2B3N21245 (Pages : 2) Reg. No:.............................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2021

BCH3B03 – Physical Chemistry – I

(2019 Admission onwards)

Time: 2 hours Max. Marks: 60

Section A (Short answers)

(Answer questions up to 20 marks. Each question carries 2marks)

1. Define compressibility factor. Mention its significance.
2. Calculate the RMS velocity of N_2 molecule at 25^0C.
3. State Law of Rectilinear diameter.
4. What is meant by cyclic process?
5. Why is that N_2 gets cooled while He gets warmed when each is allowed to undergo adiabatic expansion through a porous plug?
6. Define efficiency of a heat engine.
7. Give Kirchhoff's equation
8. State the Third Law of thermodynamics.
9. State and explain the law of mass action.
10. Define Le Chatelier principle.
11. What is meant by heterogeneous equilibrium? Give one example.
12. Illustrate vertical planes of symmetry.

[Ceiling of marks: 20]

Section B (Paragraph)

(Answer questions up to 30 marks. Each question carries 5 marks)

13. Define: (i) most probable velocity (ii) root mean square velocity, and (iii) average velocity. Give expressions for each.
14. Write a note on critical constants.
15. Explain the terms Cp and Cv.
16. Discuss Nernst heat theorem.
17. Derive the Gibbs-Duhem equation.
18. Explain homogeneous and heterogeneous equilibria, with suitable examples.
19. Give the group multiplication table for C_{2v} point group.

[Ceiling of marks: 30]

Section C (Essay)
(Answer any one. Each question carries 10 marks)

20. Based on kinetic theory of gases, derive kinetic gas equation.

21. Describe the Carnot's cycle and derive an expression for the efficiency of a heat engine

[1 x 10 = 10 Marks]

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Name: ……………………….

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2021

BMT3C03 - Mathematics – 3

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

Section A

All questions can be attended.

Each question carries 2 marks.

1. Find the vector function that describes the curve C of intersection of the plane $y = 2x$ and the paraboloid $z = 9 - x^2 - y^2$.
2. Define Tangential and Normal Components of Acceleration.
3. If $z = u^2v^3w^4$ and $u = t^2, v = 5t - 8, w = t^3 - t$. Find dz/dt.
4. Find the directional derivative of $f(x, y) = 2x^2y^3 + 6xy$ at (1, 1) in the direction of a unit vectorwhose angle with the positive x-axis is $\pi/6$.
5. State Stoke's theorem.
6. Compute all the roots of $8^{\frac{1}{3}}$ and sketch these roots on an appropriate circle centered at origin.
7. Find the circulation and net flux for the flow $f(z) = 2z$ where C is the circle $|z| = 1$.
8. Show that the function $f(z) = 4z - 6\bar{z} + 3$ is not analytic at any point.
9. Find the first partial derivatives of $z = \frac{4\sqrt{x}}{3y^2+1}$.
10. Compute $\nabla f(x, y)$ for $f(x, y) = 5y - x^3y^2$.
11. Find the directional derivative of the function $f(x, y) = 5x^3y^6$ at the point (1,1) in the direction $\theta = \frac{\pi}{6}$.
12. Find the level curve of $f(x, y) = -x^2 + y^2$ passing through (2, 3). Graph the gradient at the point.

(Ceiling 20 Marks)

Section B

All questions can be attended.
Each question carries 5 marks

13. A projectile is launched from ground level with an initial speed $V_0 = 768$ ft/s at an angle of elevation $\theta = 30^0$. Find

(a) the vector function and parametric equations of the projectile's trajectory,

(b) the maximum altitude attained,

(c) the range of the projectile, and

(d) the impact speed.

14. Verify that the given function $u = \cos at . \sin x$ satisfies Wave equation, $a^2 \frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$.

15. Define length of a space curve. Find the length of the space curve traced by the vector function $r(t) = a\cos t\,\mathbf{i} + a\sin t\,\mathbf{j} + at\mathbf{k}, 0 \leq t \leq 2\pi$.

16. Determine whether the vector field $F(x, y) = (x^2 - 2y^3)i + (x + 5y)j$ is conservative.

17. State and prove Cauchy's inequality.

18. Show that $\cos\left(\frac{\pi}{2} + i\ln 2\right) = -\frac{3}{4}$

19. Show that $f(z) = e^{\bar{z}}$ is nowhere analytic.

(Ceiling 30 Marks)

Section C

Answer any One question. Each question carries 10 marks

20. (a) Find parametric equations for the normal line to the surface .

$z = \frac{1}{2}x^2 + \frac{1}{2}y^2 - z + 4$ at the point (1, -1, 5).

(b) Find the points on the surface $x^2 + y^2 + z^2 = 7$ at which the gradient is parallel to the plane $2x + 4y + 6z = 1$.

21. (a) Show that the line integral $\int_C (y + yz)dx + (x + 3z^3 + xz)dy + (9yz^2 + xy - 1)dz$ is independent of the path C between (1, 1, 1) to (2, 1, 4).

(b) Evaluate $\int_{(1,1,2)}^{(2,1,4)} F.dr$

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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^o. 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)