx})^2)^{3/2}$.
2. Give an example for a linear and a non-linear differential equation.
3. Define an autonomous differential equation and give an example.
4. Find a solution to the differential equation $x\frac{dy}{dx} = 4y$.
5. Find the integrating factor in simplified form for the differential equation
6. $\frac{dy}{dx} + y \tan x = \sin 2x$
7. Write the general form of Bernoulli's differential equation and explain how it can be solved
8. Define the Dirac Delta function and WRITE its Laplace transformation.
9. Find the inverse Laplace transformation of $F(s) = \frac{s+1}{s^2+1}$.
10. State the superposition principle for homogenous differential equations.
11. Verify whether the functions $f_1(x) = 5$, $f_2(x) = \cos^2 x$ and $f_3(x) = \sin^2 x$ are linearly dependent or independent in the interval $(-\infty,\infty)$
12. Find the wroskian of the two functions $f_1(x) = e^x$, $f_2(x) = e^{-x}$

PART B

Answer all questions. Each question carries 5 marks.
Maximum mark from this section is 30.

13. Derive the formula for the Laplace transformation of $f'''(t)$, where $L(f(t)) = F(s)$ is given.
14. Find the Fourier cosine series of the function $f(x) = x$.
15. Using the method of separation of variables, solve the partial differential equation $\frac{\delta^2 z}{\vartheta x^2} - 2\frac{\vartheta z}{\partial x} + \frac{\partial z}{\partial y} = 0$
16. Solve the differential equation $x^2y'' + xy' - y = 0$
17. Show that the differential equation $(e^{2y} - y\cos(xy))dx + (2xe^{2y} - x\cos(xy) + 2y)dy = 0$ is exact and hence solve the same.
18. Solve the initial value problem $\cos x\,(e^{2y} - y)\frac{dy}{dx} = e^y \sin(2x)$, $y(0) = 0$
19. Using the method of undetermined coefficients, solve $y'' + 4y = 8x^2$.

PART C

Answer any ONE question. One question carries 10 marks.

20. Using the Laplace transformation, solve the initial value problem $y'' - y = t$, $y(0) = 1$, $y'(0) = -1$
21. Find the Fourier Series of the function $f(x) = x$, $-\pi < x < \pi$

1B4M21541 (Pages : 2) Reg. No:...........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester B.Sc Degree Examination, March/April 2021

BPH4C04 - Electricity, Magnetism and Nuclear Physics

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

The symbols used in this question paper have their usual meanings

Section A – Short Answer type.
(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is electrostatic shielding?
2. Distinguish between primary and secondary cosmic rays.
3. Define Nuclear Magnetic Resonance.
4. Derive the relation between permeability and susceptibility.
5. Define temperature coefficient of resistance.
6. Electron cannot be accelerated using cyclotron. Why?
7. Explain the terms retentivity and coercivity.
8. What is Meissener effect?
9. What is Higg's Boson?
10. Show that the introduction of a dielectric slab into the capacitor can increase the capacitance.
11. Define reduction factor of TG.
12. What is drift velocity? Write down its expression. **(Ceiling – 20)**

Section B – Paragraph / Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. The binding energy of $_{12}^{24}$Mg is 198.25 MeV. Find its atomic mass?
(Mass of hydrogen atom = 1.00783u , mass of neutron = 1.0865u)
14. The activity of a radioactive sample is decreased to 75% of the initial value after 30 days. Calculate the half life of sample.
15. Describe the classification of elementary particle
16. With the help of neat diagram explain the working of linear accelerator
17. What capacitance is required to store an energy of 100 KWh at a potential difference of 10^4 V?
18. Explain cosmic ray shower
19. The force between two electrons when placed in air equal to 0.5 times weight of an electron. Find the distance between two electrons
(Given mass of electron = 9.1×10^{-31} Kg). **(Ceiling – 30)**

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries 10 marks)

20. Explain the principle of potentiometer. How can we determine the resistance using potentiometer?
21. Explain the theory of vibration magnetometer. With the help of Searle's Vibration magnetometer how can we find the moment of magnet?

(1 x 10 = 10 marks)

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1B4M21555 (Pages : 2) Reg. No:..........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester B.Sc Mathematics Degree Examination, March/April 2021

BST4C04 – Statistical Inference and Quality Control

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

SECTION-A

Each question carries 2 Marks.
Maximum Marks that can be scored in this section is 20.

1. Give any three situations in which c- chart can be used.
2. What is principle of least squares?
3. Write the observational equation in the case of one-way classification
4. Distinguish between null and alternative hypothesis
5. What is meant by interval estimation?
6. How sufficiency is related to conditional distribution?
7. Distinguish between defects and defectives
8. What is median test?
9. Distinguish between assignable causes and chance causes of variation
10. Let $X_1, X_2, ..., X_n$ be a random sample from $N(0,\theta^2)$. Give a point estimator of θ^2.
11. State Crammer- Rao inequality
12. Give the test statistic for testing the discrepancy between observed frequency and expected frequency.

SECTION-B

Each question carries 5 Marks.
Maximum Marks that can be scored in this section is 30.

13. Outline the various steps for ANOVA testing in two way classification
14. A random sample of size 25 is taken from a Normal population $N(\mu, 9)$. Determine a 95% confidence interval for μ.
15. A random sample of 10 boys had the following IQ's :70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Do the data supports the assumption of a population mean IQ of 100 (use $\alpha = 0.05$)
16. Explain the method of moment estimation

17. Test the significance of the difference between the means of the samples from the following data (use $\alpha = 0.01$)

	Size	Mean	SD
Sample A	100	61	4
Sample B	200	63	6

18. What is the need for using Non parametric statistics

19. Let p be the probability that a coin will fall head in a single toss in order to test $H_0 : p = 1/3$ against $H_1 : p = 3/4$. The coin is tossed 5 times and H_0 is rejected if more than 2 heads obtained. Find the size and power of the test.

SECTION-C

(Answer *any one* Question and carries 10 marks)

20. (a) Explain F- test of equality of variances of two normal populations

(b) Following are the set of observations from two normal populations. Test the equality of these population variances at 5% level of significance

From first population	39	41	43	41	45	39	42	44
From second population	40	42	40	44	39	38	40	

21. Ten samples each of size 5 are drawn at regular intervals from a manufacturing process. The sample means ($\bar{X}$) and their ranges (R) are given below

Sample No	1	2	3	4	5	6	7	8	9	10
means ($\bar{X}$)	49	45	48	53	39	47	46	39	51	45
range (R)	7	5	7	9	5	8	8	6	7	6

Draw the control chart for means and ranges and comment the result

(for $n = 5, A_2 = 0.577, D_4 = 2.115, D_3 = 0$)