19PHY101

Reg. No:....................

CHOICE BASED CREDIT SYSTEM
B.Sc. FIRST SEMESTER DEGREE EXAMINATION, FEBRUARY 2021
Physics - Paper I

Duration:3 Hrs **Max Marks:80**

PART - A

Answer any TWELVE from the following: **(12×1= 12 Marks)**

1. Define constrained vector.
2. Define planar vector.
3. What is the conjugate of complex number $\vec{z} = a + jb$?
4. What is the cross product of two complex numbers $\overrightarrow{Z_1} = a + jb$ and $\overrightarrow{Z_2} = c + jd$.
5. Define degree of a differential equation.
6. What is the nature of the graph between load versus extension within the elastic limit?
7. Write an expression for the work done per unit volume in terms of stress and strain.
8. Write the formula for excess pressure inside a liquid drop.
9. Define critical velocity of a liquid.
10. What is the SI unit of coefficient of viscosity?
11. What is a fictitious force?
12. What is invariant according to Galilean transformation?
13. Write velocity addition theorem according to Lorentz transformation.
14. Write the condition to obtain Galilean transformation equations from Lorentz transformation equations.
15. What happens to the length of an object when it moves with the speed of light?

PART - B
UNIT I

Answer any TWO from the following: **(2×8= 16 Marks)**

16. a) Prove that the area of a parallelogram with sides $\vec{A}$ and $\vec{B}$ is $\left|\vec{A}\ X\,\vec{B}\right|$

    b) Derive expressions for radial and transverse components of velocity and acceleration of a particle moving along a curve in X-Y plane. **(2 + 6)**

17. a) Using Argand diagram explain, the subtraction of two complex numbers $\vec{z}_1 = a + jb$, $\vec{Z}_2 = c + jd$

    b) Explain the representation of complex number $\vec{z} = x + jy$ in trigonometric, polar and exponential forms and deduce the relations between them. **(2 + 6)**

18. a) Write the differential equation for Newton's law of cooling and find its solution.

    b) Write the second order differential equation and find its solution by numerical and auxiliary equation methods. **(2 + 6)**

UNIT II

Answer any TWO from the following: **(2×8= 16 Marks)**

19. a) What are I-section girders? Explain why I-section girders are preferred to rectangular cross section girders.

    b) Derive an expression for torsional couple per unit twist. **(2 + 6)**

20. a) Give any four applications of surface tension.

    b) Give the theory and derive the expression for finding the interfacial tension between two liquids by drop weight method. **(2 + 6)**

21. a) How does viscosity vary with temperature and pressure?

    b) Using Stoke's method derive an expression for the terminal velocity of the liquid. **(2 + 6)**

UNIT III

Answer any TWO from the following: **(2×8= 16 Marks)**

22. a) Give two differences between inertial and non inertial frames of references.

    b) Enunciate the law of conservation of energy by considering collision between two particles and show that it is invariant to Galilean transformation. **(2 + 6)**

23. a) Write a note on Galilean transformation of acceleration in an inertial frame.

    b) Deduce relativistic expression connecting energy and momentum. Hence write down formulae for energy and momentum of a photon. **(2 + 6)**

24. a) How do astronomers tell the difference between the different kinds of red shifts? Explain.

    b) Write Lorentz transformation equations and obtain an expression for time dilation. **(2 + 6)**

PART - C

III. Answer any FOUR from the following: **(4×5= 20 Marks)**

25. Evaluate $\int \vec{A}.\,\overrightarrow{dr}$ where $\vec{A} = 3x^2\,\hat{i} - 14\,yz\,\hat{j} + 20\,x\,z^2\,\hat{k}$ along the curve $x = t$, $y = t^2$, $z = 4t^2 - t$ from t = 0 to t = 1.

26. The initial mass of an Iodine isotope was 200g. Determine the Iodine mass after 30 days if the half life of the isotope is 8 days.

27. A cantilever of length 0.2 m is loaded by 0.2 kg at the free end. Calculate the depression at the free end. Given: Young's modulus = 18×10^{10} N m^{-2} ,breadth of cantilever = 1.5×10^{-2} m and thickness of cantilever = 0.1×10^{-2} m

28. Calculate the work done in spraying a spherical drop of water of 1 mm radius into a million droplets of equal size, surface tension of water is 0.072 N m^{-1} .

29. Find the horizontal component of the Coriolis force acting on a body of mass 0.1 kg moving northward with a horizontal velocity of 100 m s^{-1} at 300 N latitude on the earth.

30. (i) Two spaceships A and B are moving in opposite direction each with a speed of 0.9c. Find the relativistic velocity of B with respect to A. (ii) The mean life of pi meson at rest is 2×10^{-8} s. Calculate the mean life of a meson moving with velocity 0.8c.

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18PHY101 Reg. No:....................

CREDIT BASED SEMESTER SYSTEM
B.Sc. FIRST SEMESTER DEGREE EXAMINATION, FEBRUARY 2021
Physics - Paper I

Duration:3 Hrs **Max Marks:80**

PART - A

Answer any TWELVE from the following: **(12×1= 12 Marks)**

1. Define the scalar product of two vectors.
2. Write the expression for time derivative of $\vec{A} \,.\, \vec{B}$
3. What is the conjugate of complex number $\vec{z} = a + jb$?
4. What is the dot product of two complex numbers $\overrightarrow{Z_1} = a + jb$ and $\overrightarrow{Z_2} = c + jd$.
5. Define degree of a differential equation.
6. Write an expression for the work done per unit volume in terms of stress and strain.
7. On what factors does the twist produced in the wire for a given twisting couple depend?
8. Define surface tension. Give its unit.
9. What is the effect of temperature on viscosity of a liquid?
10. Define critical velocity of a liquid.
11. Define a non-inertial frame of reference.
12. What are the limitations of Newton's law of motion?
13. What is gravitational red shift?
14. Define relativity of simultaneity according to Lorentz transformation.
15. Define proper length according to Lorentz transformation.

PART - B
UNIT I

Answer any TWO from the following: **(2×8= 16 Marks)**

16. a) If $\vec{r}$ is position vector of a particle, show that $\frac{d\vec{r}}{dt}$ is its velocity and $\frac{d^2\vec{r}}{dt^2}$ is its acceleration.

    b) Define Planar vector. If $\vec{r}$ is a planar rotating vector of constant magnitude and $\overrightarrow{A_\perp}$ is a vector of same magnitude in a perpendicular direction in the same plane, show that $\frac{d\vec{A}}{d\Theta} = \overrightarrow{A_\perp}$ and $\frac{d\overrightarrow{A_\perp}}{d\Theta} = -\vec{A}$ **(2 + 6)**

17. a) Express $2e^{j\frac{5\pi}{6}}$ in rectangular form.

    b) Explain how addition and subtraction of two complex numbers $\vec{z}_1 = a + jb$, $\vec{z}_2 = c + jd$ is performed analytically and by using Argand diagram. Write the steps involved. **(2 + 6)**

18. a) Write the second order differential equation and find its solution by auxiliary equation method.

b) Write the differential equation for simple harmonic oscillator and find its solution. **(2 + 6)**

UNIT II

Answer any TWO from the following: **(2×8= 16 Marks)**

19. a) In the case of bending of a rod, young's modulus only comes into play and not modulus of rigidity even though there is a change in shape. Explain.

b) Derive an expression for torsional couple per unit twist. **(2 + 6)**

20. a) On what factors does the angle of contact depend ?

b) Give the theory and derive the expression for finding surface tension of a liquid by drop weight method. **(2 + 6)**

21. a) Distinguish between stream line and turbulent flow.

b) Using Stoke's method derive an expression for the terminal velocity of the liquid. **(2 + 6)**

UNIT III

Answer any TWO from the following: **(2×8= 16 Marks)**

22. a) Give two differences between real and inertial forces.

b) What is meant by Galilean transformation and Galilean invariance? Show that whereas length and acceleration is invariant to Galilean transformation, velocity is not. **(2 + 6)**

23. a) Show that energy is invariant to Galilean transformation in an inertial frame.

b) Deduce relativistic expression connecting energy and momentum. Hence write down formulae for energy and momentum of a photon. **(2 + 6)**

24. a) Explain the terms proper length and relative length according to Lorentz transformation.

b) State the basic postulates of special theory of relativity and hence obtain Lorentz transformation formulae. **(2 + 6)**

PART - C

III. Answer any FOUR from the following: **(4×5= 20 Marks)**

25. Evaluate $\int \vec{A}.\, \overrightarrow{dr}$ where $\vec{A} = 3x^2\,\hat{i} - 14\,yz\,\hat{j} + 20\,x\,z^2\,\hat{k}$ along the curve $x = t,\ y = t^2,\ z = 4t^2 - t$ from t = 0 to t = 1.

26. A fossil contains 25% of the original amount of C^{14} , how old is it? Half life of C^{14} is 5730 years.

27. A cube of side 0.1 m is subjected to a shearing force 1 x 10^5 N. The top surface of the cube is displaced by 0.1 mm with respect to bottom. Calculate shearing strain and rigidity modulus.

28. What would be the pressure inside a small air bubble of 0.1 mm radius just below the surface of water? Surface tension of water = 0.072 N m^{-1} .

29. A frame S^1 is moving with velocity $(5\,\hat{i} + 7\,\hat{j})$ m s^{-1} relative to an inertial frame S. A particle is moving with velocity $((t+5)\,\hat{i} + 9\,\hat{j})$ m s^{-1} with respect to S. Find the acceleration of the particle in the frame S^1.

30. (i) A photon is travelling east and another photon is travelling west. Find the relative velocity of the two photons. (ii) An electron is moving with a speed of 0.85c in a direction opposite to that of a moving photon. Calculate the relative velocity of the electron with respect to the photon.

19MAT101 Reg No : ....

CHOICE BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

MATHEMATICS

Mathematics Theory I

Duration:3 Hours **Max Marks:80**

I. Answer any EIGHT of the following : **(8×3= 24 Marks)**

1. Apply concavity test and determine where the graph of the function $y = 2 + sinx$ is concave up and where it is concave down in the interval $[0, 2\pi]$.
2. Find a horizontal tangent of the curve $f(x) = \frac{x^3}{3} - 3x$ in the interval $[-3, 3]$.
3. Evaluate $\int_{\frac{-\pi}{3}}^{0} 2sec^3 x dx.$
4. Find the average value of $g(x) = |x| - 1$ on $[-1, 1]$.
5. For the function $f(x) = 1 - x^2$ find a formula for the upper sum over the interval $[0, 2]$ obtained by dividing the interval $[0, 2]$ into n equal intervals.
6. If $f(x, y) = xcos(xy)$, then find f_x and f_y.
7. Write the domain of the function: $f(x, y) = \frac{1}{\sqrt{4-(x^2+y^2)}}$
8. Determine where the following functions are continuous:
   (i)$f(x, y, z) = \frac{y}{|x|+|z|}$ (ii)$f(x, y, z) = \frac{x^2+y^2}{x^2-3x+2}$.
9. If an ellipse, centered at the origin has foci at $(0, \pm 3)$ and eccentricity 0.5 then find the equation of the ellipse.
10. Find an equation for the hyperbola $2xy = 9$ in the new system after rotating the system through an angle of $\frac{\pi}{4}$.

II. Answer any EIGHT of the following : **(8×7= 56 Marks)**

11. State and prove mean value theorem.
12. State and prove Second derivative test for local extrema.

13. Find the asymptotes of the graph of $f(x) = \frac{x.+3}{x+2}$.

14. Derive reduction formula for $\int cos^n x dx$.

15. Prove that f is continuous on $[a, b]$ and $F(x) = \int_a^x f(t)dt$ is continuous on $[a, b]$ and differentiable on (a, b) and its derivative is $F'(x) = f(x)$:

16. Express $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ in terms of r and s if
$w = x + 2y + z^2, x = \frac{r}{s}, y = r^2 + lns, z = 2r$

17. If $z = x^3 - 3xy^2 + x + e^x cosy + 1$, then find $\frac{\partial^2 z}{\partial x^2}$ and $\frac{\partial^2 z}{\partial y^2}$.

18. The ellipse $\frac{x^2}{3} + \frac{y^2}{2} = 1$ is shifted 2 units to the right and 1 unit up. Find the equation of the new ellipse. Also, find and plot the new foci, vertices, centre in the sketch of the ellipse

19. The hyperbola $\frac{x^2}{4} - \frac{y^2}{5} = 1$ is shifted 2 units to the right and 2 units up. Find the equation of the new hyperbola. Also find and plot the new foci, vertices, centre and asymptotes in the sketch of the hyperbola.

20. Find the vertex, focus and directrix of the parabola $x^2 + 2x + 4y - 3 = 0$.

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MAT101.2 **Reg. No. ....**

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY2021

MATHEMATICS

PAPER 1 - CALCULUS AND NUMBER THEORY

Time: 3 Hrs. **Max. Marks: 120**

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
2. Answer FIVE full questions form Part B Choosing ONE full question from each unit.

PART - A

$3\times10=30$

1. a. Find the critical numbers of the function $f(x)=x^3+7x^2-5x$
   b. Find the value of c satisfying Rolle's theorem for the function of $f(x)=4x^3-9x$ in the interval $\left[-\frac{3}{2},\frac{3}{2}\right]$.
   c. Find the point of inflection of the graph of $f(x)=(1-2x)^3$
   d. Evaluate $\lim_{\theta\to0}\frac{Sin^2\theta}{Sin\theta^2}$
   e. Find the vertical and horizontal asymptotes of graph of the function $f(x)=\frac{8x-2x^2}{x^2-9}$
   f. Find the polar equation of a graph whose cartesian equation is $x^2+y^2-4x=0$
   g. Evaluate $\int_0^{\pi/2} sin^7 x dx$
   h. Evaluate $\int tan^3 x sec^3 x dx$
   i. Derive the reduction formula for $\int x^m (logx)^n dx$
   j. The region bounded by the curve $y=\sqrt{x}$, the x-axis and the line x=2 is revolved about the line x=4. Find the volume of the solid generated.
   k. Find the length of the arc of the curve $y=x^{2/3}$ from the point (1,1) to (8,4)
   l. Find the area of the region enclosed by the graph of the equation $r=3\sin\theta$
   m. Find the remainder when $1!+2!+3!+\cdots+99!+100!$ is divided by 4.
   n. If $a|bc$ with gcd $(a,b)=1$ then prove that $a|c$.
   o. Show that $a(a^2+2)/3$ is an integer for all $a\geq1$

PART – B

UNIT – I

2 a. If f (x) exists for all values of x in the open interval (a,b) and if f(x) has relative extremum at c, where $a<c<b$ then if $f'(c)$ exists, Prove that $f'(c)=0$. (6)
   b. Find the dimension of the right-circular cylinder of greatest volume that can be inscribed in a right-circular cone with a radius of 5 cm and a height of 12cm. (6)
   c. If $f(x)=x^4-\frac{1}{3}x^3-\frac{3}{2}x^2$, then find the relative extrema of f (x) using second derivative test. (6)

3 a. State and prove Rolls Theorem (6)
   b. A rectangular field is to be fenced off along the bank of a river, no fence is required along the river. If the material for the fence costs \$8 per running foot for the two ends and \$12 per running foot for the side parallel to the river, find the dimensions of the field of largest possible area that can be enclosed with \$3600 worth of fence. (6)
   c. If $f(x)=(1-2x)^3$ find the point of inflection of the graph of f(x) and determine where the graph is concave upward and where it is concave downward. Sketch the graph. (6)

UNIT – II

4 a. State and prove Cauchy's mean value Theorem. (6)
   b. Sketch the graph of $r=3+2\sin\theta$ (6)
   c. Find the third degree Tylor Polynominal for the function $f(x)=x^{3/2}$ at a=4 (6)

5. a. If f(a)=g(a)=0 and f and g are differentiable in an open interval I containing 'a' and $g'(x) \neq 0$ in I for $x \neq a$, then prove that $\lim_{x \to a} \frac{f(x)}{g(x)} = \lim_{x \to a} \frac{f'(x)}{g'(x)}$ (6)

b. Sketch the graph of the function $y=2x^3-6x+1$ (6)

c. Evaluate (i) $\lim_{x \to 0^+} (x+1)^{cotx}$ (ii) $\lim_{x \to 0} \left(\frac{1}{x^2} - \frac{1}{sec^2 x}\right)$ (6)

UNIT – III

6. a. Obtain a reduction formula for $\int x^n e^{ax} dx$. Hence evaluate $\int x^3 e^{ax} dx$ (6)

b. If f is continuous on [a,b] and let g be a function such that g'(x)= f(x) for all x in [a,b] then prove that $\int_a^b f(t)dt$=g(b) −g(a) (6)

c. Find the approximate value of the definite intergral $\int_0^2 \sqrt{1+x^4} dx$ using trapezoidal rule taking n=4 (6)

7. a. If f is continuous on the closed interval [a,b] and x is any number in [a,b] and if F is the function defined by F(x)= $\int_a^x f(t)dt$, then prove that F'(x)=f(x) (6)

b. Obtain a reduction formula for $\int tan^n x dx$ Hence evaluate $\int tan^6 x dx$ (6)

c. Evaluate $\int \frac{\sqrt{x}}{1+\sqrt[3]{x}} dx$ (6)

UNIT – IV

8. a. Find the volume of the solid generated by revolving about the x-axis the region bounded by the parabola $y=x^2+1$and the line y=x+3 using circular disc method (6)

b. If the base of a solid is the region enclosed by a circle with a radius of r units and if all plane sections perpendicular to a fixed diameter of the base are squares, then find the volume of the solid. (6)

c. Find the area of the region bounded by the graph of $r=2+2\cos\theta$ (6)

9. a. Find the volume of the solid generated by revolving about the line x=1 the region bounded by the curve $(x-1)^2 = 20-4y$ and the lines x=1, y=1 and y=3 and to the right of x=1 (6)

b. Find the area of the region inside the circle $r=3\sin\theta$ and outside the limacon $r=2-\sin\theta$ (6)

c. Find the length of the arc of the curve $x^{2/3}+y^{2/3}=1$ in the first quadrant from the point x=1/8 to x=1 (6)

UNIT - V

10. a. State and prove division algorithm (6)

b. If a cock is coorth 5 coins, a hen 3 coins and 3 chicks together, 1 coin, then how many cocks hens and chicks totaling 100 can be bought for 100 coins? (6)

c. Use Euclidean algorithm to obtain integers x and y satisfying 12378x+3054y=gcd(12378, 3054). (6)

11. a. If a=bq+r, then prove that gcd(a,b)=ged (b,r) (6)

b. A customer bought a dozen of fruits, apples and oranges for $1.32. If an apple costs 3cents more than an orange and more apples than oranges were purchased, how many pieces of each kind were bought? (6)

c. If a and b are integers not both zero, then prove that a and b are relatively prime if and only if there exist integers x and y such that ax+by=1 (6)

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18MAT101 Reg. No. ....

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
MATHEMATICS PAPER 1 - CALCULUS

Time: 3 Hrs. **Max. Marks: 120**

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B Choosing ONE full question from each unit.

PART - A **3×10=30**

1.

a. Find the values of z in the interval (a,b) = $(0, \pi)$ satisfying Cauchy's mean value theorem for the pair of functions, f(x)=sinx and g(x) = cosx.
b. Evaluate $\lim_{x\to 0}\frac{x}{tanx}$ if it exists.
c. Find the 3rd degree Maclaurin's polynomial for the function f(x)=sinx.
d. Find critical numbers of the function $f(x)=x^3+7x^2-5x$
e. Find horizontal and vertical asymptotes of the function $g(x)=1-\frac{1}{x}$
f. Find the points of inflection for the function $f(x)=x^3-3x^2+3$
g. Find the radius of curvature at any point on the curve $x=\frac{acost}{t}$, $y=\frac{asint}{t}$
h. Find the polar equation of a graph whose cartesian equation is $x^2+y^2-4x=0$
i. Sketch the graph of the equation $r=5\cos\theta$
j. Find $\int_0^{\pi/2} sin^5xcos^6xdx$
k. Evaluate $\int x^3e^{ax}\,dx$
l. Find $\int_0^{\pi/2} cos^7xdx$
m. Find the length of arc of the curve $y=x^{2/3}$ from (1,1) to (8,4)
n. Find the area of the region enclosed by the graph of the equation $r=2+2\cos\theta$
o. The region bounded by the curve $y=x^2$, the x-axis, and the line x=2 is revolved about y-axis. Find the volume of the solid generated. Take the elements of area parallel to the axis of revolution.

PART – B
UNIT – I

2. a. State and prove Cauchy's mean value theorem (6)
b. Find $\lim_{x\to 1}\frac{1-x+lnx}{x^3-3x+2}$ if it exists (6)
c. Determine nth degree Maclaurin Polynomial for $f(x)=e^x$. (6)

3. a. If $f(x)=\begin{cases}\frac{e^x-1}{x} & if\ x\#0\\ 1 & if\ x=0\end{cases}$ prove that f is continuous at 0 by using definition. Also prove that f is differentiable at 0 by computing $f'(0)$. (6)
b. Find $\lim_{x\to \pi/2^-}\frac{sec^2x}{sec^23x}$ if it exists. (6)
c. Find the third-degree Taylor polynomial of the cosine function at $\pi/4$ (6)

UNIT – II

4. a. A rectangular field is to be fenced off along the bank of a river, no fence is required along the river. If the material for the fence costs $8 per running foot for the two ends and $12 per running foot for the side parallel to the river, find the dimensions of the field of largest possible area that can be enclosed with $3600 worth of fence. (6)

b. Given $f(x) = x^3 - 6x^2 + 9x + 1$ find the point of inflection of the graph of f and determine where the graph is concave upward and where it is concave downward. Draw the sketch of the graph. (6)

c. Find the horizontal asymptotes of the graph of the function f(x)= $\frac{x}{\sqrt{x^2+1}}$ (6)

5. a. A cardboard box manufacturer wishes to make open boxes from pieces of cardboard 12 inches square by cutting equal squares from the four corners and turning up the sides. Find the length of the side of the square to be cutout to obtain a box of the largest possible volume. (6)

b. Let c be a critical number of a function f at which $f'(c) = 0$ and let f' exist for all values of x in some open interval containing c. If f'' (c) exists and
i) If f'' (c)<0 then prove that f has a relative maximum value at c,
ii) if f'' (c >0 then prove that f has a relative minimum value at c. (6)

c. Given f(x)= $2x^3 - 6x + 1$ draw a sketch of the graph of f, finding relative extrema, points of inflection, where the graph is concave upward, concave downward. (6)

UNIT – III

6 a. Find the evolute of the asteroid x=a$\cos^3\theta$, y=a$\sin^3\theta$ (6)

b. Find (r,θ) if r>0 and 0≤ θ <2π for the point whose rectangular cartesian coordinate representation is $(-\sqrt{3}, -1)$. (6)

c. Sketch the graph of r =3+2sinθ (6)

7 a. Find the radius of curvature at any point on the curve y=c.cosh(x/c) (6)

b. Plot the point having polar coordinates $\left(3, -\frac{2}{3}\pi\right)$. Find another set of polar coordinates of this point for which r < 0 and 0< θ <2π (6)

c. Draw a sketch of the four-leaved rose r=4cos2θ (6)

UNIT – IV

8. a. State and prove Mean value theorem for definite integrals. (6)

b. Find reduction formula for $\int sin^p x cos^q x dx$, where p and q are positive integers. (6)

c. Obtain the reduction formula for $\int tan^n x dx$ and hence evaluate $\int tan^6 x dx$ (6)

9 a. Obtain the reduction formula for $\int x^m (logx)^n dx$ and hence evaluate $\int_0^1 x^4 (logx)^2 dx$ (6)

b. Let the function f be continuous on the closed interval [a,b] and g be a function such that g'(x) = f(x) for all x in (a,b). Prove that $\int_a^b f(t)dt$ =g(b) −g(a). (6)

c. Find the exact value of $\int_1^4 x^2 dx$ as s limit of Riemann sum with regular partitions and for suitable choice of ξ_i. (6)

UNIT – V

10. a. Find the volume of the solid generated by revolving about x axis, the region bounded by the parabola y=x^2+1 and line y=x+3 (6)

b. Find the area of the region inside the circle r=3sinθ and outside the limacon r=2−sinθ (6)

c. Find the volume of the sphere generated by revolving about a diameter, the region enclosed by the circle $x^2+y^2=r^2$ (6)

11. a. Find the volume of the solid generated by revolving about the line x=-4, the region bounded by the two parabolas x=y−y^2 and x=y^2−3 (6)

b. Find the area of the region enclosed by the graph of the equation r=3cosθ. (6)

c. Find the length of the arc of the curve $y^3 = 8x^2$ from the point (1,2) to (27,18). (6)

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19CHE101 Reg No : ....

CHOICE BASED CREDIT SYSTEM

FIRST SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

CHEMISTRY

General Chemistry I

Duration:3 Hours **Max Marks:80**

I. Answer any SEVEN of the following : **(7X2= 14 Marks)**

a. Define van der Waal's radius.

b. Give reason: Electron affinity of F is less than Cl.

c. Write Kirchoff's equation and explain the terms.

d. Give the expression for Gibb's- Helmholtz equation.

e. Write the method of preparation of cycloalkane from calcium salts of dicarboxylic acid.

f. Give one example each for isolated and cumulative dienes.

g. Write any two applications of electronegativity of an atom.

h. Give the expression for entropy change of vapourisation.

II. Answer any SIX of the following : **(6X6= 36 Marks)**

2. a. Discuss the trends in the periodic table with respect to reducing and oxidising nature of elements. (3)

   b. Explain briefly the trends in the metallic and non metallic character of elements in a periodic table. (3)

3. a. What are the factors determining the electronegativity of an element? (3)

   b. Define electronegativity. What are the trends in electronegativity in the periodic table? (3)

4. a. Show that Joule Thomson effect is isoenthalpic. (4)

   b. Write a note on Inversion Temperature (2)

5. a. Derive the expression for the variation of enthalpy of reaction with temperature. (3)

   b. Two moles of an ideal gas is heated at constant pressure from 25^0C to 300^0C. Calculate the change in entropy. (Given $C_p = 20.5$ J/K/mole) (3)

6. a. Define ionic radius. Compare the radius of anion and cation with respect to its neutral atom.(3)

   b. Balance the following equations by Hit and Trial method : (3)

   i) $MnO_2 + HCl \rightarrow MnCl_2 + H_2O + Cl_2$

   ii) $FeS + O_2 \rightarrow FeO + SO_2$

18BOT101 Reg No : ....

CHOICE BASED CREDIT SYSTEM

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021

Botany - I

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Mention two diseases of Prions.
2. What is a dark field microscope?
3. What are heterocysts? Mention their functions.
4. What is eutrophication? Name the organism that causes Swimers itch?
5. What are synzoospore? Give an example.
6. Mention the uses of *Chlorella*.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Define Lysogenic cycle. Differentiate between lytic and lysogenic cycle.
8. Mention the uses of Stereo Microscope and TEM.
9. Explain thallus structure of *Scytonema*.
10. Explain the role of bacteria in biotechnology.
11. Explain cell Structure and asexual reproduction in *Spirogyra*.
12. Describe the structure of *Volvox* thallus with a labeled diagram.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Describe 5 kingdom classification with suitable examples.
14. Describe the symptoms and control measures of Bunchy Top disease of Banana and Tobacco Mosaic Virus disease .
15. Explain the structure of a typical bacteria cell with a neat labelled diagram.
16. Describe the symptoms and control measures of Citrus Canker and Ring Rot of Potato.
17. Write the general charcateristics of Bacillariophyta.

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19BOT101 Reg No : ....

CHOICE BASED CREDIT SYSTEM

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021

Botany - I

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Mention two diseases of Prions.
2. What is a dark field microscope?
3. What are heterocysts? Mention their functions.
4. What is eutrophication? Name the organism that causes Swimers itch?
5. What are synzoospore? Give an example.
6. Mention the uses of *Chlorella*.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Define Lysogenic cycle. Differentiate between lytic and lysogenic cycle.
8. Mention the uses of Stereo Microscope and TEM.
9. Explain thallus structure of *Scytonema*.
10. Explain the role of bacteria in biotechnology.
11. Explain cell Structure and asexual reproduction in *Spirogyra*.
12. Describe the structure of *Volvox* thallus with a labeled diagram.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Describe 5 kingdom classification with suitable examples.
14. Describe the symptoms and control measures of Bunchy Top disease of Banana and Tobacco Mosaic Virus disease .
15. Explain the structure of a typical bacteria cell with a neat labelled diagram.
16. Describe the symptoms and control measures of Citrus Canker and Ring Rot of Potato.
17. Write the general charcateristics of Bacillariophyta.

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19BOT101 Reg No : ....

CHOICE BASED CREDIT SYSTEM

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021

Botany - I

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Mention two diseases of Prions.
2. What is a dark field microscope?
3. What are heterocysts? Mention their functions.
4. What is eutrophication? Name the organism that causes Swimers itch?
5. What are synzoospore? Give an example.
6. Mention the uses of *Chlorella*.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Define Lysogenic cycle. Differentiate between lytic and lysogenic cycle.
8. Mention the uses of Stereo Microscope and TEM.
9. Explain thallus structure of *Scytonema*.
10. Explain the role of bacteria in biotechnology.
11. Explain cell Structure and asexual reproduction in *Spirogyra*.
12. Describe the structure of *Volvox* thallus with a labeled diagram.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Describe 5 kingdom classification with suitable examples.
14. Describe the symptoms and control measures of Bunchy Top disease of Banana and Tobacco Mosaic Virus disease .
15. Explain the structure of a typical bacteria cell with a neat labelled diagram.
16. Describe the symptoms and control measures of Citrus Canker and Ring Rot of Potato.
17. Write the general charcateristics of Bacillariophyta.

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19COS101 Reg No : ....

CHOICE BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

COMPUTER SCIENCE

Computer Science Theory I

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. Why NAND and NOR gates are called universal gates?
2. Describe NAND gate.
3. What are don't care conditions?
4. What is an array? How one dimensional array is declared?
5. What are unions?
6. What is meant by storage class of a variable?

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. State and prove DeMorgans theorem.
8. How do you find a complement of a number?Explain ones complement and 2's complement of a number in detail.
9. What is meant by looping? Briefly describe any two forms of looping?
10. What is the purpose of scanf()? Explain with syntax and example.
11. Explain the difference between array and structure.
12. What is a string? How do you declare a string variable in C?

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Explain logical and bitwise operators used in C.Give examples.
14. Explain in detail: a) BCD b)ASCII
15. Explain various basic datatypes supported in C.
16. Explain the following with syntax and examples: (a) nested if statement (2) if ladder statement.
17. What are the features of pointers?Explain the declaration of pointers.

19MIC101 Reg No : ....

CHOICE BASED CREDIT SYSTEM

FIRST SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

Microbiology Theory I

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. List any four criteria used for the classification of microorganisms.
2. List the phases in the history of Microbiology.
3. Name the two types of Electron Microscope.
4. What are the uses of Fluorescent Microscope?
5. List any four characteristics of pure culture.
6. What is complex media? Give an example.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Write a short note on the branches of Microbiology.
8. Write a note on Intuitive method and Numerical Taxonomy as a method used for the classification of microorganims.
9. Explain the mode of action of Surface active agents and phenols as disinfectants.
10. What is indirect staining? Explain the procedure.
11. Write a note on assay media and transport media.
12. Write a note on cultivation of anaerobic organisms.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Describe in detail the discovery of Penicillin.
14. Describe in detail Whittaker's Five Kingdom Concept.
15. Describe the parts and working principle of a light microscope.
16. Define Incineration. Explain the construction and working of the hot air oven.
17. Explain in detail pour plate method and streak plate method.

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19STA101 Reg No : ....

CHOICE BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

STATISTICS

Statistics Theory I

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Define ratio scale with an example.
2. Write an example for (i) Positive correlation (ii) Negative correlation
3. Define the term event with an example.
4. Define equilibrium price.
5. What is regression ?
6. State the law of demand.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Show that multiple correlation lies between 0 and 1.
8. State and prove the addition theorem of probability for any two events. What happens if the events are mutually exclusive?
9. State and prove the multiplication theorem of expectation.
10. Explain the steps in construction of Price index numbers.
11. Suppose A1,A2,..., An are the n independent events with probabilities $p_1,p_2,..., p_n$ then prove that $P(A_1 \cup A_2 \cup ... \cup A_n)=1-(1-P_1)(1-P_2)...(1-P_n)$.
12. The regression equation of Y on X and X on Y are y=x and 4x-y=3 and second moment of x about origin is 2,then find r and S.D(Y).

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Derive the regression equation of X on Y.

14. Let X be a random variable where f(x)=1/5, $2 \leq X \leq 7$ .Test whether given function is a p.d.f. Obtain mean ,variance and also the distribution.

15. Define index numbers and explain Time Reversal and Factor Reversal test. Also verify if Marshall Edgworth's index number satisfies these tests.

16. a) State and prove Baye's theorem of inverse probability. (5)

    b) A firm has 3 machine operators X,Y and Z.Their contributions for the production of the product are respectively 25%,30% and 40 %.The probability of producing items of substandard quality are 0.05,0.07 and 0.1 respectively.If the selected item is of substandard quality find the probability that it has been operated by operator Y. (5)

17. Derive the formula of Intraclass correlation coefficient.

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19ZOO101 Reg No : ....

CHOICE BASED CREDIT SYSTEM
FIRST SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021
Zoology
Paper I - Zoomorphology - I

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Give any four examples for corals.
2. Write a short note on Linnean Hierarchy.
3. Write a note on measly pork.
4. Draw the diagram of jaw of leech.
5. Comment on Mosquitoes as vector in disease transmissions.
6. Write any two distinguishing features of Class Gastropoda.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Draw and explain the asconoid type of canal system.
8. Write the general characters of Porifera.
9. Write the four distinctive characters of Class Polychaeta with an example.
10. Write the six distinctive characters of Class Trematoda with an example.
11. Draw and explain the oral and aboral surface of Asterias.
12. Write any six distinguishing features of class Holothuroidea with an example.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Give an account of Contractile Vacuole and osmoregulation in protozoans.
14. Explain the general characters of Phylum Protozoa with two examples.
15. Draw and explain the life cycle of Pheritima.
16. Enumerate the characters of Phylum Arthopoda, mentioning any two classes with suitable examples for each.
17. Comment on the Arthropodan characteristics of Peripatus.

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19ZOO101 Reg No : ....

CHOICE BASED CREDIT SYSTEM
FIRST SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021
Zoology
Paper I - Zoomorphology - I

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Give any four examples for corals.
2. Write a short note on Linnean Hierarchy.
3. Write a note on measly pork.
4. Draw the diagram of jaw of leech.
5. Comment on Mosquitoes as vector in disease transmissions.
6. Write any two distinguishing features of Class Gastropoda.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Draw and explain the asconoid type of canal system.
8. Write the general characters of Porifera.
9. Write the four distinctive characters of Class Polychaeta with an example.
10. Write the six distinctive characters of Class Trematoda with an example.
11. Draw and explain the oral and aboral surface of Asterias.
12. Write any six distinguishing features of class Holothuroidea with an example.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Give an account of Contractile Vacuole and osmoregulation in protozoans.
14. Explain the general characters of Phylum Protozoa with two examples.
15. Draw and explain the life cycle of Pheritima.
16. Enumerate the characters of Phylum Arthopoda, mentioning any two classes with suitable examples for each.
17. Comment on the Arthropodan characteristics of Peripatus.

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18PHY301 Reg. No:.............................

CREDIT BASED SEMESTER SYSTEM

B.Sc. THIRD SEMESTER DEGREE EXAMINATION FEBRUARY 2021

Physics - Paper III

Duration:3 Hrs **Max Marks:80**

PART - A

Answer any TWELVE from the following: **(12×1= 12 Marks)**

1. Write the relation between energy and amplitude of simple harmonic oscillator.
2. Define force constant in a mechanical system.
3. What is the nature of thermal changes in air when sound propagates through it?
4. Will a vibrating source always produce sound? Give reason.
5. Give the relation between velocity of sound in a rod and Young's modulus of the material of the rod.
6. Draw the intensity distribution curve due to interference.
7. Write the expression for fringe width for Lloyd's mirror. Mention the terms used.
8. What is interference of light?
9. How does the thickness of an air film in Newton's rings arrangement vary?
10. What is the difference in the origin of colours of a soap bubble seen in sunlight and colours emerging from a prism?
11. What happens to the diffraction pattern, if the diameter of the wire is increased?
12. Explain why is a coloured spectrum iseen when we look through a muslin cloth.
13. Give the expression for focal length of a zone plate.
14. What is a positive crystal?
15. What is the evidence to show that sound waves are not electromagnetic in nature?

PART - B

UNIT I

Answer any TWO from the following: **(2×8= 16 Marks)**

16. a) In real mechanical systems the damping coefficient is adjusted to the critical value. Explain with applications.

    b) Describe Helmholtz resonator. And derive the expression for velocity of sound in air using Helmholtz resonator. **(2 + 6)**

17. a) Two progressive waves are $y_1=10\,e^{j(7t\ -\ 10x)}$ and $y_2=0.03\,e^{j(5t-8x)}$ were superimposed. Calculate the group velocity.

    b) Derive an expression for the velocity of transverse vibrations of a stretched string. **(2 + 6)**

18. a) Compare the loudness and sound intensity.

    b) Define longitudinal waves. Derive an expression for velocity of longitudinal waves in a fluid. **(2+6)**

UNIT II

Answer any TWO from the following: **(2×8= 16 Marks)**

19. a) Give the comparisons between the fringes produced by biprism and Lloyd's mirror.

    b) Define fringe width and derive an expression for fringe width. Show that both bright and dark fringes obtained in the Young's double slit experiment are equally spaced. **(2 + 6)**

20. a) What are the conditions for two sources to be coherent?

    b) Explain with a ray diagram, the phenomenon of interference at a thin film due to transmitted light and derive an exression for optical path difference. **(2 + 6)**

21. a) Draw a neat diagram of Michelson interferometer and label its parts.

    b) Discuss the formation of interference fringes when a thin wedge shaped film is seen by normally reflected light. Calculate the thickness of thin air film. **(2 + 6)**

UNIT III

Answer any TWO from the following: **(2×8= 16 Marks)**

22. a) Draw a labelled diagram showing the experimental arrangement for Fraunhoffer diffraction at a double slit.

    b) What is meant by half period elements? How is rectilinear propagation of light explained on the basis of wave theory? **(2 + 6)**

23. a) Explain briefly how circularly polarized light is detected experimentally.

    b) Show that the rays forming spectrum in a grating suffer minimum deviation when the angle of incident equals the angle of diffraction. **(2 + 6)**

24. a) On what factors does the angle of rotation of a plane of polarization depend?

    b) Explain briefly Huygens' construction for double refraction in uniaxial crystal, when optic axis is in the plane of incidence and parallel to the refracting surface. **(2 + 6)**

PART - C

Answer any FOUR from the following: **(4×5= 20 Marks)**

25. Consider a damped oscillator with force constant $k = 32\ N\ m^{-1}$, mass $m = 0.5$ kg, damping constant $b = 1\ N{\cdot}s\ m^{-1}$. When a driving force $F_0e^{j\omega t}$ is added with $F_0 = 10$ N and $\omega = 2\ \omega_0$, find the solution for displacemenr with $y(0) = 2$, $v(0) = 0$.

26. Two wires of steel of the same length are stretched on a sonometer. The tension of the first and second are 8 kg wt and 2 kg wt respectively. Find the ratio of the fundamental notes emitted by the two wires when the diameter of cross section of the first wire is half that of the second.

27. In a Biprism experiment fringes of width 0.02 m are observed at 1m from the slit. On introducing a convex lens 0.3 m away from the slit two enlarged images of the slit is seen 0.7 cm apart. Calculate the wavelength of the light.

28. In a Michelson interferometer 100 fringes cross the field of view when the movable mirror is displaced by 0.022948 mm distance. Calculate the wavelength of monochromatic light used.

29. A plane transmission grating having 5000 lines per cm is used to obtain a separation of light from a sodium lamp in the second order. Calculate the angular separation between the two sodium lines whose wavelengths are 589 nm and 589.6 nm.

30. The rotation in the plane of polarization in a certain substance is 10° per cm. Calculate the difference between the refractive indices for right and left circularly polarized light in the substance, $\lambda = 5893\mathring{A}$.

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19PHY301 **Reg. No:....................**

CHOICE BASED CREDIT SYSTEM

B.Sc. THIRD SEMESTER DEGREE EXAMINATION, FEBRUARY 2021

Physics - Paper III

Duration:3 Hrs **Max Marks:80**

PART - A

Answer any TWELVE from the following: **(12×1= 12 Marks)**

1. Mention the factors on which natural frequency of a vibrating body depends.
2. What is the relation between resonating frequency and volume of air?
3. Why do we cup our hands around the mouth to increase loudness?
4. What will be the nature of graph between the pressure of a gas and the speed of sound waves passing through the gas?
5. Write the expression for velocity of longitudinal waves in a fluid and mention the terms used.
6. State the condition for destructive interference in terms of phase difference between two waves.
7. What is meant by secondary wave front?
8. What are coherent sources?
9. Why do colours on a soap bubble change?
10. When do we observe circular fringes in Michelson's interferometer?
11. Why is intensity of the centre of the diffraction pattern due to a single slit maximum?
12. Why are radio waves used for radio broadcasting?
13. In a diffraction grating how are the spectral lines affected when the rulings are made closer?
14. What is Brewster's angle?
15. What are uniaxial crystals? Give an example.

PART - B

UNIT I

Answer any TWO from the following: **(2×8= 16 Marks)**

16. a) Mention the forces on which a forced mechanical system depends upon and write their expressions.

    b) What are damped oscillations? Set up the equations for displacement of damped oscillations of a vibrating body and discuss the different cases and represent them graphically. **(2 + 6)**

17. a)Two progressive waves are $y_1 = 10\,e^{j(7t - 10x)}$ and $y_2 = 0.03\,e^{j(5t - 8x)}$ were superimposed. Calculate the group velocity.

    b) Draw a neat diagram of Kundt's tube and derive the expression for the velocity of sound in a Kundt's rod. **(2 + 6)**

18. a) Write a note on ultrasonics.

    b) Discuss the longitudinal vibrations in a rod (i). fixed at the centre and (ii). clamped at one of its end. Show that the frequencies of vibrations will have only odd harmonics. **(2 + 6)**

UNIT II

Answer any TWO from the following: **(2×8= 16 Marks)**

19. a) In Young's double slit expriment viole, yellow and red light are used successively to illuminate the double slits. For which colour will the fringe width be (i) maximum (ii) minimum.

    b) What is a biprism? With a neat labeled diagram explain the formation of interference fringes in a biprism. **(2 + 6)**

20. a) Why in Lloyd's mirror, fringes are observed only on one side of the mirror? Explain.

    b) Explain with a ray diagram, the phenomenon of interference at a thin film due to transmitted light and derive an exression for optical path difference. **(2 + 6)**

21. a) Explain the use of a compensating glass plate in Michelson interferometer.

    b) Explain the interference due to a wedge shaped film and obtain expression for fringe width.

UNIT III

Answer any TWO from the following: **(2×8= 16 Marks)**

22. a) Distinguish interference bands from diffraction bands.

    b) Discuss the theory of a plane diffraction grating for oblique incidence. **(2 + 6)**

23. a) What is optical activity? Define specific rotation of a solution.

    b) What is a zone plate? How is it constructed? Compare it with a convex lens.

24. a) How do you distinguish between an unpolarised light and a linearly polarized light?

    b) Explain briefly Huygens' construction for double refraction in uniaxial crystal, when optic axis is in the plane of incidence and parallel to the refracting surface. **(2 + 6)**

PART - C

Answer any FOUR from the following: **(4×5= 20 Marks)**

25. A 0.5 kg cart connected to a light spring for which the force constant is 20.0 N m^{-1} oscillates on a frictionless, horizontal air track. (A) Calculate the maximum speed of the cart if the amplitude of the motion is 3 cm. (B) What is the velocity of the cart when the position is 2 cm? (C) Compute the kinet and potential energies of the system when the position of the cart is 2 cm.

26. Calculate the amplitude, wavelength, frequency, wave velocity, particle velocity amplitude, acceleration amplitude and direction of propagation of the simple harmonic progressive wave given by $y = 5\,e^{j\,2\pi(0.2\,t - 0.5\,x)}$

27. Two coherent sources are 0.18 mm apart and the fringes are observed on a screen 80 cm away. It is found that with a certain monochromatic source of light the 4^{th} bright fringe is situated at a distance of 10.8 mm from the central fringe. Calculate the wavelength of the light.

28. In a Newton's rings experiment the diameter of the 4^{th} and 12^{th} dark rings are 4 mm and 7 mm respectively. Find the diameter of the 20^{th} ring.

29. A plane wave front of light of wavelength 5 X 10^{-7} m falls on an aperture and the diffraction pattern is observed in an eye piece at a distance of 1 m from the aperture. Find the radius of the 100^{th} half period element and the area of a half period zone.

30. The rotation in the plane of polarization in a certain substance is 10° per cm. Calculate the difference between the refractive indices for right and left circularly polarized light in the substance, $\lambda = 5893 Å$.

PHY301.1 Reg. No : ....

CREDIT BASED SEMESTER SYSTEM

B.Sc. THIRD SEMESTER DEGREE EXAMINATION FEBRUARY 2021

Physics - Paper III

Duration:3 Hrs **Max Marks:80**

PART - A

1. A. Answer any TEN from the following: **(10×1= 10 Marks)**

i. Write the relation between energy and amplitude of simple harmonic oscillator.

ii. Define force constant in a mechanical system.

iii. What is the nature of thermal changes in air when sound propagates through it?

iv. Give the relation between velocity of sound in a rod and Young's modulus of the material of the rod.

v. Draw the intensity distribution curve due to interference.

vi. Write the expression for fringe width for Lloyd's mirror. Mention the terms used.

vii. How does the thickness of an air film in Newton's rings arrangement vary?

viii. What is the difference in the origin of colours of a soap bubble seen in sunlight and colours emerging from a prism?

ix. What happens to the diffraction pattern, if the diameter of the wire is increased?

x. Give the expression for focal length of a zone plate.

xi. What is a positive crystal?

xii. What is the evidence to show that sound waves are not electromagnetic in nature?

1. B. Answer any FIVE from the following: **(5×2= 10 Marks)**

i. In real mechanical systems the damping coefficient is adjusted to the critical value. Explain with applications.

ii. Compare the loudness and sound intensity.

iii. Give the comparisons between the fringes produced by biprism and Lloyd's mirror.

iv. Draw a neat diagram of Michelson interferometer and label its parts.

v. Draw a labelled diagram showing the experimental arrangement for Fraunhoffer diffraction at a double slit.

vi. On what factors does the angle of rotation of a plane of polarization depend?

PART - B

UNIT I

Answer any TWO from the following: **(2×10= 20 Marks)**

2. a) Describe Helmholtz resonator. And derive the expression for velocity of sound in air using Helmholtz resonator.

b) Consider a damped oscillator with force constant $k = 32\ N\ m^{-1}$, mass $m = 0.5$ kg, damping constant $b = 1\ N{\cdot}s\ m^{-1}$. When a driving force $F_0 e^{j\omega t}$ is added with $F_0 = 10$ N and $\omega = 2\,\omega_0$, find the solution for displacemenr with $y(0) = 2$, $v(0) = 0$. **(6 + 4)**

3. a) Derive an expression for the velocity of transverse vibrations of a stretched string.

b)Two wires of steel of the same length are stretched on a sonometer. The tension of the first and second are 8 kg wt and 2 kg wt respectively. Find the ratio of the fundamental notes emitted by the two wires when the diameter of cross section of the first wire is half that of the second. **(6 + 4)**

4. a) Define longitudinal waves. Derive an expression for velocity of longitudinal waves in a fluid.

   b) A wire of area of cross section 0.8 mm^2 is stretched by a weight of 15 kg. Compare its frequencies in the fundamental mode of longitudinal vibrations and of transverse vibrations.
   Given $q = 1.8 \times 10^{11}$ Nm^{-2} **(6 + 4)**

UNIT II

Answer any TWO from the following: **(2×10= 20 Marks)**

5. a) Define fringe width and derive an expression for fringe width. Show that both bright and dark fringes obtained in the Young's double slit experiment are equally spaced.

   b) In a Biprism experiment fringes of width 0.02 m are observed at 1m from the slit. On introducing a convex lens 0.3 m away from the slit two enlarged images of the slit is seen 0.7 cm apart. Calculate the wavelength of the light. **(6 + 4)**

6. a) Explain with a ray diagram, the phenomenon of interference at a thin film due to transmitted light and derive an expression for optical path difference.

   b) In a Michelson interferometer 100 fringes cross the field of view when the movable mirror is displaced by 0.022948 mm distance. Calculate the wavelength of monochromatic light used. **(6 + 4)**

7. a) Discuss the formation of interference fringes when a thin wedge shaped film is seen by normally reflected light. Calculate the thickness of thin air film.

   b) In a Newton's ring experiment, the diameter of 15^{th} dark ring was found to be 0.59 cm. Find the diameter of 5^{th} and 20^{th} ring. **(6 + 4)**

UNIT III

Answer any TWO from the following: **(2×10= 20 Marks)**

8. a) What is meant by half period elements? How is rectilinear propagation of light explained on the basis of wave theory?

   b) A plane transmission grating having 5000 lines per cm is used to obtain a separation of light from a sodium lamp in the second order. Calculate the angular separation between the two sodium lines whose wavelengths are 589 nm and 589.6 nm. **(6 + 4)**

9. a) Show that the rays forming spectrum in a grating suffer minimum deviation when the angle of incident equals the angle of diffraction.

   b)The rotation in the plane of polarization in a certain substance is 10° per cm. Calculate the difference between the refractive indices for right and left circularly polarized light in the substance, $\lambda = 5893 Å$.
   (6 + 4)

10. a) Explain briefly Huygens' construction for double refraction in uniaxial crystal, when optic axis is in the plane of incidence and parallel to the refracting surface.

    b) If the diameter of the central zone is 2.5 mm and a point source of light of wavelength 750 nm is placed 5 m away from the zone plate, find the position of the primary and the secondary image. **(6 + 4)**

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19MAT301 Reg No : ....

CHOICE BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

MATHEMATICS

Mathematics Theory III

Duration:3 Hours **Max Marks:80**

I. Answer any EIGHT of the following : **(8×3= 24 Marks)**

1. Write the limit points of the sequence $\{S_n\}$ and the range set of the sequence $\{S_n\}$ where $S_n = 1 + (-1)^n \quad \forall n \in N$.
2. Define monotonic sequence.
3. Define Cauchy's sequence.
4. State Cauchy's integral test for convergence of series.
5. Show that the serirs $\sum \frac{1}{n}$ does not converge.
6. Find the velocity of escape at the surface of Jupiter whose radius is 43000 miles and acceleration of gravity at its surface is 2.6g where $g = .0061 miles/sec^3$
7. $Solve: \quad (x-2y)dx + 2(y-x)dy = 0$
8. Find the orthogonal trajectories of the family of straight lines $x^2 + y^2 = C^2$
9. Solve: $D^2y = x$.
10. Solve: $(D^2 - 3D + 2)y = e^{2x}$.

II. Answer any EIGHT of the following : **(8×7= 56 Marks)**

11. Find the nature of the series $\frac{1}{1\cdot2\cdot3} + \frac{3}{2\cdot3\cdot4} + \frac{5}{3\cdot4\cdot5} + \ldots\ldots$

12. Solve: $(D^2 - D - 2)y = 20sin2x + 4e^{3x}$.

13. Show that the series $\sum \frac{3\cdot 6\cdot 9.....3n}{7\cdot 10\cdot 13.......(3n+4)} x^n, x > 0$ converges for $x \leq 1$ and diverges for $x > 1$.

14. Show that the series $\sum \frac{(-1)^{n+1}}{\sqrt{n}}$ is conditionally convergent.

15. Solve: $x^2y_2 + 8xy_1 + 12y = x^4$.

16. $Solve :$ $(4xy + 3y^2 - x)dx + x(x + 2y)dy = 0$

17. $Solve :$ $6y^2dx - x(2x^3 + y)dy = 0$

18. $Solve :$ $y(x^2 + y)dx + x(x^2 - 2y)dy = 0 \ \ when \ \ x = 1, \ \ y = 2$

19. Solve by reducing to normal form: $x^2y_2 - 2(x^2 + x) + (x^2 + 2x + 2)y = 0$.

20. Solve by reduction of order method: $(D^2 + 1)y = cosecx$.

18MAT301 Reg. No. ....

CREDIT BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
MATHEMATICS
PAPER 1 - FUNCTIONS OF SEVERAL VARIABLES, MULTIPLE INTEGRALS AND NUMBER THEORY

Time: 3 Hrs. **Max. Marks: 120**

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
2. Answer FIVE full questions form Part B Choosing ONE full question from each unit.

PART - A 3×10=30

1. a. Find the domain of the function f(x,y)=$\frac{1}{\sqrt{x^2+y^2-25}}$

b. Show that $\lim_{(x,y)\to(0,0)} f(x,y)$ does not exist if f(x,y)= $\frac{x^2y}{x^4+y^2}$

c. If f(x,y)= $(x^2+y^2)\tan^{-1}\frac{y}{x}$ then find $f_x(x,y)$

d. Given f(x,y) = $2x^2 - y^2 + 3x - y$ find the maximum value of $D_u f$ at the point when x=1 and y=−2

e. If f(x,y) = x^2y −2x−y find the critical points of f.

f. Find the equation of the tangent plane to the surface $x^2+y^2+z^2 = 17$ at the point (2, −2,3)

g. Evaluate $\int_0^4\int_0^y \sqrt{9+y^2}$dxdy

h. Find the area of the surface cut from the plane 2x+y+z=4 by the planes x=0, x=1, y=0 and y=1

i. Find by double integration the area of the region enclosed by one leaf of the rose r=sin3θ

j. Evaluate $\int_0^1\int_0^1\int_{-1}^1 xyz\, dzdydx$

k. Evaluate the iterated integral $\int_0^\pi\int_2^4\int_0^1 re^z\, dzdrd\theta$

l. Evaluate the line integral $\int_C ydx + xdy$ where c: x=t, y=$t^2, 0\le t\le 1$

m. Find the remainder when 1!+2!+3!+4!+ ⋯ +100! Is divided by 12

n. Without performing division determine whether the integer 176521221 is divisible by 11

o. Solve the linear congruence 5x≡ 2 $(mod 26)$

PART – B
UNIT -1

2 a. Using $\varepsilon-\delta$ definition prove that $\lim_{(x,y)\to(1,2)}(3x^2+y) = 5$ (6)

b. Given f(x,y) = $\begin{cases}\frac{xy(x^2-y^2)}{x^2+y^2} & if\ (x,y)\neq(0,0)\\ 0 & \text{if } (x,y)=(0.0)\end{cases}$ Show that $f_1(0,y) = -y$ for every y. (6)

c. If u=log$\sqrt{x^2+y^2}$, x=re^s, y= re^{-s} then find $\frac{\partial u}{\partial r}$ and $\frac{\partial u}{\partial s}$ (6)

3. a. Using $\varepsilon-\delta$ definition prove that $\lim_{(x,y)\to(1,3)}(2x+3y) = 11$ (6)

b. Let f be defined by f(x,y)= $\begin{cases}x^2+y^2 & if\ x^2+y^2\le 1\\ 0 & if\ x^2+y^2>1\end{cases}$ Discuss the continuity of (6)

c. If u= xy+xz+yz, x=r, y=rcost, and z=rsint then find $\frac{\partial u}{\partial t}$ using chain rule (6)

UNIT – II

4. a. The temperature at any pount (x,y) of a rectangular plate lying in the xy-plane is determined by T(x;y)= $x^2 + y^2$

(i) Find the rate of change of the temperature at the point (3,4) in the direction making an angle of radian measure $\frac{\pi}{3}$ with the positive direction

(ii) Find the direction for which the rate of change of the temperature at the point $(-3,1)$ is maximum (6)

b. Find the equation of the tangent plane and equations of the normal line to the surface $4x^2 + y^2 - 16z = 0$ at the point (2,4,2) (6)

c. If f(x,y)= $x^3 + y^2 - 6x^2 + y - 1$ determine the relative extrema of f if there are any. (6)

5. a. If f(x,y,z)= $3x^2 + xy - 2y^2 - yz + z^2$ find the rate of change of f at $(1, -2, -1)$ in the direction of the vector 2i−2j−k (6)

b. Find the symmetric equations of the tangent line to the curve of intersection of the surfaces $x^2 + y^2 - z = 8$ and $x - y^2 + z^2 = -2$ at $(2, -2, 0)$ (6)

c. If f (x,y)=$2x^4 + y^2 - x^2 - 2y$ determine the relative extrema of f if there are any by using second derivative test. (6)

UNIT – III

6. a. Find the approximate value of the double integral $\iint_R (3x - 2y + 1)\, dA$ where R is the rectangular region having vertices $(0, -2)$ and (3,0). Take a partition of R formed by the lines x=1, x=2 and y=−1.Take (ξ_i, γ_i) at the centre of the i^{th} sub region. (6)

b. Fid the volume of the solid under the plane z=4x and above the circle $x^2 + y^2 = 16$ (6)

c. Find the region inside the cardioid r=2(1+sinθ) using double integral (6)

7. a. Find the volume of the solid in the first octant bounded by two cylinders $x^2 + y^2 = 4$ and $x^2 + z^2 = 4$ (6)

b. Evaluate the double integral $\iint_R e^{-(x^2+y^2)}\, dA$ where the region R in the first quadrant by the circle $x^2 + y^2 = a^2$and the coordinate axes. (6)

c. Find the area of the paraboloid z=$x^2 + y^2$ below the plane z=4 (6)

UNIT IV

8. a. Evaluate the integral $\int_0^1 \int_0^x \int_0^{x+y} (x + y + z)dzdydx$ (6)

b. A homogeneous solid in the shape of a right-circular cylinder has a radius of 2m and an altitude of 4m. Find the moment of inertia of the solid with respect to its axis. (6)

c. A particle traverses the twisted cubic R(t)=ti+$t^2 j$+ $t^3 k$, $0 \le t \le 1$. Find the total work done if the motion is caused by the force field F(x,y,z)=$e^x i$+x$e^z j + x sin\pi y^2 k$. Assume that the arc is measured in metres and the force is measured in newtons (6)

9. a. Evaluate the iterated integral $\int_{-1}^{0} \int_{e}^{2e} \int_{0}^{\pi/3} y\, logz\, tanx\, dx\, dz\, dy$ (6)

b. Evaluate the iterated integral $\int_0^{\pi/4} \int_0^{2acos\varphi} \int_0^{2\pi} \rho^2 sin\varphi d\theta d\rho d\varphi$

c. Suppose that a particle moves along the curve y=$x^2$from the point (-1,1) to the point (2,4). Find the total work done if the motion is caused by the force field $F(x, y) = (x^2 + y^2)i + 3x^2 yj$. Assume that the arc is measured in metres and the force is measured in newtons (6)

UNIT V

10. a. Prove that every positive integer n> 1 can be expressed as a product of primes and this representation is unique from the order in which the factors occur (6)

b. If ca$\equiv cb(mod n)$then prove that a$\equiv b\ \left(mod\,\frac{n}{d}\right)$ where d=gcd(c,n) (6)

c. Find the solution of the system of simultaneous congruences
x$\equiv 2(mod 3)$, x$\equiv 3(mod 5)$, x$\equiv 2(mod 7)$ (6)

11. a. Let $n_1 n_2 \ldots\ldots\ldots.. n_r$ be positive integers rules that gcd($n_i n_j$)=1 for i$\neq j$.
Then prove that the system of linear congrences
x$\equiv a_1$(mod n_1),
x$\equiv a_2$(mod n_2),
$\vdots$
x$\equiv a_r$(mod n_r)
has a simultaneous solution which is unique module the integer $n_1 n_2 \ldots n_r$ (6)

b. Prove that the linear congruence ax$\equiv b(mod n)$has a solution and if and only if $d|b$ where d= gcd (a, n). Also if $d|b$, prove that the equation has d mutually incongruent solutions modulo n.
(6)

c. Let N= $a_m 10^m + a_{m-1}10^{m-1} + \cdots + a_0$ be the decimal expansion of the positive integer N, 0$\leq a_k < 10$ and let S=$a_0 + a_1 + \cdots + a_m$ Then prove that $9|N$ of and only if $9|S$. (6)

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19CHE301 **Reg No : ....**

CHOICE BASED CREDIT SYSTEM

THIRD SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

CHEMISTRY

Chemistry Theory III

Duration:3 Hours **Max Marks:80**

I. Answer any SEVEN of the following : (7X2= 14 Marks)

1. a. Give one example for the clathrate of noble gases and mention its application.

   b. Water has a higher boiling point than hydrogen sulphide. Give reason.

   c. What are silicates? Name two types of silicates.

   d. Define a unit cell.

   e. What is Joule-Thomson effect?

   f. Explain the classification of ethers with examples.

   g. Explain the addition of Grignard reagent to ketones.

   h. Name a dicarboxylic acid each containing 6 and 5 carbon atoms.

II. Answer any SIX of the following : (6X6= 36 Marks)

2. Discuss the variation in the following properties of halogens
   i) Oxidation state (3)
   ii) Ionisation energy (3)

3. a) Carrbon tetrahalides do not form complexes but tetrahalides of other elements of group 14 give. Why? (3)
   b) Write a note on the trihalides of boron. (3)

4. a) Find the interplanar distance in a crystal in which a series of planes produce a first order reflection from a copper Xray tube (lambda=1.539 A^0) at an angle of 22.5^0 c . (3)
   b) How is the Avogadro number calculated by Bragg's Method? (3)

5. a) State the laws of crystallography? (3)
   b) What is meant by continuity of state?How is it achieved (3)

6. Derive the expression for Tc,Pc & Vc in terms of vanderWaals constants.(6)

7. a) Give any two methods for the preparation of acid chloride. (4)
   b) Explain hydrolysis reaction of acetic anhydride. (2)

8. a) Acetic acid is weaker than formic acid while chloroacetic acid is stronger than acetic acid. Give reason. (4)
   b) Explain HVZ reaction with an example. (2)

III. Answer any THREE of the following : **(3X10= 30 Marks)**

9. a) Explain the preparation and applications of XeF_6 and XeO_3. (6)

   b) Explain the geometry of XeF_2 and XeF_4. (4)

10. a) What are the different types of interhalogens? Explain with suitable examples. (5)

    b) Explain inert pair effect with two examples. (5)

11. a) Equal volumes of an organic liquid and water are 55 drops & 35 drops respectively. The densities of water &the organic liquid are 0.996 &0.80 g/cm^3 and the surface tension of water is $7.2x\ 10^{-2}\ Nm^{-1}$. Calculate the Surface tension of the organic liquid. (4)

    b)Explain the principle & determination of viscosity by Ostwalds viscometer method. (6)

12. a) Explain the mechanism of Aldol condensation. (5)

    b) Explain the mechanism of Perkin's reaction. (5)

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 Reg No : ....

CHOICE BASED CREDIT SYSTEM

THIRD SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

CHEMISTRY

Chemistry Theory III

Duration:3 Hours **Max Marks:80**

I. Answer any SEVEN of the following : **(7X2= 14 Marks)**

1. a. Give one example for the clathrate of noble gases and mention its application.

   b. Water has a higher boiling point than hydrogen sulphide. Give reason.

   c. What are silicates? Name two types of silicates.

   d. Define a unit cell.

   e. What is Joule-Thomson effect?

   f. Explain the classification of ethers with examples.

   g. Explain the addition of Grignard reagent to ketones.

   h. Name a dicarboxylic acid each containing 6 and 5 carbon atoms.

II. Answer any SIX of the following : **(6X6= 36 Marks)**

2. Discuss the variation in the following properties of halogens

   i) Oxidation state (3)

   ii) Ionisation energy (3)

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    b) Explain the mechanism of Perkin's reaction. (5)

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19BOT301 Reg No : ....

CHOICE BASED CREDIT SYSTEM
THIRD SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021
Botany - III

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5x2= 10 Marks)**

1. What is an offset? Give an example.
2. What are transfusion tissues? Mention its functions.
3. Name any two beverages with their botanical names.
4. "Peeling bark" is a characteristic feature of which family? Give an example.
5. Differentiate Hypogyny and Epigyny.
6. Write a note on Gynoecium of family Solanacae.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Name the type of roots found in i) *Avicennia* ii)*Jussiaea* iii) Pepper. What is their function?
8. Write a note on merits and demerits of Benthem & Hooker system of classification
9. Comment on the corolla of sub family Papilinoideae. Write the Botanical names of any three economically important plants of the family.
10. Give the Botanical name, Part used and uses of Eucalyptus and Paddy.
11. Write a note on i) Rostellum ii) Labellum iii) Glumes
12. Explain the structure of female cone *Pinus.*

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Describe the female reproductive structures in *Gnetum*. Mention four angiospermic affinities.
14. Explain the special type of inflorescences with example.
15. Give a comparative account of family Acanthaceae and Lamiaceae.
16. Write the distinguishing characters of family Euphorbiaceae.
17. Write the distinguishing characters of the family Malvaceae.

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19COS301 Reg No : ....

CHOICE BASED THIRD SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
COMPUTER SCIENCE
Computer Science III

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. List four advantages that the DBMS has over file system.
2. How is partial participation represented in ER diagram?
3. What is DML? Give examples.
4. Explain MIN() function with an example.
5. Define circular linked list. Give an example.
6. What is a data structure? Give an example.

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Explain participation constraints. How it can be represented in a E R diagram?
8. Who is a DBA? What are the responsibilities of a DBA?
9. What is unique constraint? Give example. Distinguish between Unique constraint and the Primary key constraint.
10. Explain the SELECT Command of SQL with example.
11. Write the algorithm for
    a) Pre-order traversal
    b) In-order traversal
12. Write an algorithm to insert a new node after the given node in a linked list using pointer implementation.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Explain the terms:
    (1) Data redundancy (2) Data inconsistency. (3) DBMS (4) Database (5) Metadata
14. What is join operation? Explain the different types of join operation.
15. Explain different clauses used in the SQL query.
16. Explain 5 variations of SELECT command.
17. Define stack. Write the algorithms for PUSH and POP operations on stack.

19MIC301

Reg No : ....

CHOICE BASED CREDIT SYSTEM

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021

Microbiology - III

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. What are thermophiles?
2. What is dry weight of a cell?
3. Define enthalpy.
4. Define electrophoresis.
5. What is activation energy?
6. Classify enzymes based on the type of reaction catalysed.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Write a note on binary fission and budding.
8. Define continuous growth. Explain about turbidostat.
9. Write the general properties of Polysaccharides.
10. Write briefly on rRNA.
11. Write a note on Michelis Menton equation.
12. Write a note on the medical and biological importance of enzymes.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Discuss the different phases of growth curve of bacteria.
14. Discuss the classification of bacteria based on their carbon requirement.
15. Explain the denaturation of proteins.
16. Describe the classification of lipids based on composition.
17. Explain the role of coenzymes in group transfer reactions.

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18ZOO301 Reg No : ....

CHOICE BASED CREDIT SYSTEM

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021

Zoology

Paper III - Physiology, Biochemistry and immunology

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. What is general physiology?
2. Define osmoregulation.
3. Name any two enzymes present in gastric juice.
4. Draw a neat labeled diagram of Cardiac muscle fibre.
5. Mention the important sources of Ascorbic acid.
6. Which are the classes of human Ig?

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. What is the prosthetic group of the following respiratory pigments?
   i)Haemoerythrin ii)Haemoglobin iii)Haemocyanin
8. Explain the mechanism of ultra filtration. Mention the composition of primary urine.
9. Draw a neat labelled diagram of a neuron.
10. Write a note on neuro-muscular junction.
11. Explain Radial and double immunodiffusion.
12. Write an explanatory notes on derived lipids.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Write explanatory notes on carbon dioxide transport & chloride shift.
14. With a neat labelled diagram explain the strucure of human eye.
15. Explain origin and conduction of heart beat with suitable illustrations.
16. Give an account of bilogical significance of proteins.
17. Explain factors affecting the rate of enzyme catalyzed reactions.

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18PHY501 Reg No : ....

CREDIT BASED SEMESTER SYSTEM

B.Sc. FIFTH SEMESTER DEGREE EXAMINATION FEBRUARY 2021

Physics - Paper V

Duration:3 Hrs **Max Marks:80**

PART - A

Answer any TWELVE from the following: **(12×1= 12 Marks)**

1. What is the unit of magnetic moment?
2. Give the expression for L-S coupling. Mention the terms used.
3. What is depolarization ratio in Raman effect?
4. Give the expression for the moment of inertia of a rigid rotor in terms of the reduced mass and bond length.
5. In which region of the electro-magnetic spectrum does the rotational spectrum of molecules lie?
6. State Stefan's law of blackbody radiation.
7. What is ultraviolet catastrophe?
8. Give the relation between maximum velocity of a photoelectron and the stopping potential.
9. What is the relation between the particle velocity and group velocity of a de-broglie wave?
10. What is an electron microscope?
11. What is a 'system' in quantum mechanics?
12. What is Eigen value?
13. Why a particle trapped in a box cannot be at rest?
14. What is a free particle?
15. What is the physical definition of an operator in quantum mechanics?

PART - B

UNIT I

Answer any TWO from the following: **(2×8= 16 Marks)**

16. a) Distinguish between normal and anomalous Zeeman Effect.

    b) Explain in detail the essential features of vector atom model. **(2 + 6)**

17. a) Explain the fine structure of D - line of sodium.

    b) Give brief account of vibrational spectra and explain vibrational-rotational spectra of a diatomic molecule by drawing energy level diagrams. **(2 + 6)**

18. a) Why does the sun appear reddish when it is near the horizon? Explain.

    b) Give the principle of magnetic resonance. Briefly explain ESR and NMR spectroscopy. **(2+6)**

UNIT II

Answer any TWO from the following: **(2×8= 16 Marks)**

19. a) Write a short account of the distribution of energy in the spectrum of a black body.

    b) Discuss Planck's quantum hypothesis and deduce Planck's law of energy distribution for blackbody radiation. **(2 + 6)**

20. a) Explain the effect of intensity of incident light on photo-electric current with a graph.

    b) State the laws of photoelectric effect. Derive Einstein's photo-electric equation. How does it explain the laws of photoelectric emission? **(2 + 6)**

21. a) Find the energy in eV for electromagnetic wave of wavelength 1 m.

    b) Describe with necessary theory Davison and Germer experiment for establishing wave nature of the electron and discuss it. **(2 + 6)**

UNIT III

Answer any TWO from the following: (2×8= 16 Marks)

22. a) Draw the energy level diagram for a harmonic oscillator.

    b) Write down the Schrödinger wave equation for a free particle in a linear potential box and discuss the wave function and probability graphs. **(2 + 6)**

23. a) Why states with same quantum numbers do not degenerate? Explain.

    b) Starting from the wave equation, derive an expression for one dimensional Schrödinger wave equation in time-dependent form. **(2 + 6)**

24. a) A particle is confined to a 3-dimensional box with sides of length a=L, b=2L, and c= 4L. For the state, $n_x=1$, $n_y=1$, and $n_z=4$, where is the probability of finding the particle the largest?

    b) Derive one dimensional time independent Schrödinger wave equation from time-dependent Schrödinger wave equation. **(2 + 6)**

PART - C

Answer any FOUR from the following: (4×5= 20 Marks)

25. In a Stern Gerlach experiment Silver atom covers a distance of 0.12 m through a non homogeneous magnetic field of gradient 50 T m^{-1}. The separation between the two traces on the photographic plate is found to be 0.15 mm. Mass of Silver atom = 1.79×10^{-25} kg,
    Bohr magneton = 9.2×10^{-24} J T^{1}. Calculate the velocity of Silver atom.

26. The force constant of CO bond is 187 Nm^{-1}. Find the frequency of vibration of CO molecule and spacing between vibrational levels. Mass of ^{12}C atom=1.99×10^{-26} kg and of ^{16}O atom=2.66×10^{-26} kg.

27. (i). A photon of wavelength 1.2 Å is scattered through 90^0 by a free electron. Find the frequency of scattered electron. (ii). What should be the wavelength of incident photon so that increase in wavelength of scattered photon at a scattering angle 90^0 is 1%?

28. Life time of a nucleus in the excited state is 10^{-12} s. Calculate the probable uncertainty in energy and frequency of a γ –ray photon emitted by it.

29. A particle is moving in one dimensional potential box of infinite height and width 10 Å . Calculate the probability of finding the particle within an interval of at the centre of the box when it is in the state of least energy.

30. Evaluate the first three energy levels of an electron enclosed in a box of width 10 Å . Compare it with those of glass marble of mass 1 gm, contained in a box of width 20 cm. Can these levels of the marble be measured experimentally?

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PHY501.1 **Reg No:....................**

CREDIT BASED SEMESTER SYSTEM

B.Sc. FIFTH SEMESTER DEGREE EXAMINATION FEBRUARY 2021

Physics - Paper V

Duration:3 Hrs **Max Marks:80**

PART - A

1. A. Answer any TEN from the following: **(10×1= 10 Marks)**

i. What is the unit of magnetic moment?

ii. Give the expression for L-S coupling. Mention the terms used.

iii. Give the expression for the moment of inertia of a rigid rotor in terms of the reduced mass and bond length.

iv. In which region of the electro-magnetic spectrum does the rotational spectrum of molecules lie?

v. State Stefan's law of blackbody radiation.

vi. Give the relation between maximum velocity of a photoelectron and the stopping potential.

vii. What is the relation between the particle velocity and group velocity of a de-broglie wave?

viii. What is an electron microscope?

ix. What is a 'system' in quantum mechanics?

x. What is Eigen value?

xi. What is a free particle?

xii. What is the physical definition of an operator in quantum mechanics?

1. B. Answer any FIVE from the following: **(5×2= 10 Marks)**

i Distinguish between normal and anomalous Zeeman Effect.

ii. Explain the fine structure of D - line of sodium.

iii. Write a short account of the distribution of energy in the spectrum of a black body.

iv. Explain the effect of intensity of incident light on photo-electric current with a graph.

v. Draw the energy level diagram for a harmonic oscillator.

vi. Why states with same quantum numbers do not degenerate? Explain.

PART - B

UNIT I

Answer any TWO from the following: **(2×10= 20 Marks)**

2. a) Explain in detail the essential features of vector atom model.

b) In a Stern Gerlach experiment Silver atom covers a distance of 0.12 m through a non homogeneous magnetic field of gradient 50 T m^{-1}. The separation between the two traces on the photographic plate is found to be 0.15 mm. Mass of Silver atom = 1.79 X 10^{-25} kg, Bohr magneton = 9.2 X 10^{-24} J T^{1}. Calculate the velocity of Silver atom. **(6 + 4)**

3. a) Give brief account of vibrational spectra and explain vibrational-rotational spectra of a diatomic molecule by drawing energy level diagrams.

   b) The force constant of CO bond is 187 Nm^{-1}. Find the frequency of vibration of CO molecule and spacing between vibrational levels. Mass of ^{12}C atom=$1.99X10^{-26}$ kg and of ^{16}O atom=$2.66X10^{-26}$ kg. **(6 + 4)**

4. a) Give the principle of magnetic resonance. Briefly explain ESR and NMR spectroscopy.

   b) The spectral line of Cadmium of wavelength 650 nm in a magnetic field of 10 T becomes triplet under normal Zeeman effet. If e/m = 1.76×10^{11} C kg^{-1} , calculate the wavelength of component lines. **(6 + 4)**

UNIT II

Answer any TWO from the following: **(2×10= 20 Marks)**

5. a) Discuss Planck's quantum hypothesis and deduce Planck's law of energy distribution for blackbody radiation.

   b) (i). A photon of wavelength 1.2 $\AA$ is scattered through 90^0 by a free electron. Find the frequency of scattered electron. (ii). What should be the wavelength of incident photon so that increase in wavelength of scattered photon at a scattering angle 90^0 is 1%? **(6 + 4)**

6. a) State the laws of photoelectric effect. Derive Einstein's photo-electric equation. How does it explain the laws of photoelectric emission?

   b) Life time of a nucleus in the excited state is 10^{-12} s. Calculate the probable uncertainty in energy and frequency of a γ –ray photon emitted by it. **(6 + 4)**

7. a) Describe with necessary theory Davison and Germer experiment for establishing wave nature of the electron and discuss it.

   b) The work function of aluminum is 4.2eV. If photo electrons are emitted by aluminum when light of wavelength 200 nm incident on it, calculate threshold wavelength. **(6 + 4)**

UNIT III

Answer any TWO from the following: **(2×10= 20 Marks)**

8. a) Write down the Schrödinger wave equation for a free particle in a linear potential box and discuss the wave function and probability graphs.

   b) A particle is moving in one dimensional potential box of infinite height and width 10 $\AA$. Calculate the probability of finding the particle within an interval of at the centre of the box when it is in the state of least energy. **(6 + 4)**

9. a) Starting from the wave equation, derive an expression for one dimensional Schrödinger wave equation in time-dependent form.

   b) Evaluate the first three energy levels of an electron enclosed in a box of width 10 $\AA$. Compare it with those of glass marble of mass 1 gm, contained in a box of width 20 cm. Can these levels of the marble be measured experimentally? **(6 + 4)**

10. a) Derive one dimensional time independent Schrödinger wave equation from time-dependent Schrödinger wave equation.

    b) The energy of a linear harmonic oscillator in its third excited state is 0.1 eV. Calculate its frequency. **(6 + 4)**

18PHY502 **Reg No:....................**

CREDIT BASED SEMESTER SYSTEM
B.Sc. FIFTH SEMESTER DEGREE EXAMINATION FEBRUARY 2021
Physics - Paper VI

Duration:3 Hrs **Max Marks:80**

PART - A

Answer any TWELVE from the following: **(12×1= 12 Marks)**

1. State Dulong and Petit's law.
2. What is Einstein's temperature?
3. Define mobility of electróns.
4. What is Hall voltage?
5. Write the relation between Hall coefficient and electron mobility.
6. Give the value in eV for the energy gap of a conductor.
7. Give the symbol for Zener diode.
8. Give the symbol for Photo diode.
9. What is the difference between pn junction diode and LED?
10. What are carbon nano tubes?
11. State Mosley's law.
12. What is Bragg's Spectrometer?
13. What is a line defect?
14. Write a difference between ferromagnetic and paramagnetic substance.
15. Define Curie temperature.

PART - B

UNIT I

Answer any TWO from the following: **(2×8= 16 Marks)**

16. a) Compare MB and BE statistics.

    b) Discuss Einstein's theory of specific heats of solids at low and high temperatures. **(2+6)**

17. a) What are the assumptions of Debye's theory of specific heats of solids?

    b) Assuming the expression for density of energy states, arrive at an expression for Fermi energy at 0 K . **(2+6)**

18. a) Prove that probability of occupation of the Fermi level is ½ when the temperature is greater than absolute zero.

    b) Discuss classical free electron theory and hence give the explanation of electrical resistance. **(2+6)**

UNIT II

Answer any TWO from the following: (2×8= 16 Marks)

19. a) Name the classification of nano materials.

    b) Explain the formation of a p type semiconductor and give its energy band diagram. **(2+6)**

20. a) With diagram, explain the shift in the Fermi level during reverse biasing of a p-n junction diode.

    b) With a neat diagram, explain the principle of a solar cell. **(2+6)**

21. a) Name any two properties of nano materials and explain any one of them.

    b) With the help of an energy band diagram explain the effect of forward bias on a p-n diode. **(2+6)**

UNIT III

Answer any TWO from the following: (2×8= 16 Marks)

22. a) What are the steps involved for finding the Miller indices of a given plane of a crystal.

    b) Describe the origin and mechanism of production of the continuous X-ray spectra. **(2+6)**

23. a) What is stacking fault? Explain.

    b) Name the classification of Point defects, Line defects, Surface defects and Volume defects. Explain Point defects with the equation for the number of defects at equilibrium. **(2+6)**

24. a) Name any two diamagnetic materials. Mention the reasons for these materials to be diamagnetic.

    b) Explain in detail about antiferromagnetism and ferromagnetism. Give examples for the same and mention the reasons for the materials to have these properties. **(2+6)**

PART - C

Answer any FOUR from the following: (4×5= 20 Marks)

25. Debye's temperature of diamond is 2000 K and its density is 2500 kg/m^3, its atomic weight is 12. Assuming that the transverse and longitudinal component have the same velocity, calculate the velocity of sound in diamond.

26. Calculate the Fermi energy of free electrons in sodium metal at 0 K, assuming one free electron per atom. Molecular weight of sodium is 23 kg/Kmole, density is 970 kg/m^3.

27. Determine the forward current of a Germanium diode at room temperature of 22°C when the voltage across it is 0.3 V and compare with the current when the temperature rises to 50°C. The diode has a reverse saturation current of 1μA at 22°C.

28. The saturation current density of a p-n junction germanium diode is 270 mA / m^2 at 300 K. Find the voltage that would have to be applied across the junction to cause a forward current density of 10^5 A / m^2 to flow.

29. A monochromatic X-ray beam of wavelength $0.7A^{\circ}$ undergoes 1st order Bragg's reflection from the plane (3,6,2) of a cubic crystal at a glancing angle of $39^{\circ}7'19''$. Calculate the lattice constant.

30. Estimate the order of diamagnetic susceptibility of Cu from the following data. Radius of Cu atom $= 1\mathring{A}$, lattice parameter= $3.608\mathring{A}$. Assume that only one electron per atom makes the contribution.

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PHY502.2 Reg No:....................

CREDIT BASED SEMESTER SYSTEM
B.Sc. FIFTH SEMESTER DEGREE EXAMINATION FEBRUARY 2021
Physics - Paper VI

Duration:3 Hrs **Max Marks:80**

PART - A

1. a. Answer any TEN from the following: **(10×1= 10 Marks)**

i. Why the atoms cannot vibrate independently in a solid?

ii. According to Dulong and Petit's law define the atomic heat of an element.

iii. What is Hall voltage?

iv. Define mobility of electrons.

v. What is an intrinsic semiconductor?

vi. Give the symbol for junction diode .

vii. What is the difference between pn junction diode and LED?

viii. What are Miller indices?

ix. What is the ratio of spacing between the (100), (110), (111) planes of KCl Crystal?

x. What are Point defects?

xi. What is the value of Bohr magneton?

xii. Give an example for diamagnetic material.

1. b. Answer any FIVE from the following: **(5×2= 10 Marks)**

i. Compare FD and BE statistics.

ii. What are the assumptions of Debye's theory of specific heats of solids?

iii. What is a zener diode? Give its symbol.

iv. Show the formation of 3S bands using energy level diagram.

v. What is the significance of Burger's vector?

vi. Derive the frequency of Kα line in Moseley's work from Bohr's theory of hydrogen spectrum.

PART - B

UNIT I

Answer any TWO from the following: **(2×10= 20 Marks)**

2. a) Derive expression for specific heat of solids using Einstein's theory.

b) Debye's temperature of diamond is 2000 K and its density is 2500 kg/m^3, its atomic weight is 12. Assuming that the transverse and longitudinal component have the same velocity, calculate the velocity of sound in diamond. **(6+4)**

3. a) Assuming the expression for density of energy states, find the average kinetic energy of electron at absolute zero.

b) The Hall voltage for the metal Sodium is 0.0001 mV measured at I=100 mA, B=2 T and the thickness of the specimen is 0.05 mm. Calculate a) the number of carriers/m^3 in Sodium b) the mobility of the electrons in Sodium using its electrical conductivity, σ for Sodium is $4.18 \times 10^{-8}\ \Omega^{-1}m^{-1}$. **(6+4)**

4. a) Obtain an expression for electrical conductivity of metals on the basis of free electron theory.

b) Find the Fermi energy in copper on the assumption that each copper atom contributes one free electron to the electron gas. The density of copper is 8.94×10^3 kg m^{-3} and its atomic mass is 63.35 amu. 1amu=1.67×10^{-27} kg. **(6+4)**

UNIT II

Answer any TWO from the following: **(2×10= 20 Marks)**

5. a) Explain the formation of a n type semiconductor and give its energy band diagram.

b) The intrinsic carrier density of Germanium at 27°C is $2.4 \times 10^{17} m^{-2}$. Calculate its intrinsic resistivity if the electron and hole mobilities are 0.35 $m^2V^{-1}s^{-1}$ and 0.18 $m^2V^{-1}s^{-1}$. **(6+4)**

6. a) With the help of an energy band diagram explain the effect of reverse bias on a p-n diode.

b) The current flowing in a certain reverse biased junction at room temperature is 2.5×10^{-7} A. What will be the current flowing through the junction if a forward bias of 0.1 V is applied? **(6 + 4)**

7. a) With a neat diagram, explain the principle of a solar cell.

b) Ratio of resistivity of germanium at 0°C and 100°C is 53.75. Find the energy gap of germanium. Given k=$1.38 \times 10^{-23} JK^{-1}$. **(6 + 4)**

UNIT III

Answer any TWO from the following: **(2×10= 20 Marks)**

8. a) Explain the origin of Characteristic X-rays.

b) A crystal is mounted on a X –ray spectrometer. The glancing angles of incidence to these reflections are 5°58', 12° 1' and 18°12'. Show that these are successive orders of reflection from the same crystal plane. Find the spacing of the planes given the wavelength is 0.0586 nm. **(6 + 4)**

9. a) With a suitable diagram explain about Screw dislocation .

b) Calculate the frequency of radiation which must be incident on a substance placed in a magnetic field of strength $5 \times 10^5/\pi$ Am^{-1} So that the electrons absorb energy. **(6 + 4)**

10. a) Describe the Langevin's theory of paramagnetism and obtain an expression for paramagnetic susceptibility.

b) The p.d across the X-ray tube is 5×10^5V. What is the minimum frequency of x-rays emitted? What is the corresponding wavelength. **(6 + 4)**

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18MAT501 Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
MATHEMATICS
PAPER V - DIFFERENTIAL EQUATIONS AND RING THEORY

Time: 3 Hrs. **Max. Marks: 120**

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B Choosing ONE full question from each unit.

PART - A 3×10=30

1. a. Find the complementary function of $(D^3 - 3D^2 + 4D - 2)y = e^x + cosx$

 b. Solve $(D^2 + 4)y = cos2x$

 c. Solve $(D^3 - 3D^2 + 3D - 1)y = 0$

 d. Transform $x^3\frac{d^3y}{dx^3} + 3x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = x + lnx$ into another equation with constant coefficients

 e. Reduce $y_2 - 4xy_1 + (4x^2 - 3)y = e^{x^2}$ to normal form

 f. Find B in the method of variation of parameters to solve

 $\frac{d^2y}{dx^2} + y = secx$ if y=Acosx+Bsinx

 g. Find $L\{t\ sinkt\}$

 h. For a positive integer n, prove that $L\{t^n\} = \frac{n!}{s^{n+1}}, s > 0$

 i. Evaluate $L^{-1}\left\{\frac{1}{s(s-2)}\right\}$

 j. Define ring

 k. If U is an ideal of a ring R and $1 \in U$, then show that U=R

 l. If every $x \in R$ satisfies $x^2 = x$ then prove that R is commutative.

 m. Define Euclidean ring.

 n. Find all units in J[i].

 o. Prove that $x^2 + x + 1$ is irreducible over F, the field of integérs modulo 2.

PART – B

UNIT - 1

2. a. Solve $(D^2 - 4)\ y = sin^2x$ (6)
 b. Solve $(D^2 + 5D + 6)y = sin4x + e^{-2x}$ (6)
 c. Solve $(D^3 + D^2 + D + 1)\ y = 2x^3 + 3x^2 - 4x + 5$ (6)

3. a. Solve $(D^3 - 12D + 6)y = (e^x + e^{-2x})^2$ (6)
 b. Solve $(D^2 - 4D + 3)y = sin3x\ cos2x$ (6)
 c. Solve $(D^3 - D^2 - D + 1)y = 1 + x^2$ (6)

P.T.O.

UNIT – II

4 a. Solve $\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+x^2y=0$ by reducing to normal form (6)

b. Solve $y''-y=e^x$ by reduction of order method. (6)

c. Solve $x^2\frac{d^2y}{dx^2}-3x\frac{dy}{dx}-5y=\sin(logx)$ (6)

5. a. Solve $(D^2-2D+2)y=e^x cosx$ (6)

b. Solve $\frac{d^2y}{dx^2}+tanx\frac{dy}{dx}+cos^2x.y=0$ by changing the independent variable (6)

c. Solve (D^2+1)y= secx tanx by the variation of parameters method. (6)

UNIT III

6. a. Obtain L$\{sinkt\}$ by using the definition (6)

b. Find $L^{-1}\left\{\frac{s+1}{s^2+6s+25}\right\}$ (6)

c. Solve $y''(t)-y(t)=5sin2t,\ \ y(0)=0,\ \ y'(0)=\mathbf{1}$ (6)

7. a. Derive the formula L$\{F(t)\}=\frac{1}{1-e^{-s\omega}}\int_0^{\omega}e^{-s\beta}F(\beta)d\beta$ for the Laplace transfer of a periodic function with period ω. (6)

b. Write F(t) in terms of $\propto -$ function and find L$\{F(t)\}$ if $F(t)=\begin{cases}t^2 & 0<t<2\\ 4 & 2\le t\le 4\\ 0 & t>4\end{cases}$ (6)

c. Find F(t) = $L^{-1}\left\{\frac{e^{-3s}}{(s+1)^3}\right\}$ and hence find F(2), F(5) (6)

UNIT – IV

8. a. Prove that every finite integral domain is a field (6)

b. Prove that the homomorphism $\emptyset$ of R into R' is an isomorphism if and only if its kernel $K_\emptyset=\{0\}$ (6)

c. If U is an ideal of ring R, prove that R(U)= $\{x\in R|xu=0,\forall u\in U\}$ is also an ideal of R. (6)

9. a. Define zero divisor. If R is a ring then for $a,b\in R$, prove that (i). $a.0=0$.a=0 (ii) $a(-b)=(-a)b=-(ab)$ (6)

b. Let $\emptyset: J(\sqrt{2})\to J(\sqrt{2})$ be defined by $\emptyset$(a+b$\sqrt{2}$)= a−b$\sqrt{2}$. Show that $\emptyset$ is an onto homomorphism. Find its kernel (6)

c. If R is a commutative ring with unit element, where only ideal are (0) and R itself, then prove that R is a field. (6)

UNIT – V

10. a. Prove that P is a prime ideal of J the ring of integers if and only if P=(0) or P=pJ for some prime p. (6)

b. If p is a prime number of the form 4n+1 then prove that the congruence relation $x^2\equiv -1\ (modp)$ has a solution. (6)

c. If f(x) and g(x) are two non zero elements of polynomial ring F[x], then prove that deg (f(x)g(x))=deg f(x)+ deg g(x). (6)

11. a. Let R be a Euclidean ring and a, b∈R. If b≠ 0 s not a unit in R, then prove that d(a)<d(ab) (6)

b. In the ring Z of integers, prove that U=(n_0) is a maximal ideal if n_0 is a prime number (6)

c. Let R be a Euclidean ring. Prove that any two elements a and b in R have a greatest common divisor 'd' which can be expressed as d=$\lambda a+\mu b$ for some λ, μ in R (6)

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18MAT512 Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
MATHEMATICS
PAPER VI -DISCRETE MATHEMATICS

Time: 3 Hrs. **Max. Marks: 120**

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B Choosing ONE full question from each unit.

PART - A **3×10=30**

1.a. Show that $\neg$ P(a,b) follows logically from (x)(y) (P(x,y)→ $W(x,y))and$ $\neg W(a,b)$

b. Determine if the conclusion C follows form the premises $H_1 and\ H_2$

$H_1: P \rightarrow Q, \quad H_2 = P, \quad C: Q$

c. Symbolize the statement "Everyone in final year class has a cellular phone"

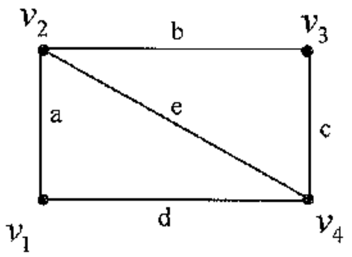
d. Define the terms (a) Hamiltonian path

(b) Eulerian path

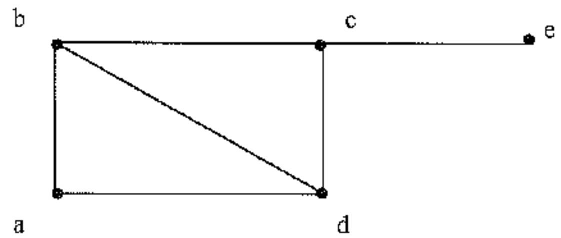
e. Define 'Undirected complete graph' and give an example of this, which is also non-planar

f. Using Euler's formula, prove that K_5 graph is non-planar

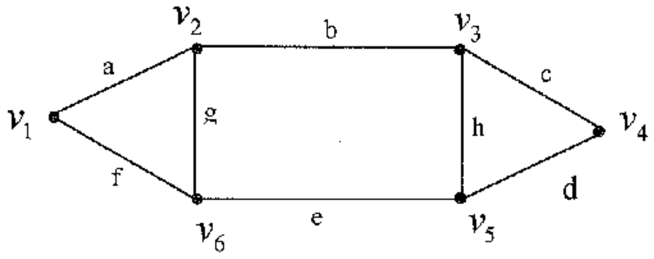
g. Define 'cut-set' and write any 2 cutsets in the graph below



h. Define 'spanning tree' and draw any two spanning trees of the graph below.



i. Define 'fundamental circuit'. How many fundamental circuits are possible with respect to a chosen spanning tree of the graph below?



j. Prove that two states are in the same block in $\pi_k$if and if they are in the same block in π_{k-1}

k. Construct a grammar for the language L=$\{a^i b^{2i} \mid i \geq 1\}$

l. Define 'finite state machine'

m. Find the particular solution for the difference equation $a_r = a_{r-1} + 7$

n. If A(z)=$\frac{2}{1-4z^2}$, find a_r

o. If a= $\alpha_0+\alpha_1 r+\alpha_2 r^2 + \ldots\ldots\ldots\ldots\ldots + \alpha_n r^n$, show that a is o($r^n$).

PART – B

UNIT – 1

2.a. Without constructing truth table show that statements $R \vee M$, $\urcorner R \vee S$, $\urcorner M$, $\urcorner S$ cannot be true simultaneously. (6)

b. State rule CP. Using rule CP show that R→ S can be derived from the premises P→ $(Q \to S)$, $\urcorner RVS$ and Q (6)

c. Prove that (∃x) (P(x) ∧ $Q(x)$) ⟹ (∃x)P(x) ∧ (∃x)Q(x). Prove that the converse does not hold (6)

3.a. If A works hard, then either B or C will enjoy themselves. If B enjoys himself, then A will not work hard. If D enjoys himself, then C will not. Therefore show that, if A works hard, then D will not enjoy himself. (6)

b. Show that ˥ (P ∧ Q) follows form ˥ P∧ ˥ Q by indirect method of proof (6)

c. Show that (∃x)M(x) follows logically from the premises (x) (H(x)→ $M(x)$) and $(\exists x)H(x)$ (6)

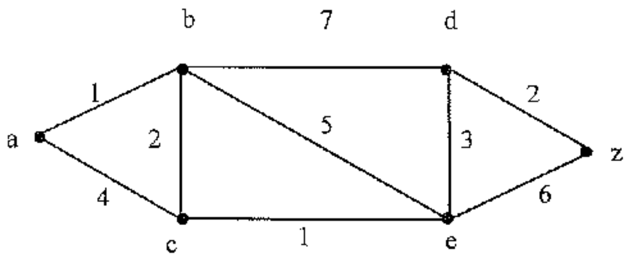
UNIT – II

4.a. Prove that an undirected graph possesses an Eulerian path if and only if it is connected and has either zero or two verities of odd degree (9)

b. Prove that there is always a Hamiltonian path in a directed complete graph (9)

5.a. For any connected planar graph, prove with usual notations that $v - e + r = 2$ (9)

b. Find the shortest distance form a to z in the graph given below (9)



UNIT III

6.a. Show that a circuitless graph with 'v' vertices and 'v-1' edges is a tree (6)

b. Prove that every circuit has an even number of edges in common with every cutset (6)

c. Draw a binary tree for the prefix code {1,01,000,001} (6)

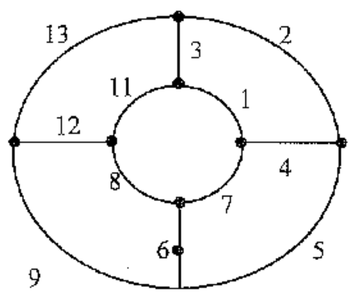
7.a. Prove that the number of vertices is one more than the number of edges in a tree (6)

b. In a graph G, with respect to a give spanning tree, let D=$\{e_{1,} e_2, ..., e_k\}$ be a fundamental cutset in which $e_{1,}$, is a branch and $e_{2,} e_3, ..., e_k$ are chords. Show that

(i) $e_{1,}$ is contained in the fundamental circuits corresponding to the chords $e_i, 2 \leq i \leq k$

(ii) $e_{1,}$ is not contained in any other fundamental circuits (6)

7.c. Describe a procedure to determine minimum spanning tree of a connected weighted graph. Use it to find a minimum tree for the following graph. (6)



UNIT – IV

8.a. Let T={$A, B, C, D, +, *, (,), =$} and N={$asgn - stat, exp, term, factor, id$}, with asgn-stat being the starting symbol. Generate the sentence C=A+D*(D+B) by using the following set of productions:

asgn-stat → id=exp
exp → exp+term
exp → $term$
term → term*factor
term → $factor$
factor → (exp)
factor → id
id → A
id → B
id → C
id → D (9)

b. Show that the language L=$\{a^k b^k | k \geq 1\}$ is not a finite state language (9)

9.a. Define phrase structure grammar
Construct a grammar for L=$\{aaaa, aa\,bb, bbaa, bbbb\}$ (9)

b. Show that the language L= $\{a^k | k = i^2, i \geq 1\}$ is not a finite state language (9)

UNIT-V

10.a. Find the homogeneous solution of the difference equation
$4a_r - 2a_{r-1} + 17a_{r-2} - 4a_{r-3} = 0$ (6)

b. Find the numeric function corresponding to the generating function A(z)=$\frac{2+3z-6z^2}{1-2z}$ (6)

c. Find the particular solution of the difference equation $a_r + a_{r-1} = 3r2^r$ (6)

11.a. If $a_r = 2^r\ r \geq 0, b_r = 3^r$ r≥ 0 find the generating function for c=a*b and hence find the numeric function c_r for c=a*b (6)

b. Find the homogeneous solution of the difference equation
$a_r + 6a_{r-1} + 12a_{r-2} + 8a_{r-3} = 0$ (6)

c. Find the particular solution of the difference equation
$a_r + 5a_{r-1} + 6a_{r-2} = 3r^2 - 2r + 1$ (6)

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MAT 501.2 Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

MATHEMATICS

PAPER V- SPECIAL FUNCTIONS AND DIFFERENTIAL EQUATIONS

Time: 3 Hrs. **Max. Marks: 120**

Note: 1. Answer any Ten questions in Part A. Each question carries 3 marks.
2. Answer FIVE full questions form Part B Choosing ONE full question from each unit.

PART - A **3×10=30**

1. a. Write the formulas for the Fourier coefficients of a function f(x) with period T.
b. Show that for $x > 0, \Gamma(x+1) = x\Gamma(x)$
c. Evaluate $\int_0^1 x^4(1-x)^3\,dx$
d. Solve $(4D^2 - 7D - 2)y = 0$
e. Find the particular solution of $(D^2+1)y = sin2x$
f. Solve $(D-3)^2 y = e^{3x}$
g. Transform $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 4y = x^2$ into a differential equation with constant coefficients using the substitution z=logx
h. Reduce $y_2 - 4xy_1 + (4x^2-3)y = e^{x^2}$ to normal form.
i. Find A in the method of variation of parameters to solve $\frac{d^2y}{dx^2} + y = secx$ if y=Acosx+Bsinx.
j. Find L$\{cos^2 kt\}$
k. Find L{t sinkt}
l. Find $L^{-1}\left\{\frac{s}{s^2+8s+16}\right\}$

m. A spring is such that it would be sketched 6- inches by a 12 pound weight. Find the spring constant.
n. Write the differential equation of motion when both damping and impressed forces are present.
o. Write the one dimensional (i)wave equation and (ii) heat equation

PART –B

UNIT – 1

2. a. Find the Fourier series of the function f(x) given by $f(x) = \begin{cases} -k & -\pi < x < 0 \\ k & 0 < x < \pi \end{cases}$ (6)

b. Evaluate $\int_0^{\pi/2} Sin^{10}\theta d\theta$ using β function (6)

c. Evaluate $\int_0^1 \frac{dx}{\sqrt{xlog\left(\frac{1}{x}\right)}}$ (6)

3. a. Find the Fourier series of the function f(x)=$\begin{cases} 0 & -2 < t < -1 \\ k & -1 < t < 1 \\ 0 & 1 < t < 2 \end{cases}$ T=4 (6)

b. Show that $\int_0^1 x^{9/2}(1-x)^{-1/2}dx = \frac{63}{256}\pi$ (6)

c. Evaluate $\int_0^{\pi/2} cos^5\theta sin^2\theta d\theta$ (6)

P.T.O.

UNIT – II

4. a. Solve $(D^3 - 12D + 16)y = (e^x + e^{-2x})^2$ (6)

b. Solve $(D^2 + 4)y = sinx + sin2x$ (6)

c. Solve $(D^3 - D^2 - D + 1)y = 1 + x^2$ (6)

5. a. Solve $(D^2 - 4)y = sin^2x$ (6)

b. Solve $(D^3 + D^2 + D + 1)y = 2x^3 + 3x^2$ (6)

c. Solve $(D^2 - 4D + 3)y = sin3x\, cos2x$ (6)

UNIT – III

6. a. By the method of changing the independent variable,

solve $\frac{d^2y}{dx^2} + \tan x\frac{dy}{dx} + ycos^2x = 0$ (6)

b. Solve $x^3\frac{d^3y}{dx^3} + 3x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} = x + logx.$ (6)

c. Solve $(D^2 + 1)y = cosecx$ by reduction of order method (6)

7. a. Solve $x^2\frac{d^3y}{dx^3} + 2x\frac{dy}{dx} = 6x^2 + 2x + 1$ (6)

b. Solve $4x^2\frac{d^2y}{dx^2} + 4x^5\frac{dy}{dx} + (x^8 + 6x^4 + 4)y = 0$ by reducing to normal form. (6)

c. Solve $(D^2 + 1)y = secx\, tanx$ by variation of parameters. (6)

UNIT – IV

8. a. If F(t) has Laplace transform and if F(t+ω)=F(t), then
prove that $L\{F(t)\} = \frac{1}{1-e^{-s\omega}}\int_0^{\omega} e^{-s\beta}F(\beta)d\beta$ (6)

b. Find F(t)= $L^{-1}\left\{\frac{e^{-3s}}{(s+1)^3}\right\}$ and hence find F(2), F(5) (6)

c. Solve $x''(t) + 2x'(t) + x(t) = 3te^{-t}, \quad x(0) - 4, \; x'(0) = 2$

9. a. Define the Gamma function Γ (x) and show that $L\{t^x\} = \frac{\Gamma(x+1)}{s^{x+1}}$ for x>-1, s>0 (6)

.b. Find $L^{-1}\left\{\frac{1}{(s^2+k^2)^2}\right\}$ by using convolution theorem.
(6)

c. Express F(t) in terms of ∝ *function and find* $L\{F(t)\}$, F(t) = $\begin{cases} 6, & 0 < t < 4 \\ 2t + 1, & t > 4 \end{cases}$ (6)

Contd...

UNIT – V

10 a. A spring is such that it would be stretched 6 inches by a 12 pound weight. Let the weight be attached to the spring and pulled down 4 inches below the equilibrium point. Let the weight be started with an upward velocity of 2 feet per second, describe the motion, No damping or impressed force is present. (9)

b. Find D'Alembert's solution of one dimensional wave equation. (9)

11 a. A spring is such that a 4 pound weight stretches it 6 inches. An impressed force $\frac{1}{2}\cos 8t$ is acting on the spring, The 4-pound weight is started form the equilibrium point with an upward velocity of 4ft per sec. Find the equation describing the position of the weight at time t. (9)

b. Find the solution $u(x, y)$ of the equation $u_x + u_y = 2(x + y)u$ by separation of variables. (9)

MAT502.1 Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

MATHEMATICS

PAPER VI -DISCRETE MATHEMATICS

Time: 3 Hrs. **Max. Marks: 120**

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.

2. Answer FIVE full questions from Part B Choosing ONE full question from each unit.

PART - A **3×10=30**

1.a. Define a chain. Give an example.

b. Show that any integer composed of 3^n identical digits Is divisible by 3^n

c. If P(A)=0.392, P(B)=0.515 and P(A ∩ B)=0.090, find P(A ∪ B) and P( )

d. Prove that the number of odd degree vertices in a graph is always even.

e. Define planar and non-planar graphs

f. If G is a connected planar graph with two or more edges and no loops, then prove that $e \leq 3v - 6$

g. Define (i) cutest (ii) Fundamental cut set

h. Prove that a cut set and any spanning tree must have at least one edge in common.

i. Obtain a binary tree for the prefix code {00,011,10,111}

j. Design finite state machine for modulo 3

k. Define tractable and intractable problems with examples.

l. Define 'equivalent machines' and '1 equivalent states'

m. Find the generating function for the numeric function $a^r = 7.3^r$, $r \geq 0$

n. Find the particular solution of the difference equation $a_r - 5a_{r-1} + 6a_{r-2} = 1$

o. If $A(z) = 3z + \frac{2}{1-2Z}$, $find\ a_r$

PART – B

UNIT – 1

2.a. In how many ways can a group of 8 people be divided into committees subject to the constraint that each person must belong to exactly one committee and each committee must contain at least 2 people. (6)

b. Determine the number of integers between 1 and 200 which are divisible by any one of the integers 2,3 and 5 (6)

c. If the length of the longest chain in a partially ordered set P is n, then show that the elements of P can be partitioned into 'n' disjoint antchains (6)

3.a. Provide a step-by-step derivation to obtain −010 using the set of productions
signed integer → sign integer

sign → +

sign → −

integer → *digit integer*

integer → *digit*

digit → 0

digit → 1 (6)

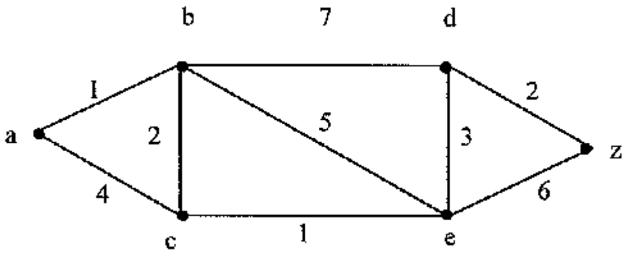
b. Prove that $\frac{\omega}{\omega_0} \leq \frac{3}{2}$ where ω is the total clapsed time and ω_0 is the minimum possible total elapsed time for a given set of tasks. (6)

c. If no three diagonals of a convex decagon meet at the same point inside the decagon into how many line segments are the diagonals divided by their intersection? (6)

UNIT – II

4.a. Prove that an undirected graph possesses an Eulerian path if and only if it is connected and has either zero or two vertices of odd degree (9)

b. Find the shortest distance form a to z in the graph (9)



5.a. For any connected planar graph, prove with usual notations that v-e+r=2 (9)

b. Let G be a linear graph with 'n' vertices. If the sum of the degrees of each pair of vertices in G is not less than n-1, show that there exists a Hamiltonian path in G (9)

UNIT III

6.a. Show that a circuitless graph with ;v' vertices and 'v-1' edges is a tree (6)

b. In a graph G, with respect to a given spanning tree, let $D=\{e_1, e \dots . e\}$be a fundamental cutset in which e_1 is a branch and $e_2, e_3 \dots e_k$are chords. Show that
(i) e_1 is contained in the fundamental circuits corresponding to the chords $e_i, 2 \leq i \leq k$
(ii) e_1 is not contending any other fundamental circuits (6)

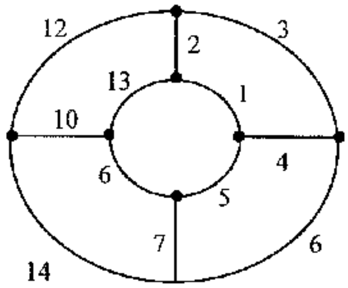
c. Construct a prefix code for the following alphabet given the respective occurrences (6)

Letter :	a	b	c	d	e
No. of occurrences :	12	3	6	4	5

7.a. Prove that the number of vertices is one more than the number of edges in a tree (6)

b. Prove that every circuit has an even number of edges in common with every cut set (6)

c. Describe a procedure to determine minimum spanning tree of a connected weighted graph. Use it to obtain the minimum spanning tree for the graph (6)



UNIT – IV

8.a. State the algorithm 'BUBBLESORT' for sorting the numbers $x_1, x_2 \ldots x_n$. Justify the algorithm with a formal proof. Find its time complexity. (9)

b. Show that the language L=$\{a^k | k = i^2, i \geq 1\}$ is not finite state language (9)

8.a. State the algorithm 'LARGEST2' for finding the largest of m numbers. Also justify it with a formal proof (9)

b. Show that the language L=$\{a^k b^k | k \geq 1\}$is not a finite state language (9)

UNIT – V

10 .a. If $3a_r - 5a_{r-1} + 2a_{r-2} = r^2 + 5, a_3 = 3, a_4 = 6,$ find a_2 and a_5 (6)

b. Find the numeric function corresponding to the generating function A(z)=$\frac{2+3z-6Z^2}{1-2Z}$ (6)

c. Find the homogeneous solution of the difference equation
$a_r + 6a_{t-1} + 12a_{r-2} + 8a_{r-3} = 0$ (6)

11.a. If $a_r = 2^r, r \geq 0$ and $b_r = 3^r$, r≥ 0 and c=a*b determine the generating function of c. Also find the numeric function c_r $for\ c = a * b$ (6)

b. Find the particular solution of the difference equation
$a_r + 5a_{r-1} + 6a_{r-2} = 3r^2 - 2r + 1$ (6)

c. Find the homogeneous solution of the difference equation
$4a_r - 2a_{r-1} + 17a_{r-2} - 4a_{r-3} = 0$ (6)

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18MAT542 Reg. No. ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
MATHEMATICS
PAPER VI- LINEAR PROGRAMMING

Time: 3 Hrs. **Max. Marks: 120**

Note: 1. Answer any TEN questions in Part A. Each question carries 3 marks.
2. Answer FIVE full questions from Part B Choosing ONE full question from each unit.

PART - A

3×10=30

1. a. Define i) a convex set in R^n

ii) an extreme point of a convex set in R^n

b. Pivot on $a_{22} = 2$ in the following canonical maximization table:

x_1	x_1	-1	
2	1	8	$= -t_1$
1	2	10	$= -t_2$
30	50	0	$= f$

c. Convert the L.P.P below to canonical form:

Maximize: f(x,y)= $-2y-x$

Subject to: $2x-y \geq -1$

$3y-x \leq 8$

$x,y \geq 0$

d. Define negative transpose of the minimum table

e. Write matrix reformulation of canonical maximization L.P.P

f. Given the L.P.P below

Maximize: $f(x_1, x_2) = x_1 + x_2$

Subject: $x_1 + 2x_2 \leq 4$

$3x_1 + x_2 \leq 6$

$x_1, x_2 \geq 0$

State the dual canonical minimization L.P.P

g. Reduce the following table of the matrix game using domination

$$\begin{bmatrix} -1 & 0 & 2 & -2 & 0 \\ 1 & -2 & -4 & 2 & 2 \\ 0 & -1 & 1 & 1 & -1 \\ 0 & 5 & 4 & 2 & 0 \end{bmatrix}$$

h. Define mixed strategy and pure strategy for the column player in the matrix game

i. State Von-Neumann minimax theorem

j. Define a cycle in a balanced transportation problem

k. State the balanced assignment problem

l. Find all permutation set of zeros in the following table of balanced assignment problem

0	0	1
0	0	0
1	0	0

m. State the maximal flow network problem

n. Prove that any flow in a capacitated directed network satisfies $\sum_j \varphi(v_j) = 0$

o. Define a source, sink and intermediate vertex in a capacitated directed network N = [V,E]

PART – B

UNIT -I

2.a. An appliance company manufactures heaters and air conditioners. The production of one heater requires 2 hours in the parts division of the company and 1 hour in the assembly division of the company, the production of one air conditioner requires 1 hour in the parts division of the company and 2 hours in the assembly division of the company. The parts division is operated for at most 8 hours per day and the assembly division is operated for at most 10 hours per day. If the profit realized upon sale is $30 per heater and $50 per air conditioner, how many heaters and air conditioners should the company manufacture per day so as to maximize profits? Solve graphically. (9)

b. Solve using the simplex algorithm (9)

x	y	−1	
−1	−1	−2	$= -t_1$
1	−2	0	$= -t_1$
−2	1	1	$= -t_1$
−1	3	0	= f

3. a. State the complete simplex algorithm for maximum table (9)

b. Apply simplex algorithm to the maximum table (9)

x_1	x_2	-1	
2	1	8	$= -t_1$
1	2	10	$= -t_2$
30	50	0	= f

UNIT – II

4.a. Solve the noncanonical L.P.P (9)

Maximize f(x,y,z) = x+2y+z

Subject to: x+y+z = 6

$x+y \le 1$

$x,y \ge 0$

b. For any pair of feasible solutions of dual canonical LPP's prove that $g-f = SX + Y'T$ (9)

5.a. Solve the dual conical L.P.P below (9)

	x_1	x_2	-1	
y_1	20	25	300	$= -t_1$
y_2	40	20	500	$= -t_2$
-1	1000	800	0	$= f$
	$= \Delta_1$	$= \Delta_2$	$= g$	

b. Solve the following minimization L.P.P using the simplex algorithm (9)

x	-1	-1	-1
y	-1	1	-1
-1	-2	1	0
	$= -t_1$	$= -t_2$	$= g$

UNIT – III

6.a. Solve the dual non canonical L.P.P below: (9)

	x_1	x_2	x_3	-1	
y_1	1	-1	2	1	$=-0$
y_2	2	0	2	-1	$=-t_1$
y_3	0	1	-1	-1	$=-t_2$
-1	1	-1	3	0	$=f$
	$=0$	$=0$	$=s_1$	$=g$	

b. Solve the matrix game

$$\begin{bmatrix} -3 & 4 \\ 2 & -3 \end{bmatrix}$$ (9)

7.a. Solve the dual non-canonical L.P.P (9)

	x_1	x_2	-1	
y_1	1	2	2	$=-0$
y_2	-1	-2	-2	$=-t_1$
-1	-1	-2	0	$=f$
	$=0$	$=s_2$	$=g$	

b. Find the optimal strategies for the row and column players and the von Neumann value of the matrix game with pay off matrix

$$\begin{bmatrix} -5/3 & 0 \\ 5 & -10/3 \end{bmatrix}$$ (9)

UNIT – IV

8.a. State the transportation algorithm (9)

b. Solve the assignment problem below (9)

4	6	5	10
10	9	7	13
7	11	8	13
12	13	12	17

9.a. State the Hungarian algorithm to solve a balanced assignment problem (9)

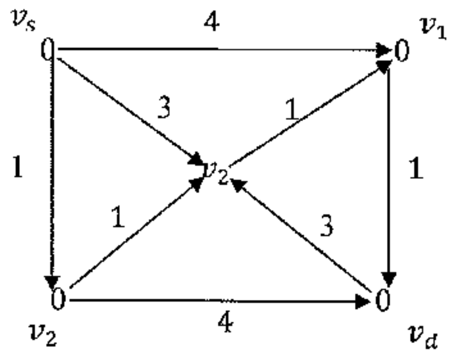
b. Solve the transportation problem below (9)

2	1	2	50
9	4	7	70
1	2	9	20
40	50	20	

UNIT – V

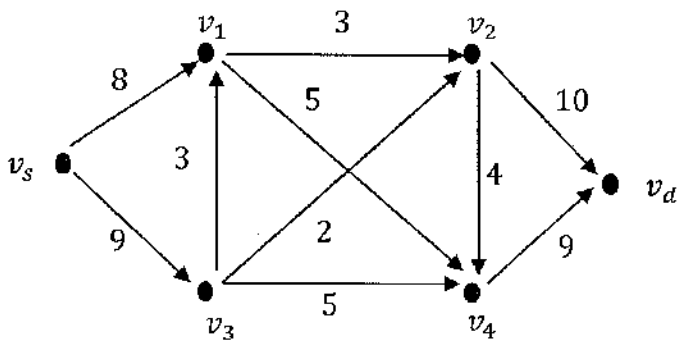
10.a. State the maximal flow algorithm (9)

b. Solve the shortest path network problem (9)



11.a. State the Dijkstra's algorithm for finding the shortest path (9)

b. Solve the maximal flow network problem: (9)



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18CHE501 Reg No : ....

CHOICE BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
CHEMISTRY
Chemistry Theory V

Duration:3 Hours **Max Marks:80**

I. Answer any SEVEN of the following : (7×2= 14 Marks)

a. What is hydrate isomerism? Give an example

b. What is linkage isomerism? Give an example.

c. Write the formula of i) Tetraamminecarbonatocobalt(III) chloride ii) Diamminetetrachloroplatinum(IV)

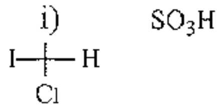
d. Define the term specific conductance of an electrolytic solution. Give the SI unit.

e. In sulphur system, what is the maximum number of phases that can co-exist? Why?

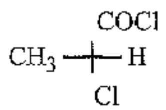
f. What are Threo and Erythro compounds? Give an example.

g. What are the conditions for a compound to exhibit geometrical isomerism?

h. Identify R or S notation i)



ii)



II. Answer any SIX of the following : (6×6= 36 Marks)

2. a) Write any three postulates of quantum mechanics. (3)
b) Explain geometrical isomerism among coordination compounds with an example. (3)

3. a) Derive de Broglie's wave equation.(3)
b) Explain ionisation isomerism for complex compounds with an example.(3)

4. a) What are freezing mixtures? Give two examples.(2)
b) Explain the determination of solubility of sparingly soluble salts.by conductometric method. (4)

5. a) Explain the phase diagram of water system. (3)
b) Explain the variation of equivalent conductance with dilution. (3)

6. a) Distinguish between true equilibrium and metastable equilibrium with an example. (3)
b) A conductivity cell having platinum electrodes having an area of 5cm^2 and placed 2 cm apart offered a conductance of 12 mS, when placed in a solution of 0.5N potassium chloride. Calculate the equivalent conductance of the solution. (3)

7. a)What are racemic mixtures? Explain with an example. (3)
   b) Explain the method of resolution of racemic mixtures by chemical method. (3)

8. a) What are enantiomers? Explain with an example.(3)
   b) Explain the classification of carbohydrates.(3)

III. Answer any THREE of the following : (3×10= 30 Marks)

9. a) Explain Planck's quantum theory of radiation. (5)
   b) Explain black body radiation with the spectrum of distribution of energy at different temperature. (5)

10. a) Draw the shapes of s, p and d orbitals. (6)
    b) Explain the radial distribution curves. (4)

11. a) Explain desiverisation of lead by Pattinson's process. (5)
    b) At 291K, the molar conductance at infinite dilution of NH_4Cl, NaOH and NaCl are $129.8 x 10^{-4}$, $217.4 x 10^{-4}$ and $108.9 x 10^{-4}$ Sm^2eq^{-1} respectively. If the molar conductivity of a centinormal solution of NH4OH is $9.33 x 10^{-4} Sm^2eq^{-1}$, what is the percentage dissociation of NH_4OH at this temperature. (5)

12. a) Mention the source and structure of sucrose and maltose. (5)
    b) Explain the mechanism of mutarotation.(5)

CHE501.2 **Reg No : ....**

CHOICE BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

CHEMISTRY

Chemistry Theory V

Duration:3 Hours **Max Marks:80**

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b. What is linkage isomerism? Give an example.

c. Write the formula of i) Tetraamminecarbonatocobalt(III) chloride ii) Diamminetetrachloroplatinum(IV)

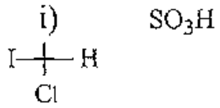
d. Define the term specific conductance of an electrolytic solution. Give the SI unit.

e. In sulphur system, what is the maximum number of phases that can co-exist? Why?

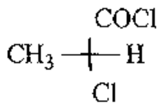
f. What are Threo and Erythro compounds? Give an example.

g. What are the conditions for a compound to exhibit geometrical isomerism?

h. Identify R or S notation i)



ii)



II. Answer any SIX of the following : **(6×6= 36 Marks)**

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   b) Explain geometrical isomerism among coordination compounds with an example. (3)

3. a) Derive de Broglie's wave equation.(3)
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4. a) What are freezing mixtures? Give two examples.(2)
   b) Explain the determination of solubility of sparingly soluble salts.by conductometric method. (4)

5. a) Explain the phase diagram of water system. (3)
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6. a) Distinguish between true equilibrium and metastable equilibrium with an example. (3)
   b) A conductivity cell having platinum electrodes having an area of $5cm^2$ and placed 2 cm apart offered a conductance of 12 mS, when placed in a solution of 0.5N potassium chloride. Calculate the equivalent conductance of the solution. (3)

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   b) Explain black body radiation with the spectrum of distribution of energy at different temperature. (5)

10. a) Draw the shapes of s, p and d orbitals. (6)
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11. a) Explain desiverisation of lead by Pattinson's process. (5)
    b) At 291K, the molar conductance at infinite dilution of NH_4Cl, NaOH and NaCl are $129.8x10^{-4}$, $217.4x10^{-4}$ and $108.9x10^{-4}$ Sm^2eq^{-1} respectively. If the molar conductivity of a centinormal solution of NH_4OH is $9.33x10^{-4}Sm^2eq^{-1}$, what is the percentage dissociation of NH_4OH at this temperature. (5)

12. a) Mention the source and structure of sucrose and maltose. (5)
    b) Explain the mechanism of mutarotation.(5)

18CHE502 Reg No : ....

CREDIT BASED SEMESTER SYSTEM

B.Sc. FIFTH SEMESTER DEGREE EXAMINATION, FEBRUARY 2021

CHEMISTRY

General Chemistry - VI

Duration:3 Hours **Max Marks:80**

I. Answer any SEVEN of the following : **(7X2= 14 Marks)**

1. a. Why are insulators non conducting materials?

   b. Give reason - Salts have high melting points.

   c. How many PMR signals are obtained in the case of toluene?

   d. Define shielding and deshielding in NMR spectroscopy.

   e. Give the synthesis of crotonic acid from DEM.

   f. How is acetone formed from Grignard reagent?

   g. How do alkyl halides react with olefins?

   h. Write the keto and enol forms of acetoacetic ester.

II. Answer any SIX of the following : **(6X6= 36 Marks)**

2. a) Give three consequences of lanthanide contraction. (3)
   b) What is the complexation tendencies of f block elements? (3)

3. Write a note on polarisation and polarising power. (6)

4. a) The pure rotational spectrum of gaseous CN consists of a series of equally spaced lines separated by 3.7879 cm^{-1}. Calculate the internuclear distance of the molecule if the molar masses are $^{12}C = 12.01 gmol^{-1}$ and $^{14}N = 14.007 gmol^{-1}$. (4)
   b) Draw the energy level diagram of a molecule for rotational transition. (2)

5. a) Derive an expression for rotational energy and rotational constant of a rigid rotor. (3)
   b) Sketch the energy levels for a anharmonic oscillator for a typical diatomic molecule. (3)

6. a) Draw the energy level diagram of a molecule for vibrational transition. (3)
   b) The force constant of HF molecule is 970 Nm^{-1}. Calculate the fundamental vibration frequency in Hz as well as zero point energy in joules. Given atomic mass of H is1.008 amu and atomic mass of F is 18.998 amu (3)

7. a) Give the salient features of the molecular orbital theory of colour (3)

   b) Write the synthesis of Congo Red (3)

8. Give the synthesis of a) 2-methylpropanoic acid from DEM

   b) propanoic acid from AAE. (6)

III. Answer any THREE of the following : (3X10= 30 Marks)

9. a) State Pearson's HSAB concept and explain any four applications of the HSAB principle.(6)

   b) Explain the limitations of the HSAB theory. (4)

10. a) Discuss the variation in oxidation states in f block elements. (6)

    b) Give two differences and two similarities between actinides and lanthanides. (4)

11. a) Derive an expression for moment of inertia of a rigid diatomic rotor. (4)

    b) Write and explain the selection rule for Infra red transition (vibrational transition). (2)

    c) The pure rotational spectrum of hydrogen fluoride gives a series of lines whose separation is $4050 m^{-1}$. Calculate the moment of inertia and internuclear distance for the molecule given atomic masses of H is 1amu and F is 19 amu (4)

12. a) Explain any 3 reactions of aluminium isopropoxide. (6)

    b) Give the synthesis of antipyrine from AAE and barbituric acid from DEM. (4)

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CHE502.2 **Reg No : ....**

CREDIT BASED SEMESTER SYSTEM

B.Sc. FIFTH SEMESTER DEGREE EXAMINATION, FEBRUARY 2021

CHEMISTRY

General Chemistry - VI

Duration:3 Hours **Max Marks:80**

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   b) Write the synthesis of Congo Red (3)

8. Give the synthesis of a) 2-methylpropanoic acid from DEM

   b) propanoic acid from AAE. (6)

III. Answer any THREE of the following : (3X10= 30 Marks)

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12. a) Explain any 3 reactions of aluminium isopropoxide. (6)

    b) Give the synthesis of antipyrine from AAE and barbituric acid from DEM. (4)

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18BOT501 Reg No : ....

CREDIT BASED SEMESTER SYSTEM
FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021
Botany - V

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Define turgour pressure and wall pressure.
2. Define Water Potential.
3. Write two practical applications of Vernalization in agriculture.
4. What are Auxins? Name two synthetic Auxins.
5. What is Hydroponics? Mention its applications.
6. Explain the reaction catalysed by Succinic Dehydrogenase in Krebs cycle.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Write a note on factors affecting enzyme activity.
8. Describe EMP pathway.
9. Write a note on i)Photosynthetic pigments and their composition ii)Differentiate action and absorption spectra.
10. Give schematic representaion of Nitrogen cycle.
11. Explain the structure and synthesis of sucrose.
12. Describe the starch hydrolysis theory to explain the mechanism of stomatal movements.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Explain the 6 major classes of plant enzymes.
14. Define i) Hypotonic solution ii) Cavitation iii) Hydrolases iv) Holoenzyme v)Allosteric inhibition
15. Explain the role of Macro and Micro elements in plant growth.
16. Explain glyoxylate cycle. Mention its significance.
17. Explain Cyclic Photophosphorylation and its significance.

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18BOT502 Reg No : ....

CREDIT BASED SEMESTER SYSTEM

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021

Botany Theory - VI

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. What is teminism?
2. What are okazaki fragments? Where do you find them?
3. Who explained double helical structure of DNA?
4. What are the components of Britten Davidson model of gene regulation?
5. What is bioinformatics? Mention any one application.
6. What are SSR?

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Describe the experiment conducted by Avery, Macleod and Mc Carty.
8. Write a note on transcription factors.
9. Write a brief note on autotetraploids with its significance.
10. Explain Tryp operon model of gene expression.
11. Explain chemical mutagens.
12. Write a note on Rice genome project.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Define transcription. Explain the process of transcription in Prokaryotes with a neat labeled diagram.
14. What is genetic code? Explain the salient features of genetic code.
15. Write a detailed note on (i) Monosomy (ii) Trisomy
16. What is duplication? Describe its types.
17. Explain in detail the procedure of SDS-PAGE.

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18COS501 Reg No : ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
COMPUTER SCIENCE
Computer Science V

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. Write any two component technologies of J2EE.
2. Write a note on Enterprise JavaBeans.
3. Give any two examples for JDBC Type-3 Driver.
4. What is the usage of executeQuery() method?
5. What is a session?
6. Why is the method getParameter() used?

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. Write a note on
   a)JavaVirtual Machine
   b)Java Platform
8. Explain n-tier architecture with a neat diagram. Write any two advantages
9. Explain the process flow of ResultSet interface with a neat diagram.
10. Explain JDBC architecture with a neat diagram.
11. Explain any two loops used in JSP with an example each.
12. Explain JSP tags with an example each.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. Explain 1-tier and 2-tier architecture with a neat diagram. Mention its advantages and disadvantages
14. Explain the process flow of PreparedStatement object with a neat diagram.
15. Explain any five methods of Connection and Statement Interface.
16. Explain any five HTTP request and HTTP response headers.
17. Define a) CGI b) Java Servlet. Explain the benefits of using Java servlet over CGI.

18COS512 Reg No : ....

CREDIT BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
COMPUTER SCIENCE
Computer Science VI

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5×2= 10 Marks)**

1. Give one difference between SF and ZF registers.
2. What is a three operand instruction? Give an example.
3. Write the general format,of an Assembly Language instruction.Give an example.
4. Write the syntax of Shift Logical Left instruction with an example.
5. Write the function of the instruction SBB.
6. What is the difference between the instructions NOP and HLT?

II. Answer any FIVE of the following : **(5×6= 30 Marks)**

7. What are the features of 8080 and 8086 Microprocessors?
8. Explain the concept of procedures with its advantages.
9. Explain any 2 string transfer instructions with examples.
10. Write a note on Stack addressing Modes.
11. State the rules for naming the variables in 8086.Give suitable examples.
12. Explain the interrupt instructions-INT, INTO and IRET.

III. Answer any FOUR of the following : **(4×10= 40 Marks)**

13. List and explain the General Purpose Registers and Segment Registers.
14. (a) Explain the different program organization directives with suitable examples. (b) With the syntax and example, explain (i) PTR (ii)PUBLIC
15. Explain: (i)DAA (ii) DAS
16. (a) Write an assembly language program to generate 8 fibonacci numbers.
    (b) Write a note on ASCII Data and BCD Data.
17. What are processor control instructions? Explain the different processor control instructions.

18MIC501 Reg No : ....

CREDIT BASED SEMESTER SYSTEM
FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021
Microbiology - V

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Write the principle of Precipitation reaction.
2. What is Hybridoma ?
3. Mention the enterotoxins of Escherichia coli.
4. Mention the selective media used to isolate Vibrio cholerae.
5. Name any two antifungal drugs and write their mode of action.
6. Define paper disc plate method.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Write a note on classification of antigens.
8. Write a note on acquired immunity.
9. Write the modes of transmission of HIV.
10. Enumerate the clinical features of Hepatitis A Virus.
11. Write a note on antiparasitic drugs.
12. List the general mode of action of antimicrobial agents.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Explain in detail Type II, III and IV Hypersensitivity reactions.
14. Discuss in detail the mechanism of Cell mediated Immune response.
15. Explain the morphology, cultural,biochemical characters ,pathogenesis and laboratory diagnosis of any two clinically important Gram positive Cocci.
16. Explain the pathogenesis and laboratory diagnosis of Plasmodium vivax.
17. Classify antibiotics based on their method of production and explain about Tetracycline.

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18MIC502 | Reg No : ....

CREDIT BASED SEMESTER SYSTEM

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021

Microbiology Theory VI

Duration:3 Hours | **Max Marks:80**

I. Answer any FIVE of the following : (5X2= 10 Marks)

1. What is ground water?
2. Name any four bacteria present in aquatic system.
3. Write the causative agent of Cryptococcosis.
4. List any four Fungi present in air.
5. List the enzymes involved in degradation of pectin and starch.
6. Define a superbug. Name any one organism used as superbug.

II. Answer any FIVE of the following : (5X6= 30 Marks)

7. Write a note on Defined substrate test and IMViC test done for coliforms.
8. Explain the factors affecting microbes in stored water.
9. Write a note on bacterial meningitis.
10. Write a note on vertical cylinder spore trap.
11. Explain the horizons of soil.
12. Explain the passive defense mechanism in plants.

III. Answer any FOUR of the following : (4X10= 40 Marks)

13. Discuss on filtration and disinfection as steps involved in purification of drinking water.
14. Explain about oxidation pond and trickling filters.
15. Describe the methods of enumeration of microorganisms in air by impingement in liquid.
16. Explain the role of secondary metabolites in disease development in plants.
17. Define a biofertilizer. Explain the production and use of Rhizobia as a biofertilizer.

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18STA501 Reg No : ....

CREDIT BASED SEMESTER SYSTEM
FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021
STATISTICS
Paper - V: Sampling Theory

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Explain Finite Population correction factor and Sampling fraction.
2. Define a Pilot Survey.
3. Give any two examples for the application of Startified Random Sampling.
4. Distinguish between Sample survey and Census survey.
5. State the necesssity of going for Circular Systematic Sampling.
6. For a population with linear trend of the form Yi=a+ib obtain a population mean.

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Explain the characteristics of a good questionnaire.
8. Derive an expression for efficiency of SRSWOR with respect to SRSWR.
9. Under certain assumptuons show that $V(\bar{y})SRSWOR \geq V(\bar{y}ST)PROP$.
10. Obtain an expression for $V(\bar{y}st)$ under Stratified Neymans allocation Random Sampling.
11. Create a practical example for the application of PPS Technique and justify the selection of the technique.
12. Obtain an expression for variance of the unbiased estimator of population mean under Systematic Sampling in terms of S^2 and $S^2{}_{sys}$.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. What are categorical and Noncaegorical data? Explain with an example.
14. Under SRSWOR show that an estimate of Standard Error of estimated population mean.
15. Derive the formula for a small sample size in the estimation of population mean under SRSWOR.
16. Under Cluster Sampling prove that $E(s_b{}^2)=S_b{}^2$ where $S_b{}^2$ is the Mean Sum of Squares between the clusters in the population.
17. Compare Systematic and Stratified random sampling interms of intraclass correlation coefficient.

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18STA512 Reg No : ....

CHOICE BASED FIFTH SEMESTER B.Sc. DEGREE EXAMINATION FEBRUARY 2021

STATISTICS

Statistics Theory VI

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. What is the objective, of sensitivity analysis?
2. Define the following terms in LPP (i) Basic feasible solution (ii) Basic solution.
3. Mention any two advantages of group replacement policy.
4. What is the objective of AP?
5. What is VED analysis?
6. What is direct inventory?

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. Explain any six models of OR.
8. Write the dual of the given primal.

   Min $Z=2X_1+3X_2+4X_3$

   s.t

   $2X_1+3X_2+5X_3\geq 2$

   $3X_1+X_2+7X_3=3$

   $X_1+4X_2+6X_3\leq 5$

   $X_1,X_2\geq 0,X_3$ is unrestricted.
9. Prove that the number of basic variables in an m x n transport table are m+n-1.
10. Define TP. How do you resolve degeneracy in TP?
11. Obtain the EOQ model with constant rate of demand and scheduling time variable.
12. Mention the various costs involved in the inventory.

III. Answer any FOUR of the following : (4X10= 40 Marks)

13. a) Make a comparative study between Primal And Dual Simplex method. (5)

    b) What are the characteristics of duality? (5)

14. Explain Two phase method and make a comparative study of it with Big M method.

15. Define AP. Explain the general formulation of AP by justifying why is it called a special case of TP.

16. Mention the steps involved in MODI method.

17. Obtain the optimum stock level z for a stochastic inventory model with instantaneous demand and set up cost.

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18ZOO501 Reg No : ....

CREDIT BASED SEMESTER SYSTEM

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021

Zoology - V

Paper V - Cell Biology, Molecular Biology and Genetic Engineering

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : (5X2= 10 Marks)

1. What are Balbiani rings? Where wre they found?
2. Name the types of Chromosomes based on the position of the Centromeres.
3. Define pluripotent.
4. What is a tetrad stage?
5. List any two hormones synthesised by GE technology.
6. What is Base substitution mutation?

II. Answer any FIVE of the following : (5X6= 30 Marks)

7. Describe the chemical composition and structural organization of microfilaments. Add a note on their functions.
8. Write a short note on chromosome banding technique.
9. Describe role of Oncogenes in cancer.
10. List any six symptoms of cancer.
11. What are polysomes? Where are they seen?
12. Explain the steps of bidirectional DNA replication.

III. Answer any FOUR of the following : (4X10= 40 Marks)

13. Explain the structure and functions of cytoplasm and lysosómes.
14. Give an account on subdivisions of cell biology.
15. Give an account of Mitosis in animal cell with suitable illustrations. Add a note on its significance.
16. Give an account of vectors used in cloning.
17. Explain the Activation of amino acid and initiation process of protein biosynthesis.

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18ZOO502 Reg No : ....

CREDIT BASED SEMESTER SYSTEM
FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021
Zoology
Paper VI - Reproductive and Developmental Biology

Duration:3 Hours **Max Marks:80**

I. Answer any FIVE of the following : **(5X2= 10 Marks)**

1. Write a note on invitro fertilization.
2. Define spermatogenises.
3. What is yolk plug stage?
4. Define embryonic induction.
5. What are fraternal twins?
6. What is amnion? Where do you find it?

II. Answer any FIVE of the following : **(5X6= 30 Marks)**

7. What is a gene bank list the advantages?
8. Give an account of types of parthenogenesis. Enumerate the significance of parthenogenesis.
9. Explain the process of blastulation in frog, with the help of neat labeled diagram.
10. Enumerate the significance of fertilization.
11. What are extraembryonic membranes? Explain their functions with a neat labelled diagram.
12. Draw a labeled diagram and explain Epitheliochorial placenta & Endotheliochorial placenta.

III. Answer any FOUR of the following : **(4X10= 40 Marks)**

13. Explain menstrual cycle with a schematic representation.
14. Explain primary and secondary sex organs in human male and female. Add a note on secondary sexual characters.
15. Give a brief overview of the process of development add a note on historical review of embryology.
16. Describe different types of cleavage. With suitable examples. Add a note on patterns of cleavage.
17. Explain the early development of chick up to formation of blastula.

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ZOO501.2 Reg No : ....

CREDIT BASED SEMESTER SYSTEM

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, FEBRUARY 2021

Zoology - V

Paper V - Cell Biology, Molecular Biology and Genetic Engineering

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