2B3N21339 (Pages : 2) Reg. No:……………………..

Name: ……………………….

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Mathematics Degree Examination, November 2021

BST3C03 – Probability Distributions and Sampling Theory

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

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

1. Define standard normal distribution.
2. What is the mgf of $N(\mu,\sigma)$?
3. Define log normal distribution.
4. State Central limit theorem.
5. Explain the term convergence in probability.
6. Distinguish between parameter and statistic.
7. How will you select a stratified random sample?
8. Derive the mean of chisquare distribution.
9. Define F statistic and write down its pdf.
10. What is standard error?
11. Define beta distribution of first kind.
12. State and prove additive property of two binomial random variables.

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

13. Establish the recurrence relation for the moments of Poisson distribution.
14. Show that a linear combination of independent normal variates is also a normal variate?
15. State and establish Bernoulli's law of large numbers.
16. A random variable X has mean 50 and variance 100. Use Chebysheff's inequality to find a lower bound to the probability $P(|X-50|<20)$.
17. Explain a systematic sample.
18. For sampling from a heterogeneous population which method do you prefer? Why?
19. Define a student's t statistic. Derive its probability density function.

Part C

Answer any one question and carries 10 Marks.

20. a)Explain convergence in probability.

    b) State and establish Weak law of large numbers for iid random variables.

21. Explain the different methods of sampling.

(1 x 10 = 10 Marks)

2B3N21310 (Pages : 2) Reg. No:……………………..

Name: ……………………….

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2021

BMT3B03 - Theory of Equations and Number Theory

(2019 Admission onwards)

Time: 2 ½ hours Max. Marks : 80

Part A

All questions can be attended.

Each questions carries 2 marks.

1. Find the product of $f(x) = x^2 - x + 1$ *and* $g(x) = x^2 + x + 1$ By the Method of Detached coefficients.
2. Without actual division , Show that $2x^4 - 7x^3 - 2x^2 + 13x + 6$ **is divisible by** $x^2 - 5x + 6$
3. Write a bi-quadratic equation with the roots $i, -i, 1+i, 1-i$.
4. Find the rational root of the function $6x^3 - x^2 + x - 2 = 0$.
5. Prove that there is no positive integer between 0 and 1.
6. Define the number sequence $3, 8, 13, 18, 23, \dots\dots\dots$ recursively.
7. State and prove the Pigeonhole Principle.
8. Let f be a function defined recursively by $f(x) = \begin{cases} 1 & if\ 3|n \\ f(n+1) & otherwise \end{cases}$. Then find $f(16)$.
9. Express the gcd of the pair of numbers 18, 28 as a linear combination of the numbers.
10. Prove or Disprove : Any two consecutive Fibonacci numbers are relatively prime.
11. Find the canonical decomposition of 1863.
12. Determine whether the linear congruence $12x \equiv 18 \ (mod\ 15)$ is solvable.
13. What is a pseudoprime. Give an example.
14. If $n = 2^k$, then prove that $\varphi(n) = n/2$.
15. Prove or disprove: If the congruence $x^2 \equiv 1 \ (mod\ m)$ has exactly two solutions, then prove that m is a prime.

(Ceiling =25Marks)

Part B

All questions can be attended.
Each questions carries 5 marks.

16. Solve $20x^3 - 30x^2 + 12x - 1 = 0$, Given that 1/2 is a root
17. Solve the cubic equation $x^3 - 6x - 6 = 0$
18. State and prove the Second Principle of Mathematical Induction.
19. Find the number of positive integers ≤ 3000 and divisible by 3,5 *or* 7.
20. Two positive integers, a and b are relatively prime if and only if there are integers α and β such that $\alpha a + \beta b = 1$.
21. State Dirichlet's Theorem. Using this theorem , prove that there are infinitely many primes of the form $2n + 3$.
22. Find the remainder when 7^{1001} is divided by 17.
23. State and prove Euler's Theorem.

(Ceiling =35Marks)

Part C (*Essay type*)

Answer any two questions
Each question carries 10 marks

24. (a) Solve the cubic equation $x^3 - 6x - 6 = 0$

    (b) Show that $\sqrt[3]{\sqrt{5}+2} - \sqrt[3]{\sqrt{5}-2} = 1$
25. State and prove Division algorithm for integers.
26. (a) Explain the Euclidean algorithm for any two positive integers a and b.

    (b) Using the euclidean algorithm, express $(4076, 1024)$ as a linear combination of 4076 and 1024.
27. (a) State and prove Fermat's Little Theorem and hence deduce that $a^p \equiv a \ (mod\ p)$.

    (b) Find the remainder when 24^{1947} is divided by 17.

(2 x 10 =20Marks)

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Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2021

BPH3C03 – Mechanics, Relativity, Waves & Oscillations

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

Section A

Answer all questions. Answer in two or three sentences.
Each correct answer carries a maximum of two marks.

1. Explain what is inertial frames
2. Show that even if no external force is acting, a particle will experience a force in an accelerated frame
3. What is meant by centrifugal force?
4. State work - energy principle
5. Show that the curl of a conservative force vanishes
6. What are non conservative forces? Give two examples.
7. Explain proper time & proper length.
8. Give the relativistic relation between momentum and energy.
9. Write the expression for mass energy relation and explain the symbols.
10. What is the Schrodinger's postulate?

11 Graphically represent the variation of P.E. and K.E. of a simple harmonic oscillator. When are they equal?

12 Explain what is meant by an harmonic oscillations.

(Ceiling: 20 Marks)

Section B (Paragraph/Problem)

(Answer all questions in a paragraph of about half a page to one page.

Each correct answer carries a maximum five marks)

13. A mass of 1 kg is thrown horizontally due north with a velocity 500m/s at latitude 30°. Obtain the magnitude of Coriolis force.
14. Show that the law of conservation of linear momentum is invariant under Galilean transformation.
15. Form the potential energy function $U = U_0 + Px + Qx^2$, find the restoring force and hence the force constant.
16. Find the centre of mass of a system of masses m_1, m_2 and m_3 placed at (x_1,y_1,z_1), (x_2,y_2,z_2) and (x_3,y_3,z_3) respectively.
17. Show that the law of addition of velocity predicts the constant value of the velocity of light in all the inertial frames.
18. Define wave function. Give its significance and write conditions for a wave function to be well behaved.
19. A particle of mass 1 g moves in a P.E. well given by $U = U_0 + 6x + x^2$. Find
    (a) the force constant (b) the frequency of oscillation and
    (c) the position of stable equilibrium.

(Ceiling:30Marks)

Section C (Essay)

Answer anyone in about two pages .Each question carries ten marks)

20. Derive Galilean transformations. Show that length and acceleration are invariant under Galilean transformation.
21. Explain the principle of rocket. Derive expression for the final velocity of rocket.

(1x10=10 Marks)