Reg. No. : ....

Name : ....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme under CBCSS

Physics and Computer Applications

Foundation Course I

PC 1121 — MECHANICS, THERMODYNAMICS AND PROPERTIES OF MATTER

(2015–2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Define Torque.

2. Give the expression for the moment of inertia of a solid sphere about a diameter.

3. State the zeroth law of thermodynamics.

4. What is a heat engine?

5. Give one demerit of diesel engine.

6. What is a T-S diagram?

7. Define Young's modulus.

8. What is a Newmann's triangle?

9. Give the expression for excess of pressure inside a spherical drop.

10. State Stefan's law.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Mass of a flywheel is concentrated at it's rim. Why?

12. State theorem of perpendicular axes.

13. Distinguish between reversible and irreversible processes.

14. State Carnot's theorem.

15. Write Clausius' statement of second law of thermodynamics.

16. Explain how entropy is related to probability and disorder.

17. Why are 'I' section girders preferred?

18. Small drops of liquids assume spherical shape. Why?

19. Explain the principle of venturimeter.

20. State Bernoulli's theorem.

21. Define solar constant.

22. Give two properties of thermal radiation.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. Show that the moment of inertia of a circular disc of radius R and mass M about a tangent line in the plane of disc is 5/4 MR^2.

24. A wheel of mass 5 Kg, and radius of gyration 40 cm is rotating at 500 rpm Find the moment of inertia and kinetic energy of the wheel.

25. A quantity of dry air at 27°C is compressed adiabatically to half of its volume. Calculate the change in temperature. ($\gamma = 1.4$).

26. Find the efficiency of the Carnot's engine working between the steam point and the ice point.

27. Calculate the change in entropy when 10 grams of water at 100°C is converted into steam at the same temperature. (Latent heat of steam = 2.25×10^6 J/kg).

28. A weight of 10 Kg is attached to one end of a copper wire 4m long and diameter 2 mm. Find the extension produced if Y of the wire is 12.5×10^{10} Nm$^{-2.}$

29. The pressure inside a soap bubble is 1 mm of Hg greater than the atmospheric pressure. What is the diameter of the bubble? (The surface tension of soap solution is 0.043 Nm^{-1}).

30. Calculate the depth of water at which an air bubble of radius 4×10^{-4} may remain in equilibrium.(Surface tension of water = 72×10^{-3} Nm^{-1}).

31. Calculate the surface temperature of the sun from the following data. Radius of the sun = 6.96×10^5 Km, Mean distance of the sun and earth = 1.497×10^8 Km. Solar constant = 1400 Nm^{-2} s^{-1}, Stefan's constant = 5.7×10^{-8} Wm^{-2}K^{-4}.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks.

32. State parallel axis theorem. Derive an expression for the moment of inertia of a uniform bar of rectangular cross section about an axis passing through its corner and perpendicular to its length.

33. Describe the working of a Carnot's heat engine. Derive an expression for its efficiency.

34. With a neat diagram, explain the determination of surface tension of a liquid by capillary method.

35. Describe an experiment to determine the thermal conductivity of a poor conductor by Lee's disc method.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme under CBCSS

Physics and Computer Applications

Foundation Course I

PC 1121 : MECHANICS, THERMODYNAMICS AND PROPERTIES OF MATTER

(2020 Admission Onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **1** mark.

1. What is a rigid body?

2. In a body with axial symmetry, what will be the direction of the total angular momentum and angular velocity if the body is allowed to rotate about the axis of symmetry?

3. What is a system?

4. What is a quasistatic process?

5. What does the second law of thermodynamics represent?

6. Why does entropy be considered as an extensive property?

7. Which are the two types of normal stress?

8. How the energy is utilized in driving the liquid under streamline and turbulent flow?

9. What do you understand from the equation of continuity of flow?

10. Write down the dimension of thermal conductivity.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions, not exceeding a paragraph. **Each** question carries **2** marks.

11. What are the factors on which the moment of inertia of a body depends? How does the moment of inertia depend on the radius of gyration?

12. A solid circular disc and a wheel of same mass and the same external radius are given. Comment on their MI with reason.

13. Prove that $J^2 = 2EI$ where J, E and I are angular momentum, rotational kinetic energy and moment of inertia respectively.

14. Distinguish between closed and isolated system with example.

15. State and explain zeroth law of thermodynamics.

16. How does the internal energy of a system develop?

17. Mention the significances and limitations of first law of thermodynamics.

18. What is an indicator diagram? What are its uses?

19. State the Nernst's heat theorem and its importance.

20. What is bending moment? How is it related to flexural rigidity?

21. Why do girders with I cross section be preferred to rectangular cross section?

22. What is venturimeter? What is its working principle?

23. How does surface energy differ from surface tension?

24. How does excess pressure develop inside a liquid drop? On what factors does it depend?

25. Define solar constant. Explain the use of phrheliometer.

26. State rotatory equivalent laws of Newton's laws of linear motion.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. A cord is wound round the axle of a flywheel. The diameter of the axle is 2.54 cm. A mass of 500g is attached to the free end of the cord. Starting form rest, the mass is released from the axle after falling through 50 cm. After the mass is released, the flywheel is making 22 rotations in 15 s before coming to rest. Calculate the kinetic energy of the mass at the moment of release.

28. Prove that the moment of inertia of sphere of mass m and diameter d about diameter is $md^2/10$. Hence find the value of the MI about a tangent.

29. Determine the freezing point of water if a pressure of 136.2 atm produces a change of specific volume of $91 \times 10^{-6}\,m^3$ for 1kg water. The latent heat of ice = $3.36 \times 10^5\,Jkg^{-1}$

30. Prove that there is no change in entropy for reversible cycle.

31. What will be the density of lead when a pressure of 2 GPa is applied? Given the density of lead=11400 kgm^{-3} and its bulk modulus = 8 GPa.

32. Calculate the work done in twisting a steel wire of radius 1 mm and length 10 cm through an angle 30° if the rigidity modulus of steel is 80 GPa.

33. Show that Bernoulli's equation can be derived from Euler's equation.

34. In an experimental method to determine the surface tension of a liquid by capillary rise method a capillary tube of diameter 1 mm is used. Determine the rise of the liquid in the tube if the surface tension of the liquid is 70 mN m^{-1} and its relative density is 1.

35. Calculate the actual velocity of efflux of water from a tank which is filled up to 1.96m.

36. The electrical conductivity of a copper wire of length 0.5 m and diameter 0.3 mm at room temperature is 5.9 x 10^7 $\Omega^{-1}m^{-1}$. Find its thermal conductivity if the Lorentz number is $2.32 \times 10^{-8} W\Omega K^{-2}$.

37. A wooden ice box of 1.8 cm thick, lined inside with cork 4 cm thick. If the termperature of the inner surface of the cork is 0°C and that of the outer surface of wood is 10°C, what is the temperature of the interface?   The thermal conductivity of wood is 0.12 Wm^{-1} K^{-1} and that of cork is 0.037 Wm^{-1} K^{-1}

38. Two concentric spherical shells of radius 5 cm and 10cm have their intermediate space filled with charcoal powder of thermal conductivity 0.084 Wm^{-1} K^{-1}. How much energy should be supplied per second to set up a temperature difference of 60°C between the shells?

(6 $\times$ 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Discuss the motion of a body rolling down an inclined plane. Use the result to identify two cylinders on hollow and other solid but of same masses and same external radii.

40. Explain the working of an ideal heat engine. How can you increase the efficiency of it?

41. Compare the working of Otto engine and Diesel engine.

42. With detailed theory on uniform bending explain how do you determine the Young's modulus of a bar and rod shaped material.

43. Describe the experimental procedure of Quicke's method with detailed theory.

44. State and explain Stefan's law? How do you determine Stefan's constant?

(2 $\times$ 15 = 30 Marks)

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Reg. No. : ....

Name : ....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme under CBCSS

Physics and Computer applications

PC 1171 : COMPUTER FUNDAMENTALS AND ORGANISATION

(2021 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

(Very Short Answer Questions)

Answer **all** questions. Each question carries **1** mark.

1.   Mention four characteristics of a computer.

2.   What do you mean by computer ports?

3.   Mention various types of printers.

4.   Expand SRAM.

5.   What are the advantages of magnetic tape?

6.   Expand the term ASCII.

7.   Which are various CPU registers?

8.   What is the use of parallel processor?

9. What do you mean by asynchronous data transfer?

10. What is an interrupt?

SECTION – B

(Brief Answer Questions)

Answer any **eight** questions. Each question carries **2** marks.

11. Write notes on CMOS.

12. What are the various types of ribbon cables?

13. Write note on optical disk.

14. Write the use of memory stick.

15. Explain RISC architecture.

16. What is hit ratio?

17. Write note about micro programmed control unit.

18. Write notes on any four input devices.

19. What is the use of SMPS?

20. What is the difference between hard copy and soft copy?

21. Explain synchronous data transfer.

22. What is a program counter?

23. What is SRAM?

24. Explain various types of instructions.

N – 4270

25. Mention any two DMA transfer modes.

26. What is an USB?

(8 × 2 = 16 Marks)

SECTION – C

(Short Essay Type Questions)

Answer any **six** questions. Each question carries **4** marks.

27. Explain BIOS.

28. Write short note on laser printer.

29. Explain primary memory in detail.

30. Explain cache memory in detail.

31. Write short note on virtual memory.

32. Explain the concept of pipelining.

33. Explain various types of instruction set.

34. Write short note on various types of interrupts.

35. Write short note on types of ROM.

36. Write short note on DRAM.

37. What is a plotter? Explain briefly.

38. Write notes on RISC architecture.

(6 × 4 = 24 Marks)

N – 4270

SECTION – D

(Long Essay)

Answer any **two** questions. **Each** question carries **15** marks.

39. Explain various output devices.

40. Explain magnetic disk in detail.

41. Explain instruction cycle with diagram.

42. Explain DMA in detail.

43. Explain basic computer organization with neat diagram.

44. Explain the concept of parallel processing.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme under CBCSS

Mathematics

Complementary Course I for Physics and Computer Applications

MM 1131.6 : MATHEMATICS I – COMPLEX NUMBERS, DIFFERENTIATION AND THEORY OF EQUATIONS

(2013 – 2018 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – I

All the **first ten** questions are compulsory. Then carry **1 mark** each.

1.   What is an Argran diagram?

2.   State de Moivre's Theorem.

3.   Find $\lim_{x \to 5} \left(x^2 - 4x + 3\right)$.

4.   Let $y = x^2 + 1$. Find the average rate of change of y with respect to x in the interval [3, 5].

5.   Find the local linear approximation of $f(x) = \sqrt{x}$ at $x_0 = 1$

6.   Find $\lim_{(x,y) \to (0,0)} \dfrac{-xy}{x^2 + y^2}$

7. Find $\dfrac{\partial z}{\partial x}$, if $Z = x^4 \sin\left(xy^3\right)$

8. State Fundamental Theorem of Algebra.

9. If $2 + \sqrt{3}$ is a root of a quadratic equations, what is the other root?

10. Which type of polynomial equations are solved by Cardano's method?

(10 × 1 = 10 Marks)

SECTION – II

Answer **any eight** questions from among the questions 11 to 22. These questions carry **2** marks each.

11. Evaluate $\dfrac{8+3i}{9-2i}$.

12. Prove that $\dfrac{1+(\cos\theta + i\sin\theta)^n}{(1+\sin\theta + i\cos\theta)^n} = \cos n\theta + i\sin n\theta$.

13. Find the natural domain of the function $\sqrt{x^2 - 5x + 6}$.

14. Let $s(t) = t^3 - 6t^2$ be the position function of a particle moving along as s-axis, where s is in meters and t is in seconds. Find the instantaneous velocity and speed.

15. If $f(x) = \sin x$ has root at $x = 0$ and $x = 2\pi$, verify Rolle's theorem.

16. Find the n$^{\text{th}}$ Taylor polynomial for $\dfrac{1}{x}$ about $x = 1$.

17. Find the Maclaurin series for e^x.

18. Find the power series expansion of $e^{-x}\tan^{-1} x$.

19. Form a 4th degree equation one of whose roots is $\sqrt{2} + \sqrt{3i}$.

20. Find the maximum number of positive and negative roots for the equation $2x^9 - 5x^8 + x^3 + 7x - 10 = 0$.

21. Solve the equation $x^4 - 11x^3 + 44x^2 - 76x + 48 = 0$, given that it has multiple roots.

22. Find the roots of $18x^3 + 18x^2 + 121x + 60 = 0$ given that the roots are in A.P.

(8 × 2 = 16 Marks)

SECTION – III

Answer **any six** from among the questions 23 to 31. These questions carry **4** marks each.

23. Separate into real and imaginary parts $\tan^{-1}(a + ib)$.

24. Sketch the graph of $y = \sqrt{x - 3}$

25. Find $\lim_{x \to \infty} \sqrt{x^6 + 5x^3} - x^3$.

26. Find the first four terms of the Taylor polynomial for in x about $x = 2$.

27. Use the Maclaurin series to evaluate sin 3° to 5 decimal place accuracy.

28. Determine the level surfaces of $x^2 + y^2 + z^2 = k$

29. Solve the equation $x^4 - 10x^2 + 9x - 2 = 0$, given that product of two roots is unity.

30. Solve $4x^4 - 4x^3 - 25x^2 + x + 6 = 0$ given that two of the roots differ by unity.

31. If α, β and γ are the roots of the equation $x^3 + qx + r = 0$, form the equation whose roots are of the form $\sum \dfrac{\beta + \gamma}{\alpha^2}$.

(6 × 4 = 24 Marks)

Answer **any two** questions from among the questions 32 to 35. These questions carry **15** marks each.

32. (a) Express $\cos 6x$ terms of powers of $\cos x$.

    (b) If $\cos(x+iy) = \cos A + i\sin B$, prove that $2x + \cosh 2y = 2$.

33. (a) Find all absolute extrema of the function $f(x) = x^3 - 3x^2 + 4$ on the interval $(0, +\infty)$.

    (b) Verify Mean Value Theorem for the function $f(x) = x^3 + x - 3$.

34. Transform the equation whose roots exceed by 2 of the roots of the equation $4x^4 + 32x^3 + 83x^2 + 76x + 21 = 0$.

35. Solve $x^4 - 2x^3 - 5x^2 + 10x - 3 = 0$ using Ferrari's method.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme under CBCSS

Mathematics

Complementary Course I for Physics and Computer Applications

MM 1131.6 : MATHEMATICS I — CALCULUS, INFINITE SERIES AND VECTOR ALGEBRA

(2019 Admission)

Time : 3 Hours　　　　　　　　　　　　　　　　　　　　　Max. Marks : 80

SECTION – I

(All the first **ten** questions are compulsory. They carry **1** mark each)

1. Find $\dfrac{dy}{dx}$ if $y = \sqrt{1 + x^2}$.

2. Define Point of inflexion.

3. Evaluate $\int (4 + x^2)^{-1} dx$.

4. Find the mean value of the function $f(x) = x^2$ between the limits $x = 2$ and $x = 4$.

5. Evaluate $\displaystyle\sum_{m=0}^{N} \exp\left(\dfrac{2\pi i m}{N}\right)$, $N > 1$,

6. Sum the series $2 + \dfrac{5}{2} + \dfrac{8}{2^2} + \dfrac{11}{2^3} + \ldots$

7. State the D'Alembert's ratio test for testing the convergence of an infinite series.

8. Define orthogonal vectors.

9. Write the direction of the line of intersection of two planes $x + 3y - z = 5$ and $2x - 2y + 4z = 3$.

10. Two particles have velocities $\bar{v}_1 = i + 3j + 6k$ and $\bar{v}_2 = i - 2k$, respectively. Find the velocity of the second particle relative to the first.

(10 × 1 = 10 Marks)

SECTION – II

(Answer **any eight** questions. These questions carry **2** marks each)

11. Find the derivative of $y = x^{\sin x}$.

12. Verify Rolle's theorem for $f(x) = x^2$ in [–1, 1].

13. Find b so that $f'(b) = \dfrac{f(c) - f(a)}{c - a}$ where $f(x) = x^2 - 3x - 1$ and $c = \dfrac{13}{7}$, $b = \dfrac{-11}{7}$.

14. Evaluate from first principles the integral $\displaystyle\int_0^b x^2 dx$.

15. Evaluate $\displaystyle\int \frac{1}{x^2 + x} dx$.

16. Determine whether $\displaystyle\int_{-\infty}^{\infty} \frac{x}{(x^2 + a^2)^2} dx$ exist and where it does, evaluate it.

17. Determine whether the series $\displaystyle\sum_{n=1}^{\infty} \frac{2\sin n\theta}{n(n+1)}$ converge where θ is a positive real numbers.

18. Evaluate the sum $\displaystyle\sum_{n=1}^{N} \frac{1}{n(n+1)(n+2)}$.

19. Write the Maclaurin series of $(1 + x)^n$, $-\infty < x < \infty$.

20. Find the angle between the vectors $\bar{a} = i + zj + 3k$ and $\bar{b} = 2i + 3j + 4k$.

21. Show that if $\bar{a} = \bar{b} + \lambda\bar{c}$, for some scalar λ then $\bar{a} \times \bar{c} = \bar{b} \times \bar{c}$.

22. Find the volume of the parallelepiped with sides $\bar{u} = i + 2j - k$, $\bar{v} = -2j + 3k$ and $\bar{w} = 7j - 4k$.

(8 × 2 = 16 Marks)

SECTION – III

(Answer **any six** questions . These questions carry **4** marks each)

23. If $2y + \sin y + 5 = x^4 + 4x^3 + 2\pi$, find $\dfrac{dy}{dx}$ when $x = 1$.

24. Find the positions and natures of the stationary points of the function $f(x) = 2x^3 - 3x^2 - 36x + 2$.

25. Find the radius of curvature of $x^3 + y^3 = 3axy$ at $\left(\dfrac{3a}{4}, \dfrac{3a}{4}\right)$

26. Show that the value of the integral $I = \displaystyle\int_0^1 \dfrac{1}{(1 + x^2 + x^3)^{\frac{1}{2}}}\, dx$ lies between 0.810 and 0.882.

27. Find the total length of the astroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.

28. Obtain the positive values of x for which the series $\displaystyle\sum_{n=1}^{\infty} \dfrac{x^{\frac{n}{2}} e^{-n}}{n}$ converges.

29. Sum the series $S(x) = \dfrac{x^4}{3(0!)} + \dfrac{x^5}{4(1!)} + \dfrac{x^6}{5(2!)} + \ldots$

30. Suppose that the four non-coplanar points A, B, C, D are positioned such that the line AD is perpendicular to BC and BD is perpendicular to AC. Show that CD is perpendicular to AB.

31. Find the distances from the point $P(1, 2, 3)$ to the plane that contains the points $A(0, 1, 0)$, $B(2, 3, 1)$ and $C(5, 7, 2)$.

(6 × 4 = 24 Marks)

SECTION – IV

(Answer **any two** questions. Each question carry **15** marks each.

32. (a) Find the third derivative of $f(x) = xe^x$.

    (b) Find from first principles the derivative with respect to x of $f(x) = x^3$.

    (c) If $y = \exp(x^3)$, show that $\dfrac{dy}{dx} = 3x^2 y$ and hence by applying Leibnitz theorem, prove that for $n \geq 1$, $y^{(n+1)} = 3\left[x^2 y^{(n)} + 2nxy^{(n-1)} + n(n-1)y^{(n-2)}\right]$.

33. (a) Find the surface area of a cone formed by rotating about the x-axis, the line $y = 2x$ between $x = 0$ and $x = h$.

    (b) The region between the curve $y = \sqrt{x}$, $0 \leq x \leq 4$ and the x-axis is revolved about the x axis to generate a solid. Find its volume.

    (c) Evaluate $\displaystyle\int_{-\infty}^{\infty} \dfrac{1}{x^2 + 6x + 18}\,dx$.

34. (a) Determine whether the series $\displaystyle\sum_{n=1}^{\infty} \dfrac{n^2}{n!}$ is convergent.

    (b) Find the Maclaurin series of $\sin^2 x$.

    (c) Expand $f(x) = \cos x$ as a Taylor series about $x = \dfrac{\pi}{3}$.

35. (a) Prove that $(\bar{a} \times \bar{b}) \times \bar{c} = (\bar{a} \cdot \bar{c})\bar{b} - (\bar{b} \cdot \bar{c})\bar{a}$.

    (b) Define a set of base vectors $\bar{a} = j + k$, $\bar{b} = i + k$, $\bar{c} = i + j$. Establish their reciprocal vectors and express the vectors $\bar{p} = 3i - 2j + k$, $\bar{q} = i + 4j$ and $\bar{r} = -2i + j + k$ in terms of $\bar{a}$, $\bar{b}$ and $\bar{c}$.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme Under CBCSS

Mathematics

Complementary Course I for Physics and Computer Applications

MM 1131.6 — MATHEMATICS — I : CALCULUS, INFINITE SERIES AND VECTOR ALGEBRA

(2020 Admission onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – I

Answer **all** the questions.

1.   Find the derivative of $y = x \sin x$.

2.   Find $\dfrac{dy}{dx}$, if $y = a^x$.

3.   Find the derivative with respect of x of $f(x) = \left(2 - 3x^2\right)^3$.

4.   Write the formula of integration of parts.

5.   Evaluate the integral $I = \int x e^x dx$.

6. Using the concept of Arithmetic series, find the sum of natural numbers from 1 to 500.

7. Discuss the convergence of series $\sum_{n=1}^{\infty}\frac{1}{n}$.

8. Find the magnitude of the vector $V = 2i + 4j - 4k$.

9. If $A = 2i + 3j + k$ and $B = -i + 2j + 3k$, then find scalar product $A \cdot B$.

10. Find $A \times B$ if $A = i - 2j + 3k$ and $B = 4i - 8j + 12k$.

(10 × 1 = 10 Marks)

SECTION – II

Answer any **eight** questions.

11. Using First Principle, find the derivative of $f(x) = 5x$.

12. Find derivative with respect x of $y = \sin(e^{2x})$.

13. Find the derivative with respect to x of $f(t) = t^2$, where $x = at$.

14. Find $\frac{dy}{dx}$ if $3xy + y^3 - 6x^2y = 3x$.

15. Write the statement of mean value theorem.

16. Evaluate the integral $I = \int xe^{\frac{x^2}{2}}dx$.

17. Find the mean value the function $y = x^2$ between $x = 1$ and $x = 2$.

18. Find the length of the line segment $y = 3x$ from $x = 1$ and $x = 2$.

N – 4273

19. Using difference method, find the sum $\sum_{n=1}^{100} \dfrac{1}{n(n+1)}$.

20. Write down the Taylor's series expansion if a function $f(x)$ about $x = 0$.

21. Write an example for a power series.

22. Write an example for alternating series.

23. If $A = 2i - 3j - 5k$ and $B = i - 2j - k$ then show that $A + B = B + A$.

24. Two particles have velocity $V_1 = 6j + k$ and $V_2 = -i + k$ respectively. Find the velocity U of the second particle relative to the first.

25. Find the equation of a line passing through the point $A(1, 1, 1)$ in the direction of the vector $D = 2i + 3j - k$.

26. Find scalar triple product of $A = i + 2j + 3k$, $B = 4i + 5j + 6k$ and $C = 7i + 8j + 10k$.

(8 × 2 = 16 Marks)

SECTION – III

Answer any **six** questions.

27. Write Leibnitz formula to calculate n^{th} derivative $f^n(x)$ of $f(x) = u(x)v(x)$, hence find the 3rd derivative of $f(x) = \dfrac{x^3}{\csc x}$.

28. Show that $y = x + \tan x$ satisfy the differential equation $\cos^2 x \dfrac{dy}{dx} - 2y + 2x = 0$.

29. Show that the function $f(x) = \dfrac{1}{4}x^3 + 1$ satisfy the hypothesis of the mean value theorem over the interval [0, 2], and find all values of c in the interval (0, 2) at which of the tangent line to the graph of f is parallel to the secant line joining the points (0, $f(0)$) and (2, $f(2)$).

30. (a) Define improper integral.

    (b) Evaluate the integral $I = \int_0^2 (2 - x)^{-1/4} dx$.

31. Find the area of the surface generated by revolving $x = \dfrac{y^3}{3}$; $0 \le y \le 1$ about y-axis.

32. Determine the length of the curve $y = \log(\sec x)$ between $0 \le x \le \dfrac{\pi}{4}$.

33. Find the value of $\int \tan^6 x dx$.

34. Find the sum of the series $\sum_{n=1}^{N}(n+1)(n+3)$.

35. Determine whether the series converge, if it converge find sum

    (a) $\sum_{k=0}^{\infty} \dfrac{5}{4^k}$

    (b) $\sum_{k=1}^{\infty} 3^{2k} 5^{1-k}$.

36. Show that $A(3, 2, 2)$, $B(6, 2, 2)$ and $C(3, 4, 2)$ are vertices of a right angle triangle.

37. Construct the reciprocal vectors of $a = 2i$, $b = j + k$, $c = i + k$.

38. Find the angle between the planes $2x + y + 2z = -1$ and $x + y - z = 2$.

(6 × 4 = 24 Marks)

SECTION – IV

Answer any **two** questions.

39. (a) If $x\sqrt{1+y} + y\sqrt{1+x} = 0$ prove that $\dfrac{d^2y}{dx^2} - \dfrac{2}{(1+x)^3} = 0$.

(b) If $y = \sin(\log x)$, prove that $x^2 y_2 + xy_1 + y = 0$.

(c) If $y = \left(\tan^{-1} x\right)^2$ then prove that $(x^2 + 1)\dfrac{d^2y}{dx^2} + 2x(x^2 + 1)\dfrac{dy}{dx} - 2 = 0$.

40. (a) Find the parametric equation describing the line segment joining the points (1, 2, 1) and (2, 5, 7).

(b) Find equation of line in 3-space passing through the points (2, –2, 2) and (–1, –4, 1).

(c) Find equation of plane passing through (1, 1, 0), (1, 2, 1) and (–2, 2, –1).

41. (a) Show that the value of the integral $I = \int_0^1 \dfrac{1}{\left(1 + x^2 + x^3\right)^{\frac{1}{2}}} dx$ lies between 0.810 and 0.882.

(b) The equation in polar coordinates of an ellipse with semi-axes a and b is $\dfrac{1}{p^2} = \dfrac{\cos^2 \varphi}{a^2} + \dfrac{\sin^2 \varphi}{b^2}$. Find the area A of the ellipse.

42. (a) Define radius of curvature and write the formula to calculate the radius of curvature of a function $f(x)$ at a point (x, y).

(b) Show that the radius of curvature at the point (x, y) on the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ has magnitude $\dfrac{\left(a^4 y^2 + b^4 x^2\right)^{\frac{3}{2}}}{a^4 b^4}$.

(c) Show that at any point (x, y) on circle of radius a, radius of curvature is a.

N – 4273

43. (a) Use the comparison test to determine whether the following series converge or diverge (i) $\sum_{k=1}^{\infty} \dfrac{1}{\sqrt{k} - \dfrac{1}{2}}$ (ii) $\sum_{k=1}^{\infty} \dfrac{1}{2k^2 + k}$.

(b) Using Ratio test, verify the convergence or divergence of the series $\sum_{k=1}^{\infty} \dfrac{k^k}{k!}$.

44. (a) Find the minimum distance from the point P with coordinates (1, 2, 1) to the line $r = a + \lambda b$, where $a = i + j + k$ and $b = 2i - j + 3k$.

(b) Find the distance from the point P with coordinates (1, 2, 3) to the plane that contains the points A, B and C having coordinates (0, 1, 0), (2, 3, 1) and (5, 7, 2).

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme Under CBCSS

Mathematics

Complementary Course II for Physics and Computer Applications

MM 1231.6 : ANALYTIC GEOMETRY, INTEGRATION, DIFFERENTIAL EQUATIONS AND MATRICES

(2014 – 2018 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – I

All the **first ten** questions are compulsory. They carry **1** mark each.

1. Write down the equations for a rotation of axes through an angle $\dfrac{\pi}{4}$.

2. Show that the equation $17x^2 - 12xy + 8y^2 + 46x - 28y + 17 = 0$ represents an ellipse.

3. A particle moves with a velocity of $v(t) = \sin t$ along an s-axis. Find the distance traveled by a particle during the time interval $0 \le t \le \pi/2$.

4. Suppose that the velocity function of a particle moving along a coordinate line is $v(t) = 3t^3 + 2$. Find the average velocity of the particle over the time interval $1 \le t \le 4$.

5. Evaluate $\displaystyle\int_{0}^{\pi} \int_{0}^{1+\cos\theta} r \, dr \, d\theta$.

6. Find the general solution of the differential equation $\dfrac{dy}{dx} + 2y = 6e^x$.

7. Solve $\left(D^2 - D - 2\right)y = 0$ where D is the differential operator.

8. Find the particular integral of $(D-1)^3 y = 12e^x$.

9. State the condition for the existence of solution of a system of linear equations.

10. State Cramer's rule.

(10 × 1 = 10 Marks)

SECTION – II

Answer any **eight** questions from among the questions **11** to **22**. These questions carry **2** mark each.

11. Find the equation of the hyperbola with foci $(5, 2), (-3, 2)$ and eccentricity 2.

12. Find the equation of the normal to the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ at the point (x_1, y_1) on it.

13. Find the area of the region enclosed by the curves $x^2 = y$ and $x = y - 2$.

14. Find the volume of the solid generated when the region between the graphs of the equations $f(x) = \dfrac{1}{2} + x^2$ and $g(x) = x$ over the interval $[0, 2]$ is resolved about the x–axis.

15. Evaluate $\iint_R xy^2 dA$ where R is the region enclosed by $y = 1$, $y = 2$, $x = 0$ and $y = x$.

16. Use double integral in polar coordinates to find the area of the region enclosed by the cardioid $r = 1 - \cos\theta$.

17. Solve $\left(x^2 - y^2\right)dx - xy\,dy = 0$.

18. Solve $\dfrac{dy}{dx} + \dfrac{y\cos x + \sin y + y}{\sin x + x\cos y + x} = 0$.

19. Solve $y'' + 16y = \cos 4x$.

2

M – 2605

20. Find the rank of the matrix $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 1 & 2 \\ -1 & 2 & 2 \end{bmatrix}$ by using elementary row operations.

21. Let A be any one singular matrix. Prove that if λ is an eigen value of the matrix A, then $\dfrac{1}{\lambda}$ is an eigen value of A^{-1}.

22. Find the characteristic equation of the matrix $\begin{bmatrix} 5 & -2 & 6 & -1 \\ 0 & 3 & -8 & 0 \\ 0 & 0 & 5 & 4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$.

(8 × 2 = 16 Marks)

SECTION – III

Answer any **six** questions from among the questions **23** to **31**. These questions carry **4** marks each.

23. Show that the equation $8x^2 - 4xy - 16x - 14y + 17 = 0$ is an ellipse whose major axis and minor axie lie along the lines $y - 2x + 1 = 0$ and $2x + 4y - 11 = 0$ and whose eccentricity is $\dfrac{\sqrt{5}}{8}$.

24. Obtain the equation of a rectangular hyperbola referred to its asymptotes as axes of coordinates.

25. Find the exact arc length of the curve $x = a\cos^3 \phi$ and $y = a\sin^3 \phi$.

26. Change into polar coordinates and evaluate $\displaystyle\int_0^a \int_y^a \dfrac{x\, dx\, dy}{x^2 + y^2}$.

27. Solve $(x + 2y^3)\dfrac{dy}{dx} = y$.

28. Find the orthogonal trajectories of the curve $y = cx^2$.

29. Solve $y'' - 3y' + 2y = x^2 e^{2x}$.

30. For what values of a and b, the system of equations

$x+y+2z=2$

$2x-y+3z=10$

$5x-y+az=b$

has finite number of solutions.

31. Find all the eigen values of the matrix $\begin{bmatrix} 3 & 1 & 1 \\ 2 & 4 & 2 \\ 1 & 1 & 3 \end{bmatrix}$.

(6 × 4 = 24 Marks)

SECTION – IV

Answer any **two** questions from among the questions **32** to **35**. These questions carry **15** marks each.

32. (a) Find the equation of the hyperbola passing through the point $(1,-1)$ and having the lines $x+2y+3=0$ and $3x+4y+5=0$ for asymptotes.

   (b) Determine the equation of the curve $4x^2-11xy+6y^2=0$ when the axes are rotated through the acute angle whose tangent is $\dfrac{4}{3}$.

33. (a) Find the area of the surface that is generated by revolving the portion of the curve $y=7x$ between $x=0$ and $x=1$ about the x–axis.

   (b) Find the area of the plane region enclosed by the curve $y^2=9-x$ and $y^2=9-9x$.

34. (a) A moving body is opposed by a force per unit mass of value cx and resistance per unit mass of value bv^2, when x and v are the displacement and velocity of the particle at that instant. Show that the velocity of the particle, if it starts from rest, is given by $v^2=\dfrac{c}{2b^2}\left(1-c^{-2bx}\right)-\dfrac{cx}{b}$.

   (b) Solve $x^2y''-xy'+y=\log x$.

35. Diagonalize the matrix $A=\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$.

(2 × 15 = 30 Marks)

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M – 2605

Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2(a) – Physics and Computer Applications

Foundation Course

PC 1221: INTRODUCTION TO PROGRAMMING

(2014 - 2017 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION A (Very Short answer type)

One word to a maximum of **one** sentences, Answer **all** questions.

1. What is the role of curly braces in a c program?

2. The preprocessor begins with a symbol _____.

3. What is a keyword?

4. List the name of type modifiers?

5. What are the differences between signed and unsigned datatype?

6. What are unary operators?

7. What is the difference between "=" and "=="?

8. The result of the expression (10/3)*3+5%3 is _____.

9. The result of 5&&2 is _____.

10. What will happen if you assign values in few locations of an array?

(10 × 1 = 10 Marks)

SECTION B (Short answer)

Answer any **eight** questions. **Each** question carries **2** marks.

11. Mention the differences between character array and integer array?

12. What is a sequential execution?

13. Is it possible to use multiple default statement in switch statement?

14. What are the drawback of linear array?

15. What is the difference between strcpy() and strncpy() functions?

16. Distinguish between logical and bitwise operators?

17. How one pointer points to another pointer?

18. The value of c after the execution of program will be

```c
void main()
{
        int a,b,c;
        a=9;
        b=10;
        c=(b<a||b>a);
        clrscr();
        printf("\n c=%d",c);
}
```

19. Explain the use of(*) indirection operator?

20. Can we declare a variable in different scopes with different datatypes?

21. What is meant by compilation?

22. What is the use of keyword struct? Explain the use of dot operator?

(8 × 2 = 16 Marks)

M – 2606

SECTION – C (Short answer)

Answer any **six** questions. **Each** question carries **4** marks.

23. Explain different type of assignment operators?

24. What is an array of pointers?

25. What are strings? How are they declared?

26. Differentiate between library and user defined functions?

27. Explain the types of recursion?

28. Distinguish between function prototype and function definition?

29. What are the relational operators?

30. Differentiate between break and continue statements?

31. Distinguish between text mode and binary mode operation of a file.

(6 × 4 = 24 Marks)

SECTION – D (Long essay)

Answer any **two** questions. **Each** question carries **15** marks.

32. Briefly explain string handling functions in C?

33. Explain the loop control structures in C with example?

34. Briefly explain the four storage classes?

35. Write a program to find product of two 3 x 3 matrices.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

Core Course

PC 1241 : ENVIRONMENTAL STUDIES

(2015-2019 Admission)

Time : 3 Hours   Max. Marks : 80

PART – A

I.   Answer **all** questions. Each question carries **1** mark.

1.   According to Engine Odum define ecology.

2.   Define Ecomark.

3.   Write the full form of UNFCCC.

4.   Differentiate renewable resources and non-renewable resources with example.

5.   What is Ex-situ conservation?

6.   What are the focal theme of world wetland Day-2019?

7.   What is Endemism?

8. Difference between greywater and blackwater.

9. What is Global warming potential?

10. The Act constituted in India after Bhopal gas tragedy. Explain.

(10 × 1 = 10 Marks)

PART – B

II. Answer **any eight** questions. Each question carries **2** marks.

11. Explain Fluorosis.

12. What is hot spots of biodiversity? Name two biodiversity hotspots is India.

13. Write a note on Ecological succession.

14. Explain photochemical smog.

15. Detail about rainwater harvesting.

16. State and explain Anthropocentrism.

17. What are the effects of noise pollution?

18. What is greenhouse effect?

19. Describe any two institutions in India that deal with environmental protection and conservation.

20. Write a note on eutrophication.

21. 'Activated sludge process' Explain.

22. What is chipko movement?

(8 × 2 = 16 Marks)

PART – C

III. Answer **any six** questions. Each question carries **4** marks.

23. Explain in detail food chain.

24. Explain biogeographical classification in India.

25. Write a short note on wild life protection Act.

26. Describe Nitrogen cycle.

27. What are the different types of disaster management cycle?

28. How population explosion will affect the environment?

29. Briefly explain the functions of wetlands.

30. What are the effects of acid rain?

31. Write a short note on consumerism.

(6 × 4 = 24 Marks)

PART – D

IV. Answer **any two** questions. Each question carries **15** marks.

32. What are the major threats of biodiversity?

33. Write an essay about the impacts of climate and weather a human life and health issues.

34. Critically examine the interconnection between development and its sustainability.

35. Discuss the importance of environment Impact Assessment (EIA).

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2 (a) - Physics and Computer Applications

Foundation Course

PC 1221 : INTRODUCTION TO PROGRAMMING

(2018 and 2019 Admission)

Time : 3 Hours　　　　　　　　　　　　　　　　　　Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences.

1.　Explain flowchart.

2.　What is object code?

3.　Mention the range of the data type 'char'.

4.　What is the significance of logical OR operator?

5.　What is the role of == operator?

6.　Discuss the use of printf() function.

7.　Discuss call-by-reference.

8.　Define pointers.

9. What are strings?

10. Define a file.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions not exceeding a paragraph of **50** words.

11. Write a short note on storage classes in C language.

12. Compare long and short modifiers in C language.

13. What do you mean by an executable file?

14. List the operators from higher priority to lower priority.

15. Discuss formatted I/O functions.

16. How to declare and initialize a one dimensional array?

17. Write a short note on if statement in C language.

18. What are the significances of using functions in a programming language?

19. Explain function prototype.

20. What is pointer to array?

21. How to initialize a structure?

22. What is the use of dot(.) operator in C?

(8 × 2 = 16 Marks)

M – 2609

SECTION – C

Answer any **six** questions, in a page of **100** words.

23. Generate an algorithm to find first N prime numbers.

24. Write a short note on static variables in C.

25. List the rules for naming variables.

26. Explain different types of assignment operators.

27. Write a note on switch-case statement.

28. Write a C program to find the factorial of a number using recursion.

29. Write a C program which contains a function calc_cube(), takes an integer argument and calculate its cube return the result to the main() function.

30. How to define a union? Give example.

31. How does file append mode differ from file write mode?

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions, not exceeding **four** pages.

32. Mention different basic data types in C. Also write about space requirement for variables of different data types.

33. Explain two dimensional array in detail. Also write a C program to perform matrix multiplication using 2-D array.

34. Explain the concept of dynamic memory allocation in C programming.

35. Write a C program to find total mark of N students using structure.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Seconds Semester B.Sc. Degree Examination, December 2021.

Career Related First Degree Programme under CBCSS

Mathematics

Group 2(a) Complementary Course II for physics and Computer Applications

MM 1231.6 – MATHEMATICS – II PARTIAL DIFFERENTIATION, VECTOR DIFFERENTIATION COMPLEX NUMBERS AND MULTIPLE INTEGRALS

(2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – I

All the first 10 questions are compulsory. they carry **1** mark each.

1. Find $\dfrac{\partial f}{\partial x}$ of the functions $f(x, y) = \sin(x / y)$.

2. Determine whether $y^2 dx + 2xy\, dy$ is exact or not.

3. Define Laplacian of a scalar field.

4. Find the gradient of the scalar field $\phi = xy^2 z^3$.

5. Find the divergence of the vector field.

    $\overline{a} = xy\hat{i} - y^2 z\hat{j} + x^2 z\hat{k}$.

6. Find $\cosh(ix)$

7. Write the imaginary part of e^z.

8. State de moivres theorem.

9. Evaluate $\int\limits_{-2y-2}^{1-y^2} \int dx\, dy$.

10. Change the cartesian integral.

$\int\limits_{-1}^{1} \int\limits_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} dy\, dx$ into polar integrals.

(10 × 1 = 10 Marks)

SECTION – II

Answer **any eight** questions each questions carry **2** marks.

11. Find the total differential of the function $f(x, y) = \sin x + 3y^2$.

12. Using chain rule find $\dfrac{df}{dt}$ gives $f(x, y) = x^2 y$, $x(t) = \cos t$, $y(t) = \sin t$.

13. State Taylors theorem for two variables x and y.

14. Determine the stationery points of the function $f(x, y) = y^2 - x^2$ and describe the nature of the function of those points.

15. Find the velocity and acceleration at time $t = \dfrac{\pi}{2}$ of a particle which moves along a curve whose position vector at time t is

$r(t) = a\cos t\hat{i} + b\sin t\hat{j} + ct\hat{k}$.

16. Find the curl of the vector field.

$\bar{a} = (y^2 \cos x + z^3)\hat{i} + (2y \sin x - 4)\hat{j} + (3xz^2 + 2)\hat{k}$

17. Prove $div(grad\phi) = \nabla^2\phi$.

18. Find the solution of the equation $z^3 = 1$

19. Find a expression for $\cos^3 \theta$ in terms of $\cos 3\theta$ and $\cos \theta$.

20. Evaluate $Ln(i)$.

M – 2610

21. Find the Jacobian $\dfrac{\partial(x,y)}{\partial(u,v)}$ of the transformation $x = u\cos V$, $y = u\sin V$

22. Evaluate $\displaystyle\int_0^1\int_0^\pi\int_0^\pi y\sin z\,dx\,dy\,dz$.

(8 × 2 = 16 Marks)

SECTION – III

Answer **any six** questions. Each question carry **4** marks.

23. Find the total derivative of the function $f(x,y,z) = xyz$, $y = \sin^{-1}x$, $z = x^2$.

24. Find the Taylor expansion, up to quadratic terms in x and y of $f(x,y) = e^x\cos y$ about the point $(0,0)$.

25. Find the greatest and smallest value the function $f(x,y) = xy$ takes on the ellipse $\dfrac{x^2}{8} + \dfrac{y^2}{2} = 1$.

26. Find the directional derivative of $\phi = xy^2z - x^2yz^3$ at the point $(-1,2,1)$ in the direction $3\hat{i} + \hat{j} - 4\hat{k}$.

27. For $\bar{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and $|\bar{r}| = r$ show that $\nabla\left(\dfrac{1}{r}\right) = \dfrac{-\bar{r}}{r^3}$.

28. Find all the nth roots of unity.

29. Find the closed form expression for the inverse hyperbolic function $y = \tanh^{-1}x$.

30. Evaluate $I = \displaystyle\iint_R y^2\,dx\,dy$ where R is the region bounded by $y = 2x$, $y = 5x$ and $x = 2$.

31. Evaluate the double integral $I = \displaystyle\int_0^4\int_{x/2}^2 dy\,dx$. Also reverse the order of integration and show that same result is obtained.

(6 × 4 = 24 Marks)

3

M – 2610

SECTION – IV

Answer **any two** questions, Each questions carry **15** marks

32. (a) Find the maxima, minima and saddle point of the function $2x^3 + 2y^3 - 9x^2 + 3y^2 - 12y$.

   (b) Find the stationary points pf $f(x, y, z) = xyz$ subject to constraints $g(x, y, z) = x + y + z = 40$ and $h(x, y, z) = x + y - z = 0$.

33. Evaluate the laplacian of the function $\psi(x, y, z) = \dfrac{zx^2}{x^2 + y^2 + z^2}$.

   (a) directly by cartesian coordinates and

   (b) after changing to spherical polar coordinate system.

   Verify that the two methods gives the same result.

34. (a) Find the volume of the tetrahedron bounded by the three coordinate surfaces $x = 0$, $y = 0$ and $z = 0$ and the plane $\dfrac{x}{a} + \dfrac{y}{b} + \dfrac{z}{c} = 1$

   (b) Evaluate the double integral

   $I = \iint_R (a + \sqrt{x^2 + y^2})\,dx\,dy$ where R is the region bounded by the circle $x^2 + y^2 = a^2$

35. (a) Draw the graph of $\sinh x$, $\cos echx$.

   (b) Use de moivres theorem to prove that

   $\cos 4\theta = 8\cos^4 \theta - 8\cos^2 \theta + 1$

   (c) Solve the equation $z^3 - 2 = 0$

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2 (a) - Physics and Computer Applications

Foundation Course

PC 1221 : INTRODUCTION TO PROGRAMMING

(2020 Admission Regular)

Time : 3 Hours   Max. Marks : 80

SECTION – A (Very Short Answer)

(One Word to Maximum of **two** Sentences. Answer **all** questions)

1.   How many keywords are there in C?

2.   What is a token?

3.   Calloc() belongs to which library?

4.   getch () function is used for?

5.   Who developed C language?

6.   Which loop is guaranteed to execute at least one time.

7.   Define string.

8.   Which symbol is used as a statement terminator in C?

9. What does a rectangle box represent in a flowchart?

10. What is a built-in function in C?

(10 × 1 = 10 Marks)

SECTION – B (Short Answer Type)

(Not to Exceed **One** Paragraph. Answer any **eight q**uestions.
Each question carries **2** marks)

11. What is an infinite loop?

12. Define array.

13. Explain while statement.

14. What are executable files?

15. Explain strlen() function.

16. What is the use of & operator?

17. Define object code.

18. Explain malloc() function.

19. What are the two types of comments in C?

20. Explain the use of putchar() function.

21. What are Relational expressions?

22. What are Arithmetic operators in C?

23. What does open () do in C?

24. Explain break statement.

25. Define binary file.

26. What are local and global variables?

(8 × 2 = 16 Marks)

M – 2611

SECTION – C (Short Essay Type)

(Not to exceed **120** words. Answer any **six** questions. Each question carries **4** marks)

27. Write a program to store given data into a file.

28. Explain conditional operator with an example.

29. Explain formatted output functions.

30. Differentiate between strcat() and strcpy() functions.

31. Define structure. Explain with an example.

32. What do you mean by pointer arithmetic?

33. Draw a flowchart to print whether the given number is odd or even.

34. Explain switch statement with an example.

35. What are the rules for naming a variable?

36. Write an algorithm to find largest number among three numbers.

37. What is pointer and how will you declare it?

38. Define the term algorithm. Explain classification of algorithm with suitable example.

(6 × 4 = 24 Marks)

SECTION – D (Long Essay Type)

(Answer any **two** questions. **Each** question carries **15** marks.)

39. Write detailed note on file handling functions.

40. Explain if statement with suitable example.

41. Explain storage classes in C.

42. Differentiate call by value and call by reference with suitable example.

43. Explain function with suitable example.

44. Write a program to read n values to an array and print it.

(2 × 15 = 30 Marks)

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M – 2612

Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme Under CBCSS

Physics with Computer Applications

Core Course

PC 1241 : ENVIRONMENTAL STUDIES

(2020 Admission – Regular)

Time : 3 Hours   Max. Marks : 80

SECTION – A (Very short answer type)

Answer **all** questions (**one** word or **one** sentence) Marks – **1** each.

1.   What is mutualism?

2.   Name any endemic species in western ghats of south India.

3.   What is water table?

4.   The average rainfall of Kerala is ——————.

5.   Which is the largest ecosystem in the world?

6.   Name any two minerals found in Kerala beaches.

7.   Define effluent.

8.   Define biome.

9. Expand UNEP.

10. What is population explosion?

SECTION – B (Short Answer Type)

Answer any **eight** questions, **2** marks each.

11. What is the importance of ecological succession?

12. What are predators?

13. What is exsitu and insitu conservation?

14. What is the structure of the ecosystem?

15. What do we mean by ambient air?

16. What is an energy pyramid and why is it important?

17. Define Geothermal energy.

18. What is Food chain?

19. Write a note on Vermicomposting.

20. Explain Noise pollution.

21. What is open dumping?

22. Explain "Anthropogenic emissions".

23. What are Greenhouse gases?

24. Detail about Environmental impact assessment.

25. Explain Cyclone.

26. What is particulate matter?

(8 × 2 = 16 Marks)

M – 2612

SECTION – C (Short essay type)

Answer any **six** questions not exceeding **120** words, **4** Marks each.

27. What is water pollution?

28. Explain Biodiversity hotspots in India. Why they are critical?

29. What are the effects of photochemical smog?

30. What are the advantages and disadvantages of nuclear energy?

31. Explain the causes of marine pollution.

32. What are the effects of ozone layer depletion?

33. Explain the economic and scientific role of biodiversity.

34. What is the advantages incineration?

35. What is ground level ozone?

36. Write short note on hazardous waste.

37. What are the benefits of composting?

38. What is thermal pollution? Explain its effects on aquatic life.

(6 × 4 = 24 Marks)

SECTION – D (Long Essay type)

Answer any **two** questions, **15** Marks each.

39. Write an essay on waste land reclamation.

40. Explain the advantages and problems of dams.

41. What are the direct and indirect benefits of forests?

42. Explain ecological pyramid its types and importance.

43. Describe Environment (Protection) Act. 1986.

44. Write an essay on global warming.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme Under CBCSS

Mathematics

Complementary Course II for Physics and Computer Applications

MM 1231.6 : MATHEMATICS – II PARTIAL DIFFERENTIATION, VECTOR DIFFERENTIATION, COMPLEX NUMBERS AND MULTIPLE INTEGRALS

(2020 Admission Regular)

Time : 3 Hours   Max. Marks : 80

SECTION – I

All the **first ten** questions are compulsory. They carry **1** mark each.

1. Find f_{xx} for the function $f(x, y) = 4x^3 y - x^2 y$.

2. Show that $2xy - 9x^2 + \left(2y + x^2 + 1\right)\dfrac{dy}{dx} = 0$ is exact.

3. Define divergence of a vector field.

4. Define del operator in Cartesian coordinates.

5. Write the value of $e^{3\pi i}$.

6. Find $\dfrac{dy}{dx}$ of $3\cosh\left(2x^4\right)$.

7. Find $\dfrac{z_1}{z_2}$ where $z_1 = e^{3i}$ and $z_2 = e^{2i}$.

8. Evaluate $\displaystyle\int_{-3}^{2}\int_{0}^{1} y^2 x\, dy dx$.

9. Reverse the order of integration in $\displaystyle\int_{0}^{1}\int_{0}^{1-x} f(x,y)dydx.$

10. Set up a double integral of $f(x, y)$ over the region given by $0 < y < 1, 0 < x < y^2$.

(10 × 1 = 10 Marks)

SECTION – II

Answer **any eight** questions from among the questions 11 to 26. These questions carry **2** marks each.

11. Find the total differential of the function $f(x, y) = \cos xy$.

12. Find $\dfrac{df}{dx}$ for the function $f(x,y) = x^2 + xy$, given that $y = \sin^{-1} x$.

13. Define Saddle point.

14. Find $\dfrac{\partial z}{\partial x} + \dfrac{\partial z}{\partial y}$ for $\left(x^2 + y^2 + z^2\right)^{5/2} = 1.$

15. Find the Laplacian of the scalar field $\phi = x^2 yz$.

16. Find $curl\,\vec{F}$ for the vector field $\vec{F}(x,y,z) = yz\vec{i} + xy^2\vec{j} + yz^2\vec{k}$.

17. Find the direction in which the function $f(x,y) = xe^y$ increase interest at the point (2,0).

18. Find the gradient of the scalar field $\phi = x^2 y + yz$.

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19. Write the real and imaginary part of $\dfrac{z}{z^*}$, where z^* is the conjugate of z.

20. Express $\sin 3\theta$ in terms of powers of $\sin \theta$.

21. Prove that $z^n - \dfrac{1}{z^n} = 2i \sin n\theta$, if $z = e^{i\theta}$.

22. Suppose $\sinh x = \dfrac{3}{4}$ find the exact value of x.

23. Evaluate the double integral $\iint_R y^2 x \, dA$ over the rectangle $R = \{(x, y); -3 \le x \le 2, 0 \le y \le 1\}$.

24. Evaluate $\int\limits_0^4 \int\limits_0^4 \int\limits_0^4 kz\,dx\,dy\,dz$.

25. Find an expression for a volume element in spherical polar coordinates.

26. Find the Jacobian for $x = r \sin \theta \cos \phi$, $y = r \sin \theta \sin \phi$, $z = r \cos \theta$.

(8 × 2 = 16 Marks)

SECTION – III

Answer **any six** questions from among the questions 27 to 38. These questions carry **4** marks each.

27. Show that $\dfrac{\partial^2 f}{\partial x \partial y} = \dfrac{\partial^2 f}{\partial y \partial x}$ for the function $f(x, y) = y^3 \cos x$.

28. Find the Taylor expansion, up to quadratic terms in $x-1$ and $y-1$, of $2x^2 - 3xy + x$ about the point $(1,1)$.

29. Discuss method of Lagrange undetermined multipliers.

30. A particle moves in three dimensional space with velocity $\vec{v}(t) = \vec{i} + t\vec{j} + t^2\vec{k}$ where t is the time variable. Find the position vector of the particle when $t = 1$ given that the particle is at $(-1,2,4)$ when $t = 0$.

31. If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ show that div grad $\left(\dfrac{1}{r}\right) = 0$.

32. Show that the acceleration of a particle travelling along a trajectory $r(t)$ is given by $a(t) = \dfrac{dv}{dt}\hat{i} + \dfrac{v^2}{\rho}\hat{n}$

   where v is the speed of the particle, $\hat{t}$ is the unit tangent to the trajectory, $\hat{n}$ is its principal normal and ρ is its radius of curvature.

33. Prove that $\omega^3 = 1$ and $1 + \omega^2 + \omega^3 = 0$.

34. Solve the equation $z^4 - 3z^3 - 2z + 6 = 0$.

35. Show that i^i is a real number.

36. Draw the region of integration and evaluate $\displaystyle\int_0^{\pi/3} \int_0^{\cos y} x\sin y\, dxdy$.

37. Find the volume of the solid bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$.

38. Evaluate $\displaystyle\int_0^8 \int_{y^{\frac{1}{3}}}^2 \sqrt{x^4 - 1}\, dxdy$.

(6 × 4 = 24 Marks)

Answer **any two** questions from among the questions 39 to 44. These questions carry **15** marks each.

39. (a) Locate all relative extrema and saddle points of

$$f(x,y) = 2x^3 + 6xy^2 - 3y^3 - 150x.$$

   (b) The temperature of a point (x,y) on a unit circle is given by $T(x,y) = xy$. Find the temperature of the two hottest points on the circle.

40. (a) Find expressions For the equations of the tangent plane and line normal to the surface $\phi(x,y,z) = c$ at the point P with coordinates x_0, y_0, z_0. Use the results to Find the equations of the tangent plane and the line normal to the surface of the sphere $\phi = x^2 + y^2 + z^2 = a^2$ at the point $(0,0, a)$.

   (b) Find $\nabla.(\nabla \times \vec{F})$ and $\nabla \times (\nabla \times \vec{F})$ where $\vec{F}(x,y,z) = \sin x\,\vec{i} + \cos(x-y)\,\vec{j} + z\vec{k}$.

41. (a) Find the derivative with respect to x of $e^{5x}(\cos 7x)$ using complex exponential.

   (b) Evaluate the integral $I = \int e^{ax} \cos bx\,dx$.

42. (a) Use a triple integral to Find the volume of the solid within the cylinder $x^2 + y^2 = 9$ and between the planes $z = 1$ and $x + z = 5$.

   (b) Evaluate $\iiint_G z\,dV$, where G is the wedge in the first octant cut off from the cylindrical solid $y^2 + z^2 \leq 1$ and the planes $y = x$ and $x = 0$.

43. (a) If $u = f\left(\dfrac{x}{y}, \dfrac{y}{z}, \dfrac{z}{x}\right)$ find the value of $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z}$.

   (b) Show that $\nabla \times (\phi a) = \nabla \phi \times a + \phi \nabla \times a$.

44. (a) Solve the hyperbolic equation $\cosh x - 5\sinh x - 5 = 0$.

(b) Evaluate the double integral $I = \iint_R \left(a + \sqrt{x^2 + y^2} \right) dx dy$. where R is the region bounded by the circle $x^2 + y^2 = a^2$.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Physics and Computer Applications

Core Course

PC 1341 : ELECTRODYNAMICS

(2014-2018 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** the questions. Answer should not exceed two sentences. **Each** question carries **1** mark.

1. Give the SI unit of electric flux.

2. Write down the expression for the electric field at a distance z above the midpoint of an infinite straight wire that carries a uniform line charge λ.

3. Give the expression for bound volume charge density in terms polarization.

4. Write down the relation connecting electric field **E**, polarization **P** and displacement **D**.

5. Write down the expression for Lorentz magnetic force on a volume current density **J**.

6. State Ohm's law.

7. Write down Faraday's law in differential form.

8. What do you mean by monochromatic waves

9. At resonance, the power factor of series LCR circuit is —————————.

10. The internal resistance an ideal constant-voltage source is —————————.

SECTION – B

Answer any **eight** questions. Answer should not exceed one small paragraph. **Each** question carries **2** marks.

11. Define Coulombs law in electrostatics. What is meant by electric field intensity at a point?

12. Define electric potential at a point. Hence derive the relation $E = -\nabla V$

13. Prove that the perpendicular component of electric field always undergoes a discontinuity across a surface charge density σ.

14. Distinguish between polar and non-polar molecules. Give one example for each

15. Starting from the equation $\nabla . E = \dfrac{\rho}{\varepsilon_o}$ arrive at $\nabla . D = \rho_f$.

16. Write down the Ampere's law in integral form. Find the magnetic field at a distance s from a long straight wire carrying a steady current l.

17. Define electromagnetic induction.

18. Give the expression for displacement current density J_d. What is the physical significance of J_d?

19. Define Poynting vector. Give its relation with intensity.

20. What is meant by wattles current?

21. State Thevenin's theorem.

22. State Maximum power transfer theorem.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. The electric field in some region is found to be $E = kr^3 \hat{r}$, in spherical coordinates *(k is some constant)*. Find the total charge contained in a sphere of radius R centered at the origin.

24. Show that the electric field $E = k[xy\hat{x} + 2yz\hat{y} + 3xz\hat{z}]$ is not a possible electrostatic field.

25. A metal sphere of radius *a* carries a charge Q. it is surrounded, out to radius *b*, by linear dielectric material of permittivity ε. Find the electric field inside and outside the material.

26. A particle of charge $2\mu C$ and mass $2.5 \times 10^{-12} kg$, moving perpendicular to a uniform magnetic field of magnitude 0.05 T traverses a circular path of radius 60cm. Find the speed of the particle.

27. A long solenoid, of radius *a*, is driven by an alternating current, so that the field inside is sinusoidal: $B(t) = B_0 \cos(\omega t)\hat{z}$. A circular loop of wire, of radius a/2 and resistance *R,* is placed inside the solenoid, and coaxial with it. Find the current induced in the loop, as a function of time.

28. How Maxwell fixed Ampere's law?

29. The total power output of sun is 3.8×10^{26} W. The earth-sun distance is 1.5×10^{11} m. If sunlight strikes a perfect absorber on earth, what pressure does it exert?

30. An AC supply of 230 V (rms), 50 Hz is connected to a series RC circuit containing $C = 5\mu F$ and $R = 1000\Omega$. Calculate the average power consumed by the circuit.

31. Determine the current flowing in the 6Ω resistance by using Thevenin's theorem.

(6 × 4 = 24 Marks)

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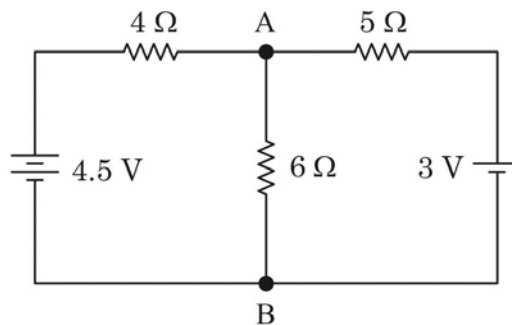
SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Derive the expression for the work done to move a point charge q from infinity to a point. Hence arrive at the expression for the work done to assemble an entire collection of point charges $q_1, q_2, q_3, \ldots\ldots q_{n,}$ form infinite separation

33. Explain magnetic vector potential. Arrive at a formula for vector potential A (Assuming $\nabla.A=0$) for the case of a volume current density **J**. Find the vector potential inside an infinite solenoid with *n* turns per unit length, radius R and current l.

34. Starting from the Maxwell's equation for free space, prove that electromagnetic waves can travel in free space with the speed of light. Write four points about electromagnetic spectrum.

35. State the Kirchhoffs laws applicable to AC circuits. Discuss the Owens's bridge for determining the inductance of a coil.

(2 $\times$ 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Group 2(a) : Physics and Computer Applications

Vocational Course

PC 1371: MICROPROCESSORS AND PROGRAMMING

(2018 Admission)

Time : 3 Hours　　　　　　　　　　　　　　　　　　Max. Marks : 80

SECTION – A (Very short answer type)

Answer **all** questions. **Each** question carries **1** mark.

1.　What is bus in computer?

2.　What is multiplexing?

3.　What is the use of HOLD signal?

4.　What is timing diagram?

5.　What is the use of D-bit in the opcode of 8086 instruction?

6.　How many control flags in 8086 microprocessor?

7.　Which instruction replaces the number in a destination with the 2's complement of that number?

8.　Which instruction used to complements the carry flag?

9. What are assembler directives?

10. What is a macro?

(10 × 1 = 10 Marks)

SECTION – B (Short answer)

Answer any **eight** questions. **Each** question carries **2** marks.

11. What is the difference between CPU bus and system bus?

12. Write a note on fourth generation microprocessors.

13. Explain the use of RESET signal in 8086 microprocessor.

14. What is a flag in microprocessor?

15. What are the uses of IN and OUT instructions?

16. Discuss the use of TEST instruction.

17. What is the significance of far JMP instructions?

18. What is an interrupt?

19. List any four assembler directives.

20. What is *a* procedure in assembly language programming?

21. Write a short note on INTEL 80486 microprocessor.

22. Write an assembly language program to find the largest element in an array.

(8 × 2 = 16 Marks)

SECTION – C (Short essay)

Answer any **six** questions. **Each** question carries **4** marks.

23. Explain the basic functional block of a microprocessor with a neat diagram.

24. Explain memory banking in 8086 Microprocessor.

25. Describe different instruction format in 8086 microprocessor.

26. Differentiate XCHG and XLAT instructions.

27. What are the different classifications of interrupts?

28. Write a note on interrupt vector table.

29. Explain the features of 8259 programmable interrupt controller with pin diagram.

30. Write a note on stack in assembly language programming?

31. Draw a block diagram of INTEL 80286 architecture.

(6 × 4 = 24 Marks)

SECTION – D (Long essay)

Answer any **two** questions. **Each** question carries **15** marks.

32. With the help of a block diagram explain the architecture of INTEL 8086 microprocessor.

33. Explain addressing modes of 8086 with examples.

34. Discuss in detail interrupts of personal computer.

35. Explain INTEL 80186 in detail. What are the different pins and signals used in it? Also explain its architecture.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Group 2(a) : Physics and Computer Applications

Vocational Course

PC 1372: DATA STRUCTURES

(2018 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A (Very Short Answer Type)

One word to maximum of **one** sentence. Answer **all** questions. Each question carries **1** mark.

1. Name any four commonly used data structures.

2. What is a linear data structure?

3. Name the common operations that can be performed on a data structure.

4. Give the name of the searching algorithm that follows divide and conquer strategy.

5. What is a stack?

6. What is a binary tree?

7. What is the necessary requirement for a binary search algorithm to work?

8. What data structure is used for depth first traversal of a graph?

9.   What is a cycle in a graph?

10.   List the primary operations in a hash table.

(10 × 1 = 10 Marks)

SECTION – B (Short Answer)

Not to exceed one paragraph, Answer any **eight** questions. **Each** question carries **2** marks.

11.   What is a linked list?

12.   How breadth first search works?

13.   What is hashing?

14.   What is the prefix and post fix notation of $(a+b)*(c+d)$?

15.   What happens after each iteration in selection sort?

16.   Draw the diagrammatic representation for a doubly linked list.

17.   What do you mean by closed path in a graph?

18.   What is polish notation? Give an example.

19.   Give four applications of stack data structure.

20.   What do you mean by ancestor node in a tree?

21.   Construct an expression tree using the algebraic expression $(a+b)/(a*b-c)+d$.
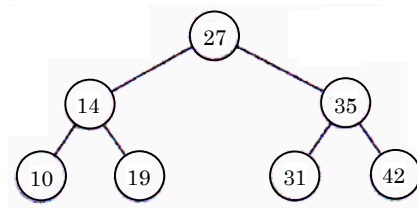
22.   Name the two types of graph traversal algorithm.

(8 × 2 = 16 Marks)

SECTION – C (Short Essay)

Not to exceed **120** words, Answer any **six** questions. **Each** question carries **4** marks.

23. Write an algorithm to insert an element into an array.

24. See the below image of a binary search tree, and traverse it using all available methods of tree traversal.

25. Explain the following terms in graphs.

    (a) connected graph

    (b) complete graph

    (c) Weighted graph

    (d) Digraph

26. Write an algorithm to delete an element from a Queue.

27. Write a C Program to implement linear search algorithm.

28. Explain Depth First Search algorithm.

29. What are the advantages of using binary search tree?

30. Write an algorithm for traversal in a singly linked list.

31. What are the features of a linked list?

(6 × 4 = 24 Marks)

SECTION – D (Long Essay)

Answer any **two** questions. **Each** question carries **15** marks.

32. Write a C program to implement the PUSH and POP operations using linked list

33. Explain how you will insert an item at the beginning of a circular singly linked list.

34. Explain the bubble sort algorithm and its implementation in C.

35. Explain the concept of inserting and deleting an element in a circular queue.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Mathematics

Complementary Course for Physics and Computer Applications

MM 1331.6 — MATHEMATICS – III — VECTOR DIFFERENTIATION, CO-ORDINATE SYSTEMS, ABSTRACT ALGEBRA AND FOURIER SERIES AND TRANSFORMS

(2013 – 2018 Admission)

Time : 3 Hours   Max. Marks : 80

PART – A

Answer **all** questions. **Each** question carries **1** mark.

1. Find the gradient of $f(x, y, z) = x + y - z$.

2. Find the curl of $\bar{i} - 2\bar{j} + \bar{k}$.

3. If $\vec{u} \times \vec{v} = \bar{i} - 2\bar{j} + \bar{k}$, find $\vec{v} \times \vec{u}$.

4. If $\vec{r}(t) = \sin t\,\bar{i} + t\,\bar{j} + \cos t\,\bar{k}$, then $\lim\limits_{t \to \frac{\pi}{2}} \vec{r}(t) = $ ————

5. State Keplers first law.

6. What is the order of the smallest non-Abelian group.

7. Units of z_4 are ————

8. Give one basis of $\mathbb{R}^2$.

9. Give an example of an even function.

10. Find the fundamental period of $\cos 2x$.

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. If $\vec{u} = \bar{i} + \bar{j} + \bar{k}$ and $\vec{v} = \bar{i} - \bar{j} + \bar{k}$, then find $\vec{u} \cdot \vec{v}$ and $\vec{u} \times \vec{v}$.

12. Define irrotational and solenoidal vector fields.

13. Find the length of an arc of the curve $x = \sqrt{5}\,t$, $y = 2\sin t$, $z = 2\cos t$ from $t = 0$ to $t = \pi$.

14. Covert the cylindrical co-ordinate $\left(2, \dfrac{\pi}{2}, 5 \right)$ to rectangular co-ordinate.

15. Convert the polar equation $r = \dfrac{4}{2\cos\theta - \sin\theta}$ into Cartesian equation.

16. Evaluate $\displaystyle\int_0^1 \int_{-1}^1 \int_{-1}^0 xyz\ dx\ dy\ dz$.

17. Write the quotient and remainder when -42 is divided by 5.

18. Define a group with an example.

19. Give an example of a finite group with 5 elements. Also define an abelian group.

20. Prove that a group has unique identify element.

21. In a group *G*, if $a * b = a * c$, then prove that $b = c$.

22. Define Fourier series of a periodic function. Write the Euler's formula for Fourier co-efficients.

(8 × 2 = 16 Marks)

PART – C

Answer any **six** questions. **Each** question carries **4** marks.

23. If $\vec{r}(t) = \sin t\,\bar{i} + 3\bar{j} + \cos t\,\bar{k}$, find the angle between $\vec{r}(t)$ and $\vec{v}(t)$.

24. If $f = 3y$, $g = x - y$, then verify that $\nabla(fg) = f\nabla g + g\nabla f$.

25. Find the directional derivative of $f(x, y) = x^2 \sin y$ at the point $(1, \pi)$ in the direction of $\vec{v} = 3\bar{i} - 4\bar{j}$.

26. Find the directrix, latus rectum and focus of the parabola $y^2 = 2x$.

27. Graph the set of points whose polar co-ordinates satisfy the relation $\dfrac{1}{2} \le r \le \dfrac{3}{2}$, $0 \le \theta \le 2\pi$.

28. Prove that every cyclic group is Abelian.

29. Let * be defined on Q^* by $a * b = \dfrac{ab}{2}$. Show that $(Q^*, *)$ is a group.

30. Find the two half range expansion of $f(x) = x$, $0 \le x < L$.

31. Find the Fourier series expansion of $f(x) = \dfrac{x^2}{2}$, $-\pi < x < \pi$.

(6 × 4 = 24 Marks)

PART – D

Answer any **two** questions. **Each** question carries **15** marks.

32. (a) Find the unit tangent vector and curvature of a helix $\vec{r}(t) = 2\cos t\,\bar{i} + 2\sin t\,\bar{j} + 3t\,\bar{k}$.

    (b) Find $divF$ and $curl\,F$ of $F = x\bar{i} + y\bar{j} + z\bar{k}$.

33. Find the volume of the region D enclosed by the surfaces $z = x^2 + 3y^2$ and $z = 8 - x^2 - y^2$.

34. Determine whether $\{(1,0,0),(1,0,1),(1,1,1)\}$ is a basis for $\mathbb{R}^3$. Also show that $\{(1,1),(2,3)\}$ is a basis for $\mathbb{R}^2$.

35. Find the Fourier Series Expansion of $f(x) = \begin{cases} x, & \text{if } \dfrac{-\pi}{2} < x < \dfrac{\pi}{2} \\ \pi - x, & \text{if } \dfrac{\pi}{2} < x < \dfrac{3\pi}{2} \end{cases}$.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme Under CBCSS

Mathematics

Complementary Course for Physics and Computer Applications

MM 1331.6 : MATHEMATICS – III

THEORY OF MATRICES, VECTOR INTEGRATION, DIFFERENTIAL EQUATIONS AND FOURIER SERIES

(2019 & 2020 Admission)

Time : 3 Hours   Max. Marks : 80

PART – A

Answer **all** questions. **Each** question carries **1** mark.

1. Find the angle between the vectors $\mathbf{A} = 3\mathbf{i} + 6\mathbf{j} + 9\mathbf{k}$ and $\mathbf{B} = -2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$.

2. Find the Wronskian of the functions $1, x, \sin x$.

3. Find the norm of $\mathbf{A} = (3 + i, 1, 2 - i, -5i, i + 1)$.

4. Write the parametric equation of the line which is parallel to the vector $\mathbf{A} = a\mathbf{i} + b\mathbf{j} + c\mathbf{k}$ and passing through the point (x_0, y_0, z_0).

5. Write one property of line integral.

6. State Stokes' theorem.

7. Examine whether the differential equation $e^x \sin y \, dx + (e^x + 1)\cos y \, dy = 0$ is exact or not.

8. Write the standard form of Bernoulli's equation.

9. What is meant by orthogonal trajectories, given an example.

10. Write the function e^x as the sum of an even function and odd function.

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Use Cramer's Rule to solve the set of equations $x + y = 4$ and $2x + y = 3$.

12. Find a vector perpendicular to both $\mathbf{A} = -3\mathbf{i} + \mathbf{j} - 2\mathbf{k}$ and $\mathbf{B} = \mathbf{i} + \mathbf{j} + \mathbf{k}$

13. Show that a product of unitary matrices is unitary.

14. Find the cosines of the angles between pairs of vectors (1, −1, 0, 0) and (0, −2, 5, 1)

15. Find the product of A $= \begin{bmatrix} 4 & 2 \\ -3 & 1 \end{bmatrix}$ and $\begin{bmatrix} 1 & 5 & 3 \\ 2 & 7 & -4 \end{bmatrix}$.

16. Write (1,0) as linear combination of (1, 1) and (−1, 2).

17. Find the inner product and norms of $\mathbf{a} = (1, 2, 3)$ and $\mathbf{b} = (0, -2, 1)$.

18. Find the vector area of the surface of the hemisphere $x^2 + y^2 + z^2 = a^2, z \geq 0$, by evaluating the line integral $S = \frac{1}{2} \oint_c \mathbf{r} \times d\mathbf{r}$ around its perimeter.

19. Solve the differential equation $\frac{dy}{dx} - y = e^{2x}$.

20. Find the orthogonal trajectories of the family of curves $y = cx$.

21. Find the characteristic roots of $y'' + 10y' + 29y = 0$.

22. Solve $x^2 y'' - 2.5xy' - 2y = 0$.

23. Write the standard form of second-order non homogeneous linear ODE and what is mean by its general and particular solution.

24. Find the average value of $\sin x + 2\sin 2x + 3\sin 3x$ on $(0, 2\pi)$.

25. Write the formulae for computing the Fourier coefficients in the Fourier series expansion of a periodic function $f(x)$ of period $2L$.

26. State the conditions for the convergence of a Fourier series of 2π periodic function.

(8 × 2 = 16 Marks)

PART – C

Answer any **six** questions. **Each** question carries **4** marks.

27. Find the distance between the lines $\mathbf{r} = \mathbf{i} - 2\mathbf{j} - (\mathbf{i} - \mathbf{k})t$ and $\mathbf{r} = 2\mathbf{j} - \mathbf{k} + (\mathbf{j} - \mathbf{i})t$.

28. Find what transformation corresponds to each of the following matrices $A = \dfrac{1}{2}\begin{bmatrix} -1 & -\sqrt{3} \\ -\sqrt{3} & 1 \end{bmatrix}$ and $B = \dfrac{1}{2}\begin{bmatrix} -1 & \sqrt{3} \\ \sqrt{3} & 1 \end{bmatrix}$. Also find their rotation angle, or find the line of reflection.

29. Find the inverse of the matrix $M = \begin{bmatrix} 1 & 0 & -1 \\ -2 & 3 & 0 \\ 1 & -3 & 2 \end{bmatrix}$.

30. Transform the basis set B = $\{(-3,2),(-1,1)\}$ into an orthonormal basis.

31. Evaluate the line integral $\oint_C [(x+y)dx - (x-y)dy]$ around the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$.

32. Evaluate the surface integral $I = \int_S a.d\mathbf{S}$, where $\mathbf{a} = x\mathbf{i}$ and S is the surface of the hemisphere $x^2 + y^2 + z^2 = a^2$ with $z \geq 0$.

33. Prove that $\int_v \nabla \phi \, dV = \oint_S \phi \, d\mathbf{S}$ by using divergence theorem.

34. Evaluate the surface integral $\int_S (\nabla \times \mathbf{a}).d\mathbf{S}$, where $a = y\mathbf{i} - x\mathbf{j} + z\mathbf{k}$ and $\mathbf{S}$ is the hemispherical surface $x^2 + y^2 + z^2 = a^2, z \geq 0$.

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

36. Solve the initial value problem $y'' + 0.4y' + 9.04y = 0, y(0) = 0, y'(0) = 3$.

37. Find Fourier coefficient of $f(x) = e^x$ in $(-\pi, \pi)$ and $f(x + 2\pi) = f(x)$.

38. Express the function $(x) = x^2$, when $-1 < x < 1$ as a Fourier series with period 2.

(6 × 4 = 24 Marks)

PART – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$ by using row reduced form.

40. Verify Green's theorem in the plane for $\oint_C \left[xy\,dx + x^2 dy \right]$, where C is the curve enclosing the region bounded by the parabola $y = x^2$ and the line $y = x$.

41. Evaluate the line integral $I = \int_A^B \mathbf{a}.d\mathbf{r}$, where $\mathbf{a} = (xy^2 + z)\mathbf{i} + (x^2 y + 2)\mathbf{j} + x\mathbf{k}$, A is the point (c, c, h) and B is the point $\left(2c, \dfrac{c}{2}, h \right)$ along the different paths

    (a) C_1, given by $x = cu$, $y = \dfrac{c}{u}$, $z = h$

    (b) C_2, given by $2y = 3c - x$, $z = h$.

    Show that the vector field $\mathbf{a}$ is in fact conservative, and find ϕ such that $\mathbf{a} = \nabla \phi$.

42. (a) Solve the differential equation $\dfrac{dy}{dx} + y = y^3 (\cos x - \sin x)$.

    (b) Solve Euler-Cauchy equation $x^2 y'' + 0.6xy' + 16.04y = 0$

43. Solve the IVP $y'' + 6y' + 8y = 2x + e^{-x}$, $y(0) = 0$, $y'(0) = 0$.

44. Find the Fourier series expansion of $f(x) = \begin{cases} \sin x, & 0 < x < \pi \\ 0, & \pi < x < 2\pi \end{cases}$. Also evaluate the series $\dfrac{1}{1.3} + \dfrac{1}{3.5} + \dfrac{1}{5.7} + \dots$

(2 × 15 = 30 Marks)

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N – 2801

Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Physics and Computer Applications

Core Course

PC 1341 — ELECTRODYNAMICS

(2019 & 2020 Admission)

Time : 3 Hours   Max. Marks : 80

PART – A

Very short answer type questions (Answer all questions. Each carries **1** mark).

1. Write the mathematical form of Gauss's law in electrostatics.

2. State Coulomb's theorem.

3. Define electric potential energy.

4. Write the mathematical term of Laplace equation.

5. What are dielectric materials?

6. State gauss's law in magnetostatics.

7. State the Lenz's laws of electromagnetic induction.

8. Write the differential form of Ampere's law.

9. What is form factor of AC?

10. State reciprocity theorem.

(10 × 1 = 10 Marks)

PART – B

Short answer type questions (Answer **any eight** questions. Each carries **2** marks).

11. State and prove Gauss's law in electrostatics.

12. What are the electrostatics problems in which Gauss's law is useful?

13. Define the term potential' and 'equipotential surface'.

14. Derive Poisson's equation starting from differential form of Gauss's law.

15. Derive the equation for energy of a point charge distribution.

16. What do you mean by bound charges?

17. Write a short note on magnetic torque.

18. Deduce Faraday's law of electromagnetic induction in the form of curl E =-dB/dt.

19. What is Displacement current?

20. Obtain the generalized form of Ampere's law.

21. Define the term: magnetic induction and Intensity of magnetisation.

22. What are the boundary conditions for electromagnetic waves in matter?

23. What is meant by 'Wattles current?

24. Give the comparison between series and parallel resonant circuit.

25. Describe Maxwell's L-C bridge for measurement of inductance.

26. Define Thevenins's theorem.

(8 × 2 = 16 Marks)

PART – C

Answer **any six** questions. Each question carries **4** marks.

27. A sphere of diameter 0.03 m is charged to a potential of 500 volts. Calculate the outward pull per unit area.

28. Four grams of gold are beaten into a thin leaf of area 1 m². A small piece is cut out of it and placed on a conductor. Calculate the surface density of charge required by the conductor so that the gold leaf is just lifted up.

29. Electric field in a given region of space is E = 5x *i* + 6y *j* + 3 *zk*. Find the volume charge density.

30. Two identical mercury drops are charged to the same potential V. Find the new potential if the two drops coalescence into one drop.

31. Find the energy of a uniformly charged spherical shell of total charge q and radius R.

32. Determine H for a solid cylindrical conductor of radius a. where the current I is uniformly distributed over the cross section.

33. A magnetic field of 0.04 Tesla acts at right angles to a coil of area 10^{-2} m² with 50 turns. If the coil is quickly withdrawn from the field in 0,05s, calculate the average emf induced in it.

34. A soft iron ring has a mean diameter of 0.2 m and an area of cross section of 5×10^{-4} m². It is uniformly wound with a coil of 2000 turns and a current of 2A is passed through it. The magnetic flux produced in the iron ring is 8 x 10^{-3} Wb. Calculate the relative permeability of iron.

35. If the A.C. main supply is given to be 240 V. what would be the average emf during a positive half-cycle? Also find the r.m.s value of voltage.

36. Calculate r.m.s value of AC voltage.

37. An isolated and charged spherical soap bubble of 6 cm radius is given a charge of 48×10^{-9} C. If the atmospheric pressure is 10^5 Nm^{-2}, calculate the increase in radius due to the charge, neglecting the surface tension effect.

38. An infinite charged sheet has a charge density of 1.0×10^{-7} C/m². How far apart are the equipotential surfaces whose potentials differ by 5 volts?

(6 $\times$ 4 = 24 Marks)

PART – D

Answer **any two** questions. Each question carries **15** marks.

39. Using Gauss's law to find the electric field intensity due to a uniform infinite cylindrical charge.

40. Calculate the potential due to a uniformly charged spherical shell of radius R and having total charge q, at a point distant r from the centre when (a) r >R (b) r'=R (c) r<R.

41. Find an expression for the power in an ac circuit containing resistance, inductance and capacitance. Determine the condition that the current in the circuit may be wattless.

42. Define Poynting vector. Obtain an expression for Poynting vector.

43. State and explain Norton's network theorem. Show that Norton's equivalent circuit can be found from Thevenin's equivalent circuit.

44. Describe with necessary theory, the Owen's bridge for determining the self inductance of a coil.

(2 $\times$ 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme Under CBCSS

Group 2 (a) – Physics and Computer Applications

Vocational Course

PC 1371 — MICROPROCESSORS AND PROGRAMMING

(2019 and 2020 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

(Very short answer type. One word to maximum of 2 sentences) (Answer **all** questions. **Each** question carries **1** mark)

1. Define memory word size.

2. Name the world's first microprocessor.

3. What are the basic functional blocks of 8086?

4. List two processor control instructions.

5. State whether control transfer instructions affect flags? If yes. Why?

6. Define interrupt.

7. Expand DB.

8. Give the names of general purpose registers of 80286.

9.   Give the versions of 80386.

10. Name one advanced 32-bit super scalar processor.

(10 × 1 = 10 Marks)

SECTION – B

(Short Answer Type Questions) (Not to exceed **one** paragraph) Answer any **eight** questions. **Each** question carries **2** marks.

11. What is microcontroller?

12. List out the four operations commonly preferred by MPU.

13. Explain Maskable and non maskable interrupts.

14. How does microprocessor access 8-bit or 16-bit data from odd and even memory banks?

15. Give a brief description on Address Unit of 80286.

16. Write short notes on interrupts pins of 80386.

17. How will you enable or disable interrupts in 8086?

18. Writes notes on 80286 registers.

19. Writes notes on 80286 real mode operation.

20. What is the function of ALE signal?

21. What do you mean by de-multiplexing?

22. Write the various functional blocks of INTEL 8257?

23. What is Type-4 interrupt?

24. Draw the timing diagram for memory read operation in Intel 8086.

25. Which are the functional units of 80486 Processor?

26. Which are the different modes of operation of 80386?

(8 × 2 = 16 Marks)

SECTION – C

(Short Essay Questions) (Not to exceed **120** words) Answer any **six** questions. Each question carries **4** marks.

27. Explain with neat diagram the flag register of 8086 processor.

28. Explain the working of the following instructions XLAT, AAA, RAR, LOOP.

29. Explain string instruction of 8086.

30. Explain the sequence of CALL instruction by 8086 processor.

31. Briefly explain the purpose of interrupt vector table.

32. Write the difference between PUSH and POP instructions.

33. Explain the data transfer group and logical group of 8086 instructions.

34. How is Macro defined and called in an assembly language program?

35. Explain any two assembly language program development tools.

36. Write an assembly language programme to divide 8-bit numbers from a 16-bit number.

37. Write an assembly language programme to count the number of words in a string.

38. Write notes on the registers of 80386 microprocessor.

(6 × 4 = 24 Marks)

SECTION – D

(Long Essay Questions. Answer any **two** questions. **Each** question carries **15** marks)

39. Discuss on the evolution of microprocessors.

40. Sketch the architecture of 80486 and explain briefly.

41. Explain different types of interrupt.

42. Write notes on Pentium and Advanced Pentium processors.

43. Explain Program Interrupt Controller 8259 with block diagram.

44. Define assembler. What are assembler directives? Explain any five categories of assembler directives in detail.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Group 2 (a) – Physics and Computer Applications

Vocational Course

PC 1372 : DATA STRUCTURES

(2019 and 2020 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1.   What is space complexity?

2.   Define data structure.

3.   What do you mean by tree traversal?

4.   What is Big O notation?

5.   What is a BST?

6.   Define queue.

7.   What is meant by degree of a tree?

8.   What is a complete binary tree?

9. Name any two graph algorithms.

10. BFS stands for?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. State the difference between linear and non-linear data structure.

12. What is a hash table?

13. What is recursion?

14. Write down in-order, pre-order and post-order tree traversal algorithms.

15. What is the need of circular queue?

16. Define push and pop operations.

17. What are the uses of data structures?

18. Name any four applications of stack.

19. List any four advantages of linked Lists.

20. Which value would be in top of stack after evaluating the postfix expression: 5, 6, 2, +, *, 12, 4, /, -.

21. Draw the linked representation of a binary tree with 7 nodes.

22. Differentiate between binary tree and complete binary tree.

23. Given the height h, how to calculate the total number of nodes in a complete binary tree?

24. What is meant by weighted graph?

25. What is adjacency in a graph?

26. Name any two application of graphs.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. Write and explain selection sort algorithm.

28. Differentiate between linked lists.

29. What is addressed by time complexity? Define best, worst and average complexity of algorithms.

30. Explain the working of insertion and deletion operations in FIFO data structure.

31. Write down the algorithm to create single linked list using pointers.

32. What do you know about non-linear data structures?

33. Explain the traversal operation on circular Linked list using pointers

34. What are the basic operations performed on stacks?

35. What is a stack? Explain the algorithms to check whether stack is empty or full.

36. Write a note on expression trees.

37. Write an algorithm to search a vertex in a graph.

38. Discuss on the application of graphs.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. What is hashing? Explain in detail.

40. Write notes on different types of queues.

41. Discuss on the applications of linked lists.

42. Write the algorithm for merge sort.

43. Explain the operations performed on a tree.

44. Compare BFS and DFS for graphs.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

Core Course

PC 1441 : CLASSICAL MECHANICS AND THEORY OF RELATIVITY

(2015 – 2018 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. Each carries **1** mark.

1.   What is simple harmonic oscillator?

2.   Give two examples of damped harmonic oscillators in real life.

3.   What are conservative and non conservative forces?

4.   What are constraints of motion? Give an example?

5.   Write an expression for the reduced mass of a two particle system.

6.   Define D'Alembert's principle.

7.   What are generalized coordinates?

8.   Define inertial frame of reference.

9. Define coriolis force.

10. What are tachyons?

SECTION – B

Answer any **eight** questions. Each question carries **2** marks.

11. What is a symmetric compound pendulum? Explain the term: length of the equivalent simple pendulum.

12. Explain the terms restoring force and force constant.

13. Write note on quality factor in damped harmonic oscillator.

14. What is central force field? Give examples.

15. Distinguish between a centre of mass frame and a laboratory frame.

16. Distinguish between elastic and inelastic collisions. Give example.

17. Explain the principle of virtual work.

18. What are the advantages of Lagrange's approach over Newton's approach?

19. Distinguish between Scleronomic and Rheonomic constraints.

20. Deduce an expression for the relativistic energy

21. What do you understand by Lorentz Fitzgerald contradiction?

22. What are Galilean transformations?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks.

23. Find the minimum period of a compound pendulum if the distance of its point of suspension from the centre of gravity is 1.23m and $g = 9.8 \, m/s2$. What will be the value of the radius of gyration?

24. A uniform thin rod of length 120cm and width 6cm is swinging in a vertical plane as pendulum about appoint A at some distance from one end. If the time of swing is minimum, find the distance of A from the end of the rod.

25. Calculate the reduced mass of hydrogen atom and Positronium and H_2 molecule.

26. Deduce the Kepler's third law of planetary motion.

27. How will you reduce the two body problem into a one body problem? Hence explain the concept of reduced mass.

28. Obtain the equation of motion of a simple pendulum by using Lagrangian method and hence deduce the formula for its time period for small amplitude oscillations.

29. Calculate the acceleration of the system, if the pulley is a disc of radius and moment of inertia I about an axis through its centre and perpendicular to its axis.

30. What is the mass of an electron that has a kinetic energy of 2 MeV?

31. Calculate the velocity of an elementary particle whose mass is 10 times its rest mass.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** carries **15** marks.

32. Deduce an expression for the time period of a compound pendulum. Show how the property of interchangeability of the points of suspension and oscillation is used to find the value of g.

33. Deduce the equation of the orbit and discuss the various special cases depending on the value of E and hence of $\in$.

34. Explain the terms configurational space, holonomic and non holonomic constraints and show that the constraints in a rigid body are conservative.

35. Briefly explain about Michelson Morley experiment, significance of its negative result and mention its applications

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

Core Course

PC 1442 : OPTICS

(2014 – 2018 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Very short answer. Answer **all** questions. Each question carries **1** mark.

1.   What are coherent sources of light?

2.   Discuss why two independent sources of light cannot produce interference fringes.

3.   Write down the condition for destructive interference.

4.   Define the term grating element

5.   What is meant by resolving power of a microscope?

6.   What are half period zones?

7.   What is meant by population inversion?

8.   What is Brewster's law?

9.   What is dispersion of light?

10.   What is numerical aperture?

(10 × 1 = 10 Marks)

SECTION – B

Short answer. Answer any **eight** questions. Each question carries **2** marks.

11.   Distinguish between Interference and Diffraction.

12.   What is meant by fringes of equal thickness?

13.   Differentiate between Fresnel and Fraunhofer classes of diffraction.

14.   Write down properties of laser light.

15.   Explain the principle of light propagation in an optical fiber.

16.   What are fiber optic sensors? Explain with an example.

17.   How do you determine refractive index of a liquid using Newton's ring experiment?

18.   Explain the working of a Ruby laser.

19.   Explain the working of a half wave plate?

20.   What are Einstein's coefficients?

21.   What is an optical resonator? Explain its importance in LASER action.

22.   Explain the method of production of circularly polarized light?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks.

23. Numerical aperture of optic fibre is 0.24. If refractive index of core is 1.48, calculate refractive index of cladding.

24. A parallel beam of monochromatic light is allowed to be incident normally on a plane transmission grating having 5000 lines/cm and second order spectral lines is found to be diffracted through 30 degree. Calculate the wavelength of light.

25. In Fraunhofer diffraction pattern due to single slit, the screen is at a distance of 100cm from the slit and the slit is illuminated by a monochromatic light of 589.3nm The width of the slit is 0.1mm. Calculate the separation between central maximum and the second minimum.

26. Find the angular width of central maximum in the Fraunhofer diffraction pattern of a slit of width 1.2 micrometer when the slit is illuminated by a monochromatic light of wavelength 600nm.

27. What will be the effect on fringe width if all the interference apparatus is immersed in liquid of refractive index 1.33

28. A parallel beam of light of wavelength 589 nm is incident on a thin glass plate of refractive index 1.5 such that the angle of refraction is 60 degree. Calculate the smallest thickness of glass plate which will appear dark by reflection.

29. In a Newton's ring experiment, diameter of the tenth dark ring is 5mm when a wavelength of 590nm is used. Find the radius of curvature of lens used.

30. Calculate the thickness of a quarter wave plate if refractive index of O-ray is 1.658 and refractive index of E-ray is 1.486 for a wavelength of 589nm?

31. How will you orient the polarizer and analyzer so that the beam of natural light is reduced to
    (a) 0.5
    (b) 0.25 and
    (c) 0.75 of its original intensity.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Explain the theory of plane transmission grating and describe the method of determination of wavelength of light using this method.

33. Explain how Newton's rings are formed and describe the method of determination of wavelength of light using Newton's ring arrangement.

34. What is meant by polarization of light? Explain any three methods of producing plane polarized light. Differentiate between plane polarization, circular polarization and elliptical polarization.

35. Describe pulse dispersion in step index fiber. Differentiate between single mode fiber and multi-mode fiber. Write a note on fiber optic communication system.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Group 2(a) — Physics and Computer Applications

Vocational Course

PC 1471 : SOFTWARE ENGINEERING

(2014 – 2017 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A (Very Short Answer)

One word to maximum of **one** sentence. Answer **all** questions.

1. Define a system.

2. Distinguish between the terms deliverable and milestones.

3. What is ERD?

4. What is a data object?

5. What are test cases?

6. Expand UML.

7. What do you mean by risk?

8. Expand SDD.

9. What do you mean by module coupling?

10. What is use case scenarios?

SECTION – B (Short Answer)

Not exceeding **one** paragraph. Answer any **eight** questions. Each question carries **2** marks.

11. List the goals of software engineering.

12. What is requirement engineering?

13. What are the two types of software products?

14. What is software process? List its activities.

15. Explain structured language specifications.

16. What are the merits of incremental model?

17. What is the linkage between Dataflow and ER diagram?

18. What is a state transition diagram?

19. What is software architecture? What is its importance?

20. What are the challenges in software scenario?

21. What are the Steps in Bottom-Up Integration?

22. What is Behavioural Testing?

(8 × 2 = 16 Marks)
SECTION – C (Short Essay)

Not exceeding **120** words. Answer any **six** questions. Each question carries **4** marks.

23. What are the advantages and disadvantages of iterative software development model?

24. Explain Unit Testing and integration testing.

25. Compare the Characteristics of software and characteristics of hardware.

26. What are the steps to be followed in testing a software?

27. State the advantages and disadvantages in LOC based cost estimation.

28. Explain the various differences between procedural and object oriented design.

29. Explain Decision Table testing.

30. What you mean by software project planning? Outline the goals of software project planning.

31. What are the different types of Cohesion?

(6 × 4 = 24 Marks)

SECTION – D (Long Essay)

Answer any **two** questions. Each question carries **15** marks.

32. What is software Engineering? What are the essential characteristics and challenges of Software Engineering? Explain.

33. What do you mean by SDLC? Explain in detail the spiral model of software development.

34. What is prototyping? Explain the types of prototyping.

35. What is the importance of software requirement specification (SRS) in software development? Explain the characteristics of a good SRS.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme Under CBCSS

Group 2(a) – Physics with Computer Applications

Vocational Course

PC 1472 – OBJECT ORIENTED PROGRAMMING

(2014-2017 Admission)

Time : 3 Hours　　　　　　　　　　　　　　　　　　Max. Marks : 80

SECTION – A (Very short answer)

(Answer **all** questions each question carries **1** mark.)

1. Define OOPs.

2. What are data types?

3. What is the use of string?

4. What are derived data types?

5. What is a class?

6. Define object.

7. What is a pointer?

8. What is the use of this pointer?

9. What is a constant?

10. What is type casting?

(10 × 1 = 10 Marks)

SECTION – B (Short Answer)

Answer any **eight** questions each short question carries **2** marks.

11. What are the disadvantages of conventional programming?

12. Explain Identifiers.

13. Explain procedural Language.

14. Explain structural Programming.

15. What is an array?

16. Explain input stream.

17. What is anonymous object?

18. What is the use of void data type?

19. What is throw and catch in oops?

20. What is a destructor?

21. What is a reference variable?

22. What is member function?

(8 × 2 = 16 Marks)

SECTION – C (Short Essay)

Answer any **six** questions each short essay carries **4** marks.

23. Explain Basic data types and derived data types with example.

24. Explain "if else" and "nested if else" with example.

25. Explain operator over loading with example.

26. What is function overloading?

27. Explain Switch-case statement.

28. Describe access specifiers in details.

29. Explain Heap Consumption.

30. Explain abstract class.

31. Explain Exception handling.

(6 × 4 = 24 Marks)

SECTION – D (Long essay)

Answer any **two** questions. Each long essay question carries **15** marks.

32. Discuss in detail on various types of inheritance with example.

33. Explain features of QOP in detail.

34. Explain for loop and nested for loop in detail.

35. Elaborate on pure virtual function in detail.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Group 2(a) — Physics and Computer Applications

Vocational Course

PC 1472 : OBJECT ORIENTED PROGRAMMING USING C++

(2018 Admission)

Time : 3 Hours   Max. Marks : 80

PART – A (Very Short Answer Questions)

Answer **all** questions.

Each Question carries **1** mark.

1.   What is a class?

2.   What do you mean by abstraction?

3.   What do you mean by object-oriented programming?

4.   Write syntax of an inline function in C++.

5.   What is protected access specifier?

6.   What do you mean by copy constructor?

7.   What do you mean by object slicing?

8.   Write various file management modes.

9.   What do you mean by hierarchical inheritance?

10.   Write notes on logical operators in C++.

(10 × 1 = 10 Marks)

PART – B (Brief Answer Questions)

Answer **any eight** questions.

Each Question carries **2** marks.

11.   Write a note on destructors in C++.

12.   What are the various IO statements in C++?

13.   Write a note on default arguments in C++.

14.   Write the use of Cin and Cout objects in C++.

15.   What do you mean by late binding and early binding?

16.   What is the use of pure virtual function in C++?

17.   Write a note about dynamic memory allocation in C++.

18.   Write a note on any random files.

19.   How do you define a subclass in C++?

20.   What is the use of macros in C++?

21.   What do you mean by inheritance?

22.   Write a C++ program to perform method overloading.

(8 × 2 = 16 Marks)

PART – C (Short Essay Type Questions)

Answer **any six** questions.

Each Question carries **4** marks.

23. Explain data types in C++.

24. Write a short note on inline functions in C++.

25. Explain the concept of friend class in C++.

26. Write a note on static data members and member functions in C++.

27. Write a note on advantages and disadvantages of inheritance in C++.

28. Explain the concept of constructors with example.

29. Explain how to implement method overloading in C++.

30. Write a C++ program to implement the concept of object and class.

31. Write a note on exception handling in C++.

(6 × 4 = 24 Marks)

PART – D (Long Essays)

Answer **any two** questions.

Each Question carries **15** marks.

32. Explain various control statements in C++.

33. Explain operator overriding in C++ with example.

34. Explain the concept of file management in C++.

35. Write a C++ program to implement multi-level inheritance.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme Under CBCSS

Complementary Course for Physics and Computer Applications

MM 1431.6 : MATHEMATICS – IV – LINEAR TRANSFORMATIONS, VECTOR INTEGRATION AND COMPLEX ANALYSIS

(2013 – 2018 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – I

All the **first ten** questions are compulsory. They carry **one** mark each.

1. Define a dilation from $\mathbb{R}^2$ to $\mathbb{R}^2$.

2. How many rows and columns must be a matrix A have in order to define a mapping $\mathbb{R}^4$ to $\mathbb{R}^5$ by the rule $T(x) = Ax$?

3. Define a one-to-one mapping from $\mathbb{R}^n$ to $\mathbb{R}^m$.

4. Define boundary points of a set.

5. Give an example of a function which is analytic everywhere.

6. What is the value of $e^{2\pi i}$?

7. Write the Cauchy-Riemann equation in polar form.

8. Give an example of an nonorientable surface.

9. Define div $\overline{F}$.

10. Find a parametric representation of $x^2 + y^2 + z^2 = a^2$.

(10 × 1 = 10 Marks)

SECTION – II

Answer **any eight** questions. These questions carry **2** marks each.

11. Show that the transformation T defined by $T(x_1, x_2) = (4x_1 - 2x_2, 3|x_2|)$ is not linear.

12. Find the standard matrix A for the transformation $T(x) = 3x$ for x in $\mathbb{R}^2$.

13. $T(x_1, x_2) = (2x_2 - 3x_1, x_1 - 4x_2, 0, x_2)$. Check whether T is one-to-one or not.

14. Show that $|z_1 + z_2|^2 + |z_1 - z_2|^2 = 2(|z_1|^2 + |z_2|^2)$.

15. Find the derivative of $\dfrac{z-i}{z+i}$ at i.

16. Write $z = 1 + i$ in exponential polar form.

17. Find $Ln(-1)$.

18. Prove that $\oint_C \dfrac{dz}{z} = 2\pi i$, where C is a unit circle counter clock wise.

19. Find the principal value of $(-i)^i$.

20. If $f(x, y, z) = 3x^2 y - y^3 z^2$, find the gradient field of f.

21. Show that $\overline{F} = (z + y)i + zj + (y + x)k$ is not conservative.

22. When $\overline{r} = xi + yj + zk$, what is $div\,\overline{r}$?

(8 × 2 = 16 Marks)

SECTION – III

Answer **any six** questions. These questions carry **4** marks each.

23. Let $T : \mathbb{R}^2 \to \mathbb{R}^3$ be a linear transformation such that $T(x_1, x_2) = (x_1 - 2x_2, -x_1 + 3x_2, 3x_1 - 2x_2)$. Find x such that $T(x) = (-1, 4, 9)$.

24. Let $A = \begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}, u = \begin{bmatrix} 1 \\ 0 \\ -4 \end{bmatrix}, v = \begin{bmatrix} a \\ b \\ c \end{bmatrix}.$

    Define $T : \mathbb{R}^3 \to \mathbb{R}^3$ by $T(x) = Ax$. Find $T(u)$ and $T(v)$.

25. Determine a and b such that $u = ax^3 + by^3$ is harmonic.

26. Find an analytic function whose real part is $u = \dfrac{x}{x^2 + y^2}$.

27. Find $\int_c \bar{z}\, dz$, where C : from 0 along the parabola $y = x^2$ to $1 + i$.

28. Find the solutions of $e^z = 3$.

29. Find the flux of $\bar{F} = (x - y)i + xj$ across the circle $x^2 + y^2 = 1$ in the xy–plane.

30. Show that $\bar{F} = (e^x \cos y + yz)i + (xz - e^x \sin y)j + (xy + z)k$ is conservative and find a potential function for it.

31. Verify Green's theorem for the field $\bar{F} = xyi + x^2 j$ and the region $\mathbb{R}$ bounded by the parabola $y = x^2$ and the line $y = x$.

(6 × 4 = 24 Marks)

SECTION – IV

Answer any **two** questions. These questions carry **15** marks each.

32. (a) Find all the roots of $\sqrt[3]{1+i}$.

     (b) Prove that $\cosh^2 z - \sinh^2 z = 1$.

     (c) Solve for z, $\log z = \dfrac{-\pi i}{2}$.

33. (a) State Cauchy's integral formula.

     (b) Integrate $g(z)$ around the circle $C : |Z| = 3/2$ in the clockwise direction, where $g(z) = \dfrac{\tan z}{z^2 - 1}$.

34. (a) State Gauss's Divergence theorem.

     (b) Verify divergence theorem for the field $\overline{F} = xi + yj + zk$ over the sphere $x^2 + y^2 + z^2 = a^2$.

35. (a) State Stoke's theorem.

     (b) Use Stoke's theorem to evaluate $\oint_C \overline{F} \cdot d\overline{r}$, if $\overline{F} = xzi + xyj + 3xzk$ and C is the boundary of the portion of the plane $2x + y + z = 2$ in the first octant, traversed counter clockwise as viewed from above.

(2 $\times$ 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

Core Course

PC 1441 : CLASSICAL MECHANICS AND THEORY OF RELATIVITY

(2019 Admission Onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** the questions in **one** or **two** sentences. Each question carries **1** mark.

1. What is conservative force?

2. Define inverse square law of force.

3. What is meant by centre of mass coordinate system?

4. Define constraints.

5. What are generalised coordinates?

6. What is Coriolis force?

7. Write the principle of equivalence.

8. What is meant by inertial frame of reference?

9. Define frame of reference.

10. State the postulates of special theory of relativity

SECTION – B

Answer any **eight** questions not exceeding a paragraph. Each question carries **2** marks.

11. Explain the law of conservation of energy.

12. Prove the angular momentum of a particle moving under the action of a central force remains constant.

13. What are central forces? Give an example.

14. State the significance of negative result of Michelson – Morly experiment.

15. Distinguish between conservative and dissipative forces.

16. Explain fictitious forces and centrifugal forces.

17. Explain time dilation.

18. Distinguish between holonomic and nonholonomic constraints

19. Explain principle of virtual work.

20. Explain D'Alembert's principle.

21. Explain the Galilean transformation for coordinates.

22. Explain concept of space.

23. Give mass- energy relation and discuss its significance? What is rest mass energy?

24. Write down Lorentz transformation equations.

25. Explain variation of mass with velocity.

26. Explain twin paradox.

<div align="right">**(8 × 2 = 16 Marks)**</div>

<div align="center">SECTION – C</div>

Answer any **six** questions. Each question carries **4** marks.

27. Find Lagrange's equation of motion of a simple pendulum.

28. Masses of 4, 3 and 1 kg are located at positions $3j+2t^2k, 3ti-3k$ and $4ti+t^2j$ respectively. Find the position of the centre of mass and the angular momentum of the system about the origin at t = 2s.

29. Derive the expression for variation of mass with velocity.

30. Derive the equations for the simple pendulum using the Lagrange equation.

31. State and prove work energy theorem.

32. State and prove law of conservation of linear momentum.

33. Show that velocity of light is invariant under Lorentz transformation.

34. Compare Lagrangian approach over Newtonian approach.

35. Calculate the kinetic energy of an electron, moving with velocity of 0.98 c in the laboratory frame. (Rest mass of electron $=9.11×10-31$kg)

36. The length of the moving rod is measured to be exactly half its proper length. What is the speed of the rod, relative to the observer at rest?

37. How fast would a rocket have to go relative to an observer for its length to be corrected to 99% of its length at rest?

38. At what speed is a particle moving if the mass is equal to three times its rest mass.

<div align="right">**(6 × 4 = 24 Marks)**</div>

<div align="center">3</div>

<div align="right">**N – 8017**</div>

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Derive the differential equation for the orbit of a particle moving under central force.

40. Obtain the Lagrange's equations of motion using D' Alembert's principle for holonomic system.

41. Explain the Kepler's problem of planetary motion and hence deduce it.

42. Obtain the period of oscillation of a compound pendulum using Lagrange's equation.

43. Describe with relevant theory explain Michelson's Morly experiment.

44. Derive Lorentz transformation equations. Show that for small values of velocity, Lorentz co-ordinate transformations reduce to Galilean transformations

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

Core Course

PC 1442 : OPTICS

(2019 Admission Onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions; **each** carries **1** mark.

1. State the superposition principle.

2. What are coherent sources?

3. Define bandwidth.

4. What is Rayleigh's criterion for resolution?

5. State and explain grating law.

6. State Brewster's law.

7. What is the principle of optical fibre?

8. What is meant by population inversion?

9. Give an example for positive and negative crystals.

10. Write Cauchy's dispersion formula.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight; each** carries **2** marks.

11. Define temporal and spatial coherence.

12. What are the conditions of obtaining constructive and destructive interference?

13. Explain the phenomenon of color of thin films.

14. How will you determine the refractive index of a liquid using Newton's rings?

15. How will you test the optical flatness of a glass?

16. Write two applications of Michelson interferometer.

17. What are Fresnel's half period zones? Why are they called so?

18. Distinguish between e-rays and o-rays.

19. Explain how circularly polarised light can be produced.

20. What is double refraction?

21. What is a quarter wave plate? What is its use?

22. Give two characteristics of LASER beam.

23. Which are the components of a LASER?

24. Discuss the advantages of fibre optic communication system.

25. What is numerical aperture of an optical fibre?

26. What is the difference between a step index fibre and graded index fibre.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six; each** carries **4** marks.

27. Green light of wavelength 5100 A° from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen 200 cm away is 2 cm, find the slit separation?

28. A soap film 5×10^{-5} cm thick is viewed at an angle of 35° to the normal. Find the wavelength of light in the visible spectrum, which will be absent from the reflected light, μ = 1.33.

29. The diameter of the nth ring changes from 1.2 cm to 1.04 cm when the airspace between the lens and the plate is replaced by a liquid. Find refractive index of the liquid.

30. If the grating element is 2×10^{-6} cm. How many order of spectrum are possible for a light of wavelength 650 nm?

31. What is the radius of sixth zone in a zone plate of focal length 10 cm, for a light of wavelength 6000 A°.

32. A plane transmission grating has 14000 lines to an inch for a length of 6 inches. If the wavelength region is 5×10^{-5} cm, find the resolving power of the grating in the first order and the smallest wavelength difference that can be resolved?

33. Calculate the thickness of ice capable of inverting a circularly polarised light. μ_o = 1.309, μ_e = 1.313, wavelength of light = 590 nm.

34. When sunlight is incident on water surface at a glancing angle of 37°, the reflected light is found to be completely plane polarised. Determine the refractive index of water and angle of refraction.

35. The polarizer and the analyser are crossed. Through what angle should the analyser be rotate so that 25% of the light passes through the analyser?

36. Derive the relation between Einstein's coefficients.

37. The energy level difference between two laser level is 0.21eV. Determine the wavelength of radiation.

38. Calculate the numerical aperture and acceptance angle of a fibre having core refractive index = 1.55 and cladding refractive index = 1.50.

(6 $\times$ 4 = 24 Marks)

Answer any **two**; **each** carries **15** marks.

39. Explain the formation of Newton's rings. How can these be used to determine the wavelength of monochromatic light?

40. Describe Michelsons interferometer. How will you determine the wavelength of monochromatic light with the help of Michelsons interferometer.

41. Discuss in detail Fraunhofer diffraction due to a single slit. Derive an expression for the width of central maximum.

42. Explain double refraction. Explain the working of Nicol prism. Give Huygens theory of double refraction.

43. Explain with theory the production of circularly and elliptically polarised light waves.

44. Explain the principle, construction and working of a He-Ne laser.

(2 $\times$ 15 = 30 Marks)

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N – 8019

Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Group 2(a) — Physics and Computer Applications

Vocational Course

PC 1472 — OBJECT ORIENTED PROGRAMMING USING C++

(2019 Admission Onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – A

(Very Short Answer)

(One word to maximum of **two** sentences. Answer **all** questions).

1.   What is the use of write ( )?

2.   What does set precision mean in C++?

3.   What does open ( ) do in C++?

4.   Who developed C++?

5.   What is polymorphism?

6.   Explain pure virtual function.

7.   Explain the term prototype.

8.   What is cout?

9.   Explain the function of seekp( ).

10. Which C++ Oops feature is related to reusability?

(10 × 1 = 10 Marks)

SECTION – B

(Short Answer Type)

Not exceeding **one** paragraph. Answer any **eight** questions. Each question carries **2** marks.

11. How do you implement encapsulation in C++?

12. Explain if-else statement.

13. Write short note on friend class.

14. Explain procedural oriented language.

15. What are extraction and insertion operators in C++?

16. Explain the use of break statement.

17. What is default constructor? Write its syntax.

18. Explain new operator.

19. What is type conversion?

20. What is the syntax of class declaration?

21. What is Object slicing?

22. Write a note on early binding.

23. What is abstract class?

24. List the operators that cannot be overloaded.

25. What are the characteristics of a destructor?

26. What are access specifiers?

(8 × 2 = 16 Marks)

SECTION – C

(Short Essay Type)

Not exceeding **120** words. Answer any **six** questions. Each question carries **4** marks.

27. Draw a neat diagram of the hierarchy of stream classes for I/Operations.
28. Explain difference between while and do while statement with suitable example.
29. Write note on tellg( ) and tellp( ).
30. What are inline function?
31. Explain call by reference with an example.
32. Write note on static member function.
33. Write a program to implement unary operator overloading using friend function.
34. What are macros? Give an example.
35. Write note on benefits and applications of OOPs.
36. Explain virtual base classes.
37. Explain try and catch statements with an example.
38. Explain any three file modes briefly.

(6 × 4 = 24 Marks)

SECTION – D

(Long Essay Type)

Answer any **two** questions. Each question carries **15** marks.

39. Explain loops in C++ with suitable example.
40. Explain the characteristics of a constructor. Explain its types with example.
41. Explain binary operator overloading with an example program.
42. How run time polymorphism is implemented in C++? Explain with an example.
43. Explain formatted I/O operations in C++.
44. What is inheritance? Explain its types.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Complementary Course for Physics and Computer Applications

MM 1431.6 : MATHEMATICS-IV-ABSTRACT ALGEBRA, LAPLACE TRANSFORMS, SPECIAL FUNCTIONS AND FUNCTIONS OF A COMPLEX VARIABLE

(2019 Admission Onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – I

All the first **ten** questions are **compulsory**. They carry **1** mark each.

1. Is the set of all non-negative integers (including 0) a group under addition? Justify your answer.

2. State whether TRUE or FALSE: An element in a group may have more than one inverse.

3. Give the generators of the cyclic group $\mathbb{Z}$ under addition.

4. Write the Laplace transform of $\sin kt$.

5. Write the inverse Laplace transform of $\dfrac{s}{s^2 - k^2}$.

6. $\displaystyle\int_0^\infty x^n e^{-x} dx = ?$

7. Give the recursion relation for gamma function.

8. Define beta function.

9. Find the real and imaginary parts of e^{-z}.

10. Define singular point of a complex function.

SECTION – II

Answer any **8** questions. They carry **2** marks each.

11. Define subgroup of a group.

12. Show that the identity e in a group is unique.

13. Define a field.

14. Define zero divisors in a ring.

15. Find the Laplace transform of $\sin^3 2t$.

16. Find $L\left[e^{at} \cosh bt\right]$.

17. Find $L^{-1}\left[\dfrac{3(s^2 - 2)^2}{2s^5}\right]$.

18. If $L[f(t)] = F(s)$, prove that $L\left[e^{at} f(t)\right] = F(s - a)$.

19. Find $\dfrac{\Gamma\left(\dfrac{2}{5}\right)}{\Gamma\left(\dfrac{12}{5}\right)}$.

20. Evaluate $\Gamma\left(\dfrac{-3}{2}\right)$ in terms of $\sqrt{\pi}$.

21. Prove that $B(p, q) = B(q, p)$.

22. Evaluate $\displaystyle\int_0^\infty \dfrac{y^2 \, dx}{(1 + y)^6}$

23. State Cauchy-Riemann Equations.

2

24. Define holomorphic function.

25. Define conjugate harmonic functions.

26. State Cauchy's integral formula.

(8 × 2 = 16 Marks)

SECTION – III

Answer any **6** questions. They carry **4** marks each.

27. Show that the subset S of $M_n(\mathcal{R})$ consisting of all invertible $n \times n$ matrices under matrix multiplication is a non-abelian group.

28. Show that if G is a group with binary operation *, then the right cancellation law holds in G.

29. Prove that every field is an integral domain.

30. Find $L\left[e^{4t} \sin 2t \cos t\right]$.

31. Find $L\left[te^{-t} \cosh t\right]$.

32. Find $L\left[\dfrac{1 - \cos 2t}{t}\right]$.

33. Prove $\Gamma\left(\dfrac{1}{2}\right) = \sqrt{\pi}$.

34. Express $\displaystyle\int_0^{\frac{\pi}{2}} \sqrt{\sin^5 x \cos^3 x}\,dx$ in terms of gamma function.

35. Express $\displaystyle\int_0^1 \dfrac{dx}{\sqrt{1 - x^3}}$ in terms of beta function.

36. Using Cauchy Riemann equations, check whether $\dfrac{-x - iy}{x^2 + y^2}$ is analytic.

37. Evaluate $\displaystyle\oint_C \dfrac{\sin 2z\,dz}{6z - \pi}$, where C is $|z| = 3$.

38. Find the residues $R\left(-\dfrac{3}{4}\right)$ and $R(2)$ for the function $f(z) = \dfrac{z}{(4z + 3)(2 - z)}$.

(6 × 4 = 24 Marks)

N – 8020

SECTION – IV

Answer any **2** questions. They carry **15** marks each.

39. (a) Verify that the set of non-zero rationals, $\mathcal{Q} - \{0\}$, is a group under the usual multiplication.

    (b) Show that a subgroup of a cyclic group is cyclic.

40. (a) Show that $\langle \mathcal{R}, +, . \rangle$ is a ring.

    (b) Evaluate $L^{-1}\left[\dfrac{3s+7}{s^2-2s-3}\right]$.

41. (a) Evaluate $L\left[t^2 u(t-3)\right]$.

    (b) Using Convolution Theorem, evaluate $L^{-1}\left[\dfrac{1}{s(s^2+4)}\right]$

42. (a) Evaluate $\displaystyle\int_0^\infty y^7 e^{-y^2}\,dy$.

    (b) Prove that $B(p,q) = 2\displaystyle\int_0^{\frac{\pi}{2}} (\sin\theta)^{2p-1}(\cos\theta)^{2q-1}\,d\theta$.

43. (a) Using residue theorem, evaluate $\displaystyle\oint_C \dfrac{dz}{z^2(z-1)}$ where C is $|z| = 2$.

    (b) Find the Laurent's series expansion of $\dfrac{z}{(z+1)(z+2)}$ in $0 < |z+2| < 1$.

44. (a) Using contour integration, evaluate $\displaystyle\int_0^{2\pi} \dfrac{d\theta}{5+4\cos\theta}$.

    (b) Using contour integration, evaluate $\displaystyle\int_0^\infty \dfrac{dx}{1+x^4}$.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2 (a) : Physics and Computer Applications

Core Course VII

PC 1541 : ELECTRONICS

(2014, 2016-2017 Admission)

Time : 3 Hours　　　　　　　　　　　　　　　　　　Max. Marks : 80

SECTION – A

Answer **all** questions, **each** question carries **1** mark.

1. What is the value of ripple factor for a full wave rectifier?

2. What is stabilisation in transistors.

3. How can crossover distortion be eliminated?

4. What is class C amplifier?

5. What is undamped oscillation?

6. What is phase modulation?

7. What is a differential amplifier?

8. Draw the block diagram of an op-amp.

9. State Demorgan's theorem.

10. Give the truth table of JK flip-flop.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight,** e**ach** question carries **2** marks.

11. What is a zener diode?

12. What is avalanche break down mechanism in diodes?

13. What are the different filters used in power supplies?

14. What is bandwidth of an amplifier?

15. Define stability factor for a transistor.

16. What is the total gain of a two stage amplifier whose individual stages have a gain of 5dB and 7dB?

17. What are the factors that affect the frequency stability of an oscillator?

18. What are common mode and differential mode signals?

19. Give the expression for gain of

    (a) inverting amplifier

    (b) non inverting amplifier.

20. Explain a diode detector circuit used for AM demodulation.

21. How can we obtain NOT gates from NAND gates.

22. Give the truth table for AND and OR gates.

(8 × 2 = 16 Marks)

M – 1823

SECTION – C

Answer any **six**, **each** question carries **4** marks.

23. For the center-tapped full wave rectifier shown below find the average or d.c. load current.
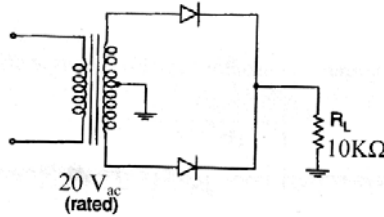
24. A given multi-stage amplifier has the following voltage gains. $Av_1 = 10$, $Av_2 = 20$ and $Av_3 = 40$. What is the overall gain? Also express the overall gain in dB.

25. An amplifier has a voltage gain of 100. With negative feedback the voltage gain reduces to 20. Calculate the fraction of the output that is fed back to the input.

26. An audio signal given by $15 \sin 2\pi$ (2000t) amplitude modulates a sinusoidal carrier wave $60 \sin 2\pi$ (100,000t). Determine the modulation index.

27. Figure shows an inverting amplifier with an input voltage V_i. When the input voltage is increased from 0.1V to 0.4V, what will be the voltage at node A in each case.
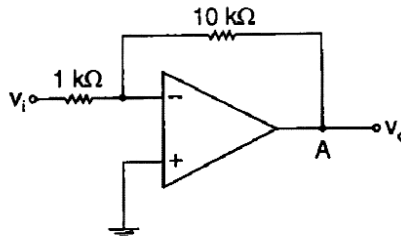
28. What is the value of output voltage for the non-inverting op-amp shown below?
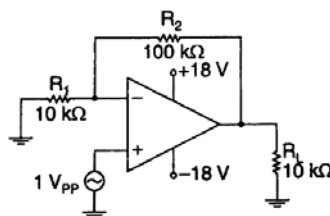
29. Perform subtraction of the binary numbers using 2's complement method.

    $(1111)_2 - (1101)_2$.

30. Implement AND and OR gates using NOR gates.

31. For an N-channel JFET I_{DSS} = 20MA, V_p = −8 volts, g_{mo} = *5000 μs.* Determine the value of drain current and transconductance at V_{GS} = −4 volts.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two**, **each** question carries **15** marks.

32. Explain the working of a center-tapped full wave rectifier with circuit diagram and waveforms.

33. Explain how voltage regulation is achieved using zener diode voltage regulator.

34. Explain the working of a Hartley oscillator. What is the equation for frequency of oscillation?

35. Draw and explain

    (a) inverting amplifier using op-amp.

    (b) non inverting amplifier using op-amp.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2(a) : Physics and Computer Applications

Core Course VIII

PC 1542 : ATOMIC AND NUCLEAR PHYSICS

(2014, 2016 & 2017 Admission)

Time : 3 Hours   Max. Marks : 80

PART – A

Answer **all** questions. Answer should not exceed **two** sentences. **Each** question carries **1** mark.

1. What is j-j coupling?

2. What are the basic concepts of vector atom model?

3. What is Stark effect?

4. Define nuclear binding energy?

5. What are magic numbers?

6. What is radioactivity?

7. Define half life of a neutron

8. What is the Q-value of the nuclear reaction? What is its significance?

9. What is the function of moderator in a nuclear reactor?

10. What are leptons?

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions. Answer should not exceed one small paragraph. **Each** question carries **2** marks.

11. Write note on normal Zeeman effect and anomalous Zeeman effect.

12. Write note on the range of alpha particles.

13. State and explain the Larmor's theorem

14. Write note on the isotope effect in rotational spectra.

15. What are the drawbacks of liquid drop model?

16. Differentiate between molecular spectra and atomic spectra.

17. Explain about nuclear fusion reactions in stars.

18. Explain about the magnetic bottle.

19. Write note on nuclear forces and its characteristics.

20. Write note on controlled thermonuclear reactions.

21. Write note on the fundamental interactions in nature.

22. Briefly explain about quarks.

(8 × 2 = 16 Marks)

PART – C

Answer any **six** questions. **Each** question carries **4** marks.

23. A radioactive sample Z has a half life of 360 days. How much time will be taken by the sample to decay to its 20 percent?

24. In the CO molecule the wave-number difference between the successive absorption lines in the pure rotational spectrum is 768 m^{-1}. Calculate the moment of inertia of the molecule and the equilibrium bond length of the molecule. Masses of the C^{12} and O^{16} atoms are respectively 1.99×10^{-26} kg and 2.66×10^{-26} kg.

25. Obtain the ground state of nitrogen .

M – 1824

26. The red line of cadmium splits into three components separated by 240 MHz when the source is placed in a magnetic field of flux density 8.6 mT, the light being examined in a direction perpendicular to the magnetic field. Calculate the ratio of charge to mass *(e/m)* of the electron.

27. Explain the magnetic dipole moment of electron due to spin and orbital motion

28. Explain about the Meson theory of nuclear forces

29. Comment on the radiocarbon dating.

30. Explain about nuclear fusion and the working principle of a hydrogen bomb.

31. Explain about the parity conservation and time reversal symmetry

(6 × 4 = 24 Marks)

PART – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Obtain an expression for a successive radioactive decay. Obtain conditions for secular and transient equilibrium.

33. Explain the Stern Gerlach experiment with a neat diagram.

34. What is nuclear fission? Briefly explain the detailed mechanism of nuclear fission, energy release, production of neutrons and chain reaction.

35. Explain with suitable examples the conservation law of baryon number, lepton number and strangeness.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2 (a) : Physics and Computer Applications

Vocational Course

PC 1571 : DATABASE MANAGEMENT SYSTEMS

(2014, 2016-2017 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A [Very short answer type]

One word to maximum of **one** sentence. Answer **all** questions. **Each** question carries **1** mark.

1. What is DataBase?

2. Define DBMS.

3. Define Schema.

4. Give an example for one-to-many relationship.

5. What is functional dependency?

6. Define Strong entity.

7. What is extension and intension?

8. What is the use of Projection in SQL?

9. What is Redundancy?

10. Define Attribute Domain.

(10 × 1 = 10 Marks)

SECTION – B [Short answer]

Not to exceed one paragraph. Answer any **eight** questions. **Each** question carries **2** marks.

11. What is meant by the term query language?

12. Define normalization. Enlist its type.

13. Enlist DDL and DML commands.

14. What are Entities and Attributes?

15. With an example explain what a derived attribute is?

16. What do you mean by weak entity sets?

17. Define Physical schema and Logical schema.

18. Define integrity constraints.

19. Give various symbols used in E.R. diagram.

20. List the various disadvantages in the file system and explain how it can be overcome by the database system.

21. What is the difference between tuple relational calculus and domain relational calculus?

22. Mention the steps involved in processing a query.

(8 × 2 = 16 Marks)

SECTION – C [Short Essay]

Not to exceed **120** words. Answer any **six** questions. **Each** question carries **4** marks.

23. What are advantages of data base management system?

24. Explain 2NF with example.

25. What is database modeling? How is E-R model different from other data models? What are the main advantages of the E-R model?

26. Compare and Contrast the Lossless and Lossy Decompositions.

27. What are the different levels of abstraction?

28. Explain Natural Join with Example.

29. Explain Data Independence and its types in detail.

30. Discuss various Design and Maintain issues in SQL.

31. Describe database security.

(6 × 4 = 24 Marks)

SECTION – D [Long Essay]

Answer any **two** questions. **Each** question carries **15** marks.

32. What is an Entity? What is a Relationship? Explain ER modelling with the help of database for a Student Management System.

33. Explain Relational Algebra with syntax and example.

34. Discuss various types of JOIN operations.

35. Write SQL query for following consider table
    (a) EMP(empno, deptno, ename ,salary, Designation, joiningdate, DOB,city)
    (b) Display names of employees whose experience is more than 10 years
    (c) Display age of employees
    (d) Display average salary of all employee
    (e) Display name of employee who earned highest salary

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme Under CBCSS

Group 2(b) — Physics and Computer Applications

Core Course VII

PC 1541 — ELECTRONICS

(2018 and 2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** carries **1** mark.

1.   What is a rectifier circuit?

2.   Which is the most widely used method of biasing a transistor?

3.   Give an application for class C amplifier.

4.   In which power amplifier does crossover distortion occur?

5.   What is the feedback usually employed in oscillators?

6.   What is the disadvantage of negative feedback?

7.   What is amplitude modulation?

8.   What is CMRR?

9.   What do you mean by input offset voltage?

10. Why NAND gate is called a universal gate?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight, each** carries **2** marks.

11. What is DC resistance of a diode?

12. What are the advantages of bridge-rectifier over centre-tapped full wave rectifier?

13. What is ac load line?

14. What are the different methods of biasing a transistor?

15. What is phase distortion?

16. What are the disadvantages of class B push pull amplifier?

17. What is the advantage of expressing gain of an amplifier in dB?

18. What is an emitter follower?

19. How is 360° phase shift achieved in RC phase shift oscillator'?

20. Explain an inverting amplifier using op-amp.

21. List the properties of an op-amp.

22. What is the need for negative feedback in op-amps.

23. What do you mean by frequency response of an op-amp?

24. Why SSB transmission is more power efficient?

25. Which are the basic laws of Boolean algebra?

26. What is master slave JK flip-flop?

(8 × 2 = 16 Marks)

SECTION – C
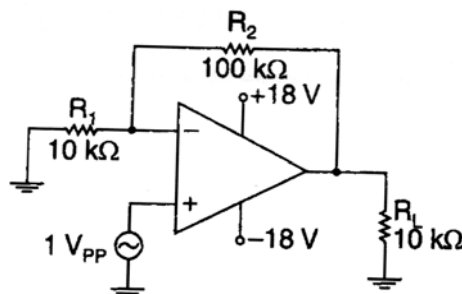
Answer any **six**, **each** carries **4** marks.

27. For the center-tapped full wave rectifier shown below find the average or d.c. load current.


30 V$_{ac}$
(rated)

R_L
5.1 kΩ
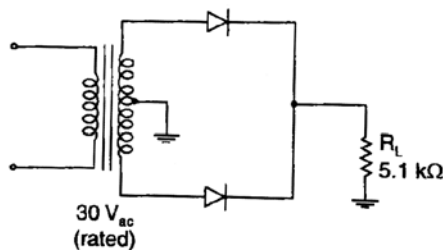
28. What is the value of load regulation for a zener diode voltage regulator, given V_{NL} = 8V, V_{FL} = 7.995V, change in current ΔI_L = 40 mA?

29. The common base d.c. gain (α) of a transistor is 0.987. If I_E is 10 mA, determine the value of collector and base currents?

30. The voltage gain of an amplifier without feedback is 400. If the feedback ratio (β) is equal to 0.1. Find the voltage gain of the amplifier with negative feedback.

31. Two stages of a multi-stage amplifier have gains of 50dB and 20dB. What is the overall gain for the amplifier?

32. A transistorized RC phase shift oscillator has the following values R1 = R2 = R3 = 2.2 MΩ and C1 = C2 = C3 = 47 pF. At what frequency will the circuit oscillate?

33. The total power content of an AM wave is 1500W. For a 100% modulation determine the power transmitted by the carrier.

34. Figure shows an inverting amplifier with an input voltage of 1 V. Find the value of output voltage.
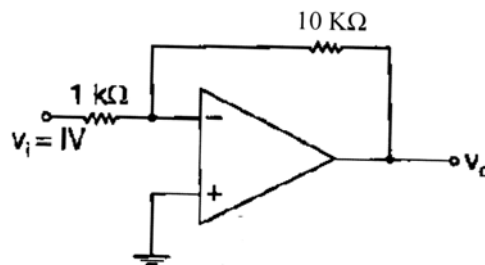
35. What is the value of output voltage for the non-inverting op-amp shown below?

M – 1828

36. For the summing amplifier given below find the value of output voltage.
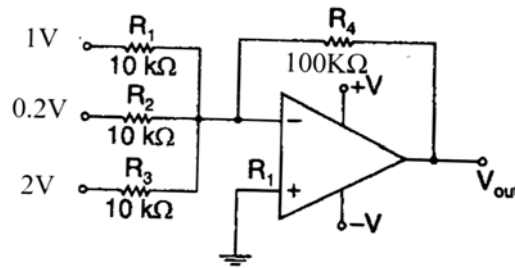
37. State and prove De Morgan's theorem.

38. Implement NOT and OR gates using NOR gates.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two, each** carries **15** marks.

39. Explain the working of a zener diode voltage regulator.

40. Explain the steps to be followed to design a transistor biasing and stabilization circuits.

41. What are the different distortions seen in amplifiers?

42. Explain the principle of feedback amplifiers.

43. Sketch the block diagram of a super heterodyne AM receiver and explain.

44. Explain the working of a full-subtractor.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme Under CBCSS

Group 2 (a) – Physics and Computer Applications

Core Course VIII

PC 1542 – ATOMIC AND NUCLEAR PHYSICS

(2018 & 2019 Admn)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all ten** questions. Each carries **1** mark.

1. What is spatial quantization?

2. What is anomalous Zeeman effect?

3. Define hyperfine structure.

4. HCI molecules shows a rotational spectral line but it is not shown by an H_2 molecule. Why?

5. Distinguish between hadrons and leptons.

6. The neutrons and protons could not be subdivided. Justify the statement.

7. What is nuclear fusion?

8. What are isotopes?

9. An alpha particle is emitted from a nucleus. What will happen to its atomic number and mass number?

10. What do you mean by mean life of a nucleus?

(10 × 1 = 10 Marks)

SECTION – B

Answer **all eight** questions. Each question carries **2** marks.

11. Distinguish between L-S coupling and JJ coupling.

12. Explain the postulates of vector atom model.

13. Define Bohr magnetron, What its value?

14. What are the spectra associated with a diatomic molecule? Write the wavelength region where thee spectra are observed.

15. Explain Pauli's exclusion principle.

16. What is a rigid rotator?

17. Write the properties of beta particles.

18. State the proton-electron hypothesis.

19. Very briefly explain the shell model of nucleus.

20. What is packing fraction of a nucleus?

21. Explain half-life of a nucleus.

22. What are the radioactive series?

23. Explain the principle of an atom bomb.

24. What is a magnetic bottle?

25. Write a short note on properties of gamma rays.

26. Write the structure of neutron and proton using quark model.

(8 × 2 = 16 Marks)

M – 1829

SECTION – C

Answer **any six** questions. Each question carries **4** marks.

Avogadrow number $N = 6.023 \times 10^{23}$, 1 amu = $1.67 \times 10^{-27} kg$ Energy of 1 amu = 931 MeV, Bohr magnetron $\mu_B = 9.27 \times 10^{-24} J\ T^{-1}$.

27. A hydrogen atom is placed in a magnetic field of 2 T, Calculate the energy difference between $m_l = +1$ and $m_l = -1$ component in the 2 p state. Given that the Bohr magnetron $\mu_B = 9.27 \times 10^{-24} J\ T^{-1}$.

28. Find the values of L and S for the ground state of nitrogen.

29. Draw the Zeeman splitting of the ground state level $3^2 S_{1/2}$ and the excited state levels $3^2 P_{1/2}$ and $3^2 P_{3/2}$ of sodium. Draw the transitions allowed by selection rules.

30. Calculate the energy corresponding to 542 nm in joule, electron volt and in wavenumber.

31. The HCl molecule gives the vibrational spectral line of wavelength 3.465×10^{-6} m. Calculate the force constant of the HCl bond. Given that atomic masses of $^1H = 1.0087$ amu, $^{35}Cl = 35.453$ amu and I amu = $1.67 \times 10^{-27} kg$.

32. Assume that the 1 amu = 931 MeV, Calculate the mass of C-12 isotope.

33. Estimate the binding energy of $^{15}P_{31}$ Mass of $^{15}P_{31} = 30.973763$ amu. Mass of proton =1.001825 amu and mass of neutron =1008665 amu.

34. The disintegration constant of a radioactive substance is 9.435×10^{-8}, calculate its half-life period.

35. Calculate the time required for disintegrating 20% of 238U, which has a half-life of 4.5 billion years.

M – 1829

36. Calculate the energy released by the fission of 1 kg of U235 in KWh, given that the energy released per fission is 200 MeV, 1 MeV $= 1.6 \times 10^{13} J$, 1 KWh$= 3.6 \times 10^6 J$.

37. Explain thermonuclear reactions, and explain the proton-proton chain reaction. Nuclear fusion -1 mark- pp- reaction 3 marks.

38. Write a note on elementary particle quantum numbers.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. Each question carries **15** marks.

39. Explain the Stern and Gerlach experiment and its inference. What do you mean by electron spin and gryomagnetic ratio?

40. Write a note on the change in spectrum of an atom, viz; Na when its is placed in a weak, moderate and strong magnetic fields. Explain, how Paschen-Back effect is occurring and write its theory.

41. Classify the molecules based on their moment of inertia, with the help of examples. Discuss the rotational spectra of a diatomic molecule in detail.

42. Explain the liquid drop model and the semi-empirical mass formula and explain the existence magic numbers.

43. Explain alpha decay and derive the KE associated with an alpha particle. Explain the theory of alpha decay.

44. Explain the process of release of energy by nuclear fission chain reaction. Explain the working of a nuclear reactor.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2(a) : PHYSICS AND COMPUTER APPLICATIONS

Core Course

PC 1571 : DATABASE MANAGEMENT SYSTEM

(2018 and 2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

(Very Short Answer)

(**One** word to maximum of **2** sentences. Answer **all** questions. Each question carries **1** mark.)

1. Define key in a database.

2. What do you mean by one to one relationship?

3. Define trivial FD.

4. What is a derived attribute? Give an example.

5. Which is the keyword used in conjunction with SELECT statement to eliminate all the duplicate records and fetching only unique records?

6. What is a strong entity?

7. Write down various DDL commands.

8. What is a physical database schema?

9. What is the purpose of the keyword DESC in an SQL statement?

10. What is the purpose of normalization?

(10 × 1 = 10 Marks)

SECTION – B

(Short Answer)

(Not to exceed **one** paragraph, answer **any eight** questions. Each question carries **2** marks.

11. What do you mean by insertion anomaly?

12. Mention the aggregate functions in SQL and its purpose.

13. What is a composite attribute? Give an example.

14. Explain view in a database.

15. What is physical data independence?

16. Mention any four DML commands in SQL.

17. List out different types of JOIN in SQL operations.

18. What do you mean by domain constraints? Give example.

19. Explain UPDATE command with syntax and example.

20. What is tuple relational calculus?

21. Give an SQL query to illustrate the usage of (a) BETWEEN (b) LIKE.

22. What is the use of GROUP BY and HAVING clause in SQL?

23. What do you mean by partial participation? How it can be represented in an ER diagram?

24. Differentiate the DELETE and DROP commands in SQL.

25. Explain the following (a) Super key (b) Candidate key.

26. Explain the use of (a) NOT NULL (b) DEFAULT.

(8 × 2 = 16 Marks)

SECTION – C

(Short Essay)

(Not to exceed **120** words, answer **any six** questions. Each question carries **4** marks.

27. Write a note on domain relational calculus.

28. Explain nested queues in SQL with syntax and example.

29. Explain the concept of primary key and foreign key with examples.

30. Differentiate database approach versus tile processing approach.

31. Explain functional dependency with an example.

32. Explain different schemas in a DBMS.

33. What is generalization? Explain with example.

34. Explain aggregate functions in SQL.

35. Explain set difference in SQL with an example.

36. What is a weak entity? Explain with an example.

37. Explain specialization in ER model.

38. Explain Boyce Codd normal form with an example.

(6 × 4 = 24 Marks)

SECTION – D

(Long Essay)

(Answer any **two** questions, Each question carries **15** marks.

39. With a neat diagram explain the components of a DBMS.

40. Explain the symbols used in ER model. Draw an ER diagram for a Hotel Management System.

41. Explain in detail, the relational algebra operations with examples.

42. Explain 1NF, 2NF and 3NF in detail.

43. Consider the following schema and write down the SQL for the following. Assume the table is created with necessary constraints and values inserted.

    Sailors(sid:integer,sname:string,rating:integer,age:integer)

    Boats(bid:integer,bname:string,color:string)

    Reserves(sid:integer,bid:integer,day:date)

    (a) Find the names of sailors who have reserved boat 103.

    (b) Find the color of the boat reserved by Lubber.

    (c) Find the names of sailors who have reserved a red boat or a green boat.

    (d) Count the number of sailors.

    (e) For each red boat, find the number of reservations for this boat.

44. Explain lossy join and loseless join decompositions with examples.

(2 × 15 = 30 Marks)

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P – 2871

Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme under CBCSS

Group 2(a): Physics and Computer Applications

Core Course

PC 1541: ELECTRONICS

(2014 – 2017 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A (Very Short Answer Type)

(One word to maximum one sentence, Answer **all** questions, each question carries **1** Mark)

1.   Define peak inverse voltage of a diode.

2.   Draw the schematic symbol of Zener diode.

3.   What is dc load line?

4.   What is the maximum efficiency of class B amplifier?

5.   Which feedback is preferred in oscillators?

6.   Define modulation.

7.   Define Slew rate.

8. Compute the gain of the amplifier circuit.
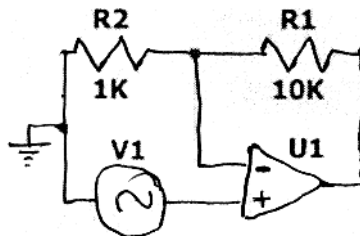
9. Add the binary numbers 10011 and 11011.

10. What happens to the output of JK flip flop when both the inputs are high?

(10 × 1 = 10 Marks)

SECTION – B (Short Answer)

(Not to exceed **one** paragraph, answer any **eight** questions. Each carries **2** Marks)

11. Define the terms ripple factor and rectification efficiency.

12. List the reasons for keeping the operating point of a transistor as fixed.

13. Define Class AB amplifier.

14. State the Barkhausen criterion for oscillation.

15. Explain the needs for modulation.

16. List any two properties of ideal opamp.

17. What is half adder?

18. Compare half wave and full wave rectifiers.

19. List the conditions for proper biasing a transistor.

20. Draw the schematic symbol of opamp.

21. Explain the operation of XOR gate.

22. Define gain bandwidth product.

SECTION – C (Short Essay)

(Not to exceed **120** words, answer any **six** questions. Each carries **4** Marks)

23. How does a Zener diode can act as a voltage regulator?

24. Compare common CB and CE transistor configuration.

25. Give the advantages of class B push pull amplifier.

26. Briefly discuss Emitter follower.

27. Explain linear demodulation of AM signal.

28. Explain the principle of virtual ground.

29. Realize AND, OR and NOT gates using NAND gates.

30. Explain Boolean laws.

31. Briefly discuss FM and PM.

(6 × 4 = 24 Marks)

SECTION – D (Long Essay)

(Answer any **two** questions. Each carries **15** Marks)

32. Explain different types of filter circuits.

33. Describe the operation of SR, D, JK and T flip flops in detail.

34. Explain RC phase shift oscillator.

35. Explain Opamp inverting and non inverting amplifiers.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme Under CBCSS

Group 2 (a) — Physics and Computer Applications

Core Course VIII

PC 1542 — ATOMIC AND NUCLEAR PHYSICS

(2013-2017 Admission)

Time : 3 Hours   Max. Marks : 80

PART – A

Answer **all** the questions. Answer should not exceed **two** sentences. **Each** question carries **1** mark.

1. What is L-S coupling?

2. What is spatial quantization?

3. What are the selection rules in spectroscopy?

4. What do you mean by isotope effect?

5. What is an anharmonic oscillator?

6. What is the nuclear stability?

7. Define a nuclear reactor?

8. What do you mean by the range of alpha particles?

9. Define an elementary particle. Is the neutron an elementary particle?

10. What is the difference between a particle and its antiparticle?

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions. Answer should not exceed **one** small paragraph. **Each** question carries **2** marks.

11. Write note on the quantum mechanical explanation of normal Zeeman effect.

12. What is nuclear quadrupole moment?

13. Explain the neutrino theory of beta decay.

14. State and explain the Pauli's Exclusion Principle.

15. State and explain the Geiger —Nuttal law.

16. Differentiate between alpha, beta and gamma rays.

17. Explain about the isospin and hypercharge of a particle.

18. Explain the vibrational energy of a diatomic molecule.

19. Write note on breeder reactor.

20. Write note on spin orbit coupling.

21. Explain about the optical spectra and its selection rules.

22. Briefly explain about the fundamental interactions in nature.

(8 × 2 = 16 Marks)

PART – C

Answer any **six** questions. **Each** question carries **4** marks.

23. The red line of cadmium splits into three components separated by 120 MHz when the source is placed in a magnetic field of flux density 4.3 mT, the light being examined in a direction perpendicular to the magnetic field. Calculate the ratio of charge to mass *(e/m)* of the electron.

24. The lines in the pure rotational spectrum of HCl are spaced as 10.4×10^2 per metre. Calculate the moment of inertia and the internuclear distance.

   (Mass of proton = 1.67×10^{-27} kg; mass of chlorine = 58.5×10^{-27} kg.)

25. Show that the radioactive decay is exponential in nature.

26. Obtain the ground state of carbon.

27. If the time required for 10% of a radioactive sample to disintegrate is 2.1×10^9 years. Find the half life of the sample.

28. Explain the Stern Gerlach experiment with neat diagram.

29. Derive expression for the frequencies of the Stark components of the $J = 1 \rightarrow J = 2$ transitions of a linear molecule.

30. Explain with suitable examples the conservation law of baryon number, lepton number and strangeness

31. Obtain conditions for secular and transient equilibrium.

(6 × 4 = 24 Marks)

PART – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Describe briefly about the Gamow's theory of alpha decay and the experimental verification of the theory.

33. Explain the Anomalous Zeeman Effect, Paschen Back effect and Stark effect.

34. What is nuclear fusion? Explain the thermonuclear reactions, principle of a hydrogen bomb and controlled thermonuclear reactions.

35. What are quarks? Give qualitative description of quark model.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme Under CBCSS

Group 2(a) – Computer Applications

Vocational Course

PC 1571 — DATABASE MANAGEMENT SYSTEMS

(2014-2017 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

(Very Short Answer Type) In **one** word to maximum of **one** sentences. Answer **all** questions.

1.   Define super key.

2.   What is relation instance?

3.   Define attribute.

4.   What is the symbol of projection operation?

5.   Define SQL.

6.   Define tuple.

7.   What is cardinality?

8.   Define recursive relationship.

9. What is a relationship?

10. Define multi-valued attribute.

<div align="right">(10 × 1 = 10 Marks)</div>

SECTION – B

[Short Answer] Not exceeding **one** paragraph, Answer any **eight** questions. **Each** question carries **2** marks.

11. Define DDL Compiler.

12. Differentiate Primary and Foreign Key.

13. Who is naïve user? Define with example.

14. Write about DCL commands in SQL.

15. What you mean by INNER JOIN?

16. Write about INSERT query in SQL.

17. What is Key Constraint?

18. Describe Weak Entity Set.

19. What is update anomaly?

20. Differentiate Simple and Composite attribute.

21. Define INF.

22. What you mean by data integrity?

<div align="right">(8 × 2 = 16 Marks)</div>

SECTION – C

[Short Essay] Not exceeding **120** words, Answer any **six** questions. Each question carries **4** marks.

23. Write a note on database users.

24. Describe advantages of Relational Model.

25. Define Boyce-Codd normal form. How does it differ from 3NF?

26. Describe three level architecture of DBMS.

27. Write a note on select query with example.

28. Explain projection operation with example.

29. Write a detailed note on DDL commands.

30. Describe UPDATE query in detail.

31. What are the basic components of ER diagram?

(6 × 4 = 24 Marks)

SECTION – D

[Long Essay] Answer any **two** questions. **Each** question carries **15** marks.

32. Write a note on advantages of DBMS.

33. Explain in detail about Relational calculus.

34. Describe Normalization in detail.

35. Draw an ER diagram for a library database.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme under CBCSS

Group 2 (a) – Physics and Computer Applications

Core Course VII

PC 1541 : ELECTRONICS

(2018 Admission onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions in one or two sentences. Each question carries **1** mark.

1. The potential barrier at a PN-junction is due to the charges on either side of the junction. These charges are _____

   (a) Minority carriers

   (b) Majority carriers

   (c) Both majority and minority carriers

   (d) fixed donor and acceptor ions

2. Write down truth table for NAND gate.

3. What is the collector current for a CE configuration with $\beta = 100$ and a base current of 50 μA?

4. Define modulation index.

5. What is a rectifier?

6. A two stage amplifier has first stage voltage gain of 20 and second stage voltage gain of 400. What is the overall gain of the amplifier in decibel (dB)?

7. The main disadvantages of transformer coupled amplifier is _____.

8. Sketch the output wave forms of class A and class B amplifiers.

9. An amplifier has a bandwidth of 30 kHz and voltage gain of 100. When negative feedback is applied, its gain is reduced to 20, what will be the new bandwidth.

10. Convert 1101.110_2 to decimal.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions, not exceeding a paragraph. Each carries **2** marks.
(Not to exceed one paragraph)

11. Sketch the VI characteristics of a PN junction diode under forward and reverse bias. How dynamic and static resistance were calculated from the curve?

12. How zener breakdown is different from avalanche breakdown?

13. Define Peak inverse voltage. What is peak inverse voltage for a diode in a full wave bridge rectifier?

14. Negative feedback reduces the gain of an amplifier, but why is it used in an amplifier design?

15. Write down laws of Boolean Algebra.

16. What are the different current components of a n-p-n transistor when the emitter junction is forward-biased and the collector junction is reverse-biased. What is the source of the leakage current in a transistor?

17. Why are NAND and NOR gates called universal gates? Justify your answer with the help of examples.

18. What do you mean by the term load line? Explain its significance.

19. What do you understand class A, class B and class C power amplifier?

20. Explain collector efficiency and distortion of a power amplifier.

21. With the help of circuit symbol and truth table explain how does the XOR gate differ from the OR gate?

22. What is an emitter follower? Where it is used. Mention its characteristics.

23. Using 1's complement subtract 100101 from 111101.

24. Explain frequency modulation.

25. What is meant by CMRR? Explain the significance of a relatively large value of CMRR.

26. Explain phase reversal in a CE amplifier.

(8 × 2 = 16 Marks)

SECTION – C

Short essay questions (Not to exceed 120 words). Answer any **six** questions.
Each question carries **4** marks.

27. Explain how Zener diode can be used as voltage regulator.

28. A centre-tap transformer has 230 V primary winding rated at 12-0-12 volts. This transformer is used in the FW rectifier circuit with a load resistance of 100. What are the dc output voltages, dc load current and the rms voltage developed across the diode? Assume the diodes and the transformer to be ideal.

29. A transistor with $\alpha = 0.98$ carries a base current of 50 μA. It produces a collector to base leakage current of 5 μA. Determine the values of emitter current and collector current of the transistor.

30. Draw circuit diagram of common emitter transistor configuration. Sketch the static output characteristics of common-emitter transistor and indicate the active, saturation and cut-off regions.

31. Sketch the single stage CE transistor amplifier circuit. Draw its frequency response curve. Mark different regions.

32. In a phase shift oscillator $R_1=R_2=R_3= 1$ MΩ and $C_1=C_2=C_3= 50$ pF. At what frequency the circuit will oscillate. What will be the resistance R used to produce frequency of 10 kHz for the same capacitors?

33. Explain the working principle of a Hartley oscillator with a neat sketch.

34. The signal and output voltages of an amplifier are 5 mV and 1 V, respectively. If the gain with negative feedback is 50 and the input resistance without feedback (voltage-series) is 2 kΩ, find the feedback fraction and input resistance with the feedback.

35. (a) Design an inverting amplifier with a gain of 5 and input resistance of 10 kΩ.

    (b) Design an noninverting amplifier with a gain of 22.

36. Determine the output voltage of an op-amp for input voltages of V_{i1} = 150 µV, V_{i2} = 140 µV. The amplifier has a differential gain of A_d = 4000 and the value of CMRR is:

(a) 100

(b) 10^5

37. With a neat circuit diagram explain action of full adder. Construct its truth table.

38. Simplify the given equations and implement the results with logic gates:

(a) $Y = A + \bar{A}B$

(b) $Y = AB + \bar{A}C + BC$

(6 × 4 = 24 Marks)

SECTION – D

Long Essay question. Answer any **two** questions.
Each question carries **15** marks.

39. With neat circuit diagram explain construction and working of transformer coupled Class A amplifier and Class B push pull amplifier.

40. (a) Describe the operation of SR flip flop with the help of schematic diagram and truth table.

(b) Explain the action of D flip flop with block diagram and truth table.

41. What is an operational amplifier? List the characteristics of an ideal op-amp with equivalent circuit. Explain common mode and differential operation of op-amp. Explain action of summing amplifier.

42. Describe the operating principle of npn transistor under biased condition. Explain the current amplification factors α, β and γ for common base, common emitter and common collector configuration respectively of a transistor. Obtain relation between them.

43. What is modulation? Explain amplitude modulation. Derive the expression for modulated wave. Draw the frequency spectrum of modulated wave.

44. (a) Draw the circuit diagram of a full-wave bridge rectifier using junction diodes and explain clearly its action.

    (b) Why is a filter used in a rectifier? Enumerate the different types of filters used at the output of a rectifier.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2022

Career related First Degree Programme Under CBCSS

Group 2 (a) : Physics and Computer Applications

Core Course VIII

PC 1542 : ATOMIC AND NUCLEAR PHYSICS

(2018 Admission onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Very short answer type questions. Answer **all ten** questions of **1** mark each.

1. $L – S$ coupling is mainly observed in lighter atoms. Why?

2.   Define Stark effect.

3.   What is the importance of selection rules in atomic spectra?

4.   In which region of electromagnetic spectrum do most of the pure vibrational spectra of molecules fall?

5.   What are relative values of the three principal moments of inertia of a linear molecule?

6.   What is meant by the saturation of nuclear forces?

7.   Define half-life of a radioactive isotope.

8.   Nuclear fusion is known as thermonuclear reactions. Why?

9. What are the four fundamental interactions in physics?

10. What are fermions and bosons?

(10 × 1 = 10 Marks)

SECTION – B

Short answer type questions. Answer any **eight** questions. **Each** question carries **2** marks.

11. What is meant by space quantization?

12. State Pauli's exclusion principle. Give the electronic configuration of Silicon (Z = 14).

13. Normal Zeeman effect applies to transitions between singlet states only. Why?

14. Write a note on Paschen-Back effect.

15. Give the different quantized energies possessed by a molecule. Mention their regions in electromagnetic spectrum.

16. Homonuclear diatomic molecules like H_2 will not give pure vibrational spectra. Why?

17. What are the conditions for a pure rotation of a molecule to be microwave active?

18. What is meant by binding energy of a nucleus? Write the equation for binding energy.

19. Discuss the nuclear magnetic moment.

20. What is meant by a radioactive series? Name four radioactive series.

21. Explain radiocarbon dating.

22. What is meant by electron capture? Give an example.

23. Explain the breeder reactor.

24. Explain proton-proton cycle happening inside sun.

25. Write a note on resonance particles.

26. What are the field bosons?

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. **Each** question carries **4** marks.

27. Why is it impossible for $2^2P_{5/2}$ state to exist?

28. Find the possible values of angles between the z- axis and the direction of the spin angular momentum vector S of an electron.

29. Calculate the precessional frequency of an electron orbit when placed in a magnetic field of 4T. $(e = 1.6 \times 10^{-19} C, m = 9.1 \times 10^{-31} kg)$.

30. Calculate the wavelength separation between the unmodified line of wavelength 6000A° and the modified lines in normal Zeeman effect when a magnetic field of 2T is applied. $(e = 1.6 \times 10^{-19} C, m = 9.1 \times 10^{-31} kg, c = 3 \times 10^8 m/s)$.

31. Calculate the frequency, wave number and energy of radiation of wavelength 5000A°. $(c = 3 \times 10^8 m/s, h = 6.624 \times 10^{-34} Js)$.

32. The fundamental and first overtone frequencies of NO molecule are centered at 1876.06 cm^{-1} and 3724.2 cm^{-1} respectively. Evaluate the equilibrium vibration frequency and zero point energy.

33. The average spacing between adjacent rotational lines of CN radical is 3.798 cm^{-1}. Calculate the length of CN bond $(h = 6.626 \times 10^{-34} Js, c = 3 \times 10^8 m/s$, mass of $C = 12u$, mass of N = 14.003 u, 1 u = 1.67 × 10^{-27} kg).

34. Calculate the binding energy of the last neutron in m $^{23}_{11}Na$. Mass of $^{23}_{11}Na = 22.989767u$, mass of $^{22}_{11}Na = 21.9944u$, mass of neutron = 1.008665 u.

35. Find the density of $^{20}_{10}Ne$ nucleus. Given 1 u = 1.66 × 10^{-27} kg and $R_0 = 1.2 \times 10^{-15} m$.

36. The half-life of ^{198}Au is 2.7 days. Calculate the activity of 1.50 *mg* of *Au* – 198 if its atomic weight is 198 g/mol. Given Avogadro number, $N_A = 6.02 \times 10^{23}$ atoms/mol.

37. Calculate the energy released in the following nuclear fission reaction

    $n + _{92}^{235}U \rightarrow _{56}^{142}Ba + _{36}^{91}Kr + 3n$.

    The rest masses of *n* is 1.0087 u and atomic masses of $_{92}^{235}U$, $_{56}^{142}Ba$ and $_{36}^{91}Kr$ are 235.0439 u, 141.9164 u and 90.9234 u respectively.

38. The neutral pion at rest decays by $\pi^0 \rightarrow \gamma + \gamma$. Calculate the wavelength of gamma ray photon. Rest mass of $\pi^0 = 264 m_e$, where m_e is the mass of the electron.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. **Each** question carries **15** marks.

39. (a) Explain Stern-Gerlach experiment and give the significance of the result.

    (b) Write a note on electron spin.

40. Describe the optical spectra in vector atom model giving spectral notation. Explain the selection rules, intensity rule and interval rule.

41. Explain the vibrational spectra of a diatomic molecule. Give its selection rules. What are fundamental and first overtones in vibrational transition?

42. Explain liquid drop model of a nucleus and arrive at the semi-empirical mass formula.

43. Explain the Gamow's theory of alpha decay and derive an expression for decay constant.

44. Explain the elementary particle quantum numbers and their conservation laws with examples.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme Under CBCSS

Group 2(a) – Physics and Computer Applications

Vocational Course

PC 1571 : DATABASE MANAGEMENT SYSTEM

(2018 Admission Onwards)

Time : Three Hours

Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. What do you mean by tuple?

2. What is primary key?

3. Define DBMS

4. Expand BCNF

5. What is functional dependency?

6. Define relational algebra.

7. Expand DML

8. What is a query?

9. Write the use of INSERT query

10. DBA stands for?

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions. **Each** carries **2** marks.

11. How to create a table in DBMS?

12. What do you mean by many-many relationship?

13. What is the difference between primary key and candidate key?

14. Write short note on database schema

15. List any four types of normalization

16. What is the use of SELECT query? Write the syntax

17. What is lossless decomposition?

18. What do you mean by attribute inheritance?

19. What is a relationship?

20. When we identify an attribute as derived attribute?

21. How to change an attribute value in SQL?

22. List any four mathematical functions used in SQL.

23. What is participation?

24. What are weak entity sets?

25. What is equi join?

26. What is transitive dependency?

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. **Each** question carries **4** marks.

27. What are the four types of relationships? Explain in detail

28. Write a note on data types supported by SQL

29. What is an attribute? Write briefly about different types of attributes

30. Write a note on BCNF

31. How to check integrity in databases?

32. Discuss about specialization and generalization in E-R model

33. What is the difference between ORDER BY and GROUP BY clause?

34. Write a note on lossy decomposition

35. Write about the role of DBA

36. Discuss about domain relational calculus

37. What are the constraints used while creating a table?

38. Write a note on database security

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. **Each** carries **15** marks.

39. Explain key constraints in detail

40. What is E-R diagram? Explain the symbols used in E-R diagrams. Illustrate with examples

41. Explain all DML commands in SQL

42. Discuss the various types of JOIN used in SQL

43. What is relational algebra? Explain select and project operations with proper examples

44. Compare 2NF and 3NF

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022.

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

Core Course

PC 1641 – SOLID STATE PHYSICS

(2014 & 17 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions, each question carries **1** mark

1. Define basis.

2. What are amorphous solids? Give an example.

3. Define Bravais lattice.

4. What is metallic bonding?

5. Define Fermi energy.

6. Define electrical conductivity of a metal.

7. Define specific heat capacity.

8. Define dielectric constant.

9. What is polarizability?

10. Define critical temperature.

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight**; each question carries **2** marks

11. Distinguish between a reflection symmetry and inversion symmetry.

12. Explain triclinic and monoclinic crystal systems.

13. Write the properties of covalent bond crystals.

14. Give any two properties of reciprocal lattice.

15. Distinguish between free electron gas and ordinary gas.

16. Write the limitations of the free electron theory.

17. Write the assumptions of Debye model.

18. What is Debye's temperature?

19. What is magnetic susceptibility? Write the relation between magnetic susceptibility and permeability.

20. Explain ferromagnetism.

21. Discuss the applications of superconductivity

22. Explain superconductivity phenomenon.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six**, each question carries **4** marks.

23. NaCl crystals have FCC structure. The density of sodium chloride is 2180 kg m^{-3}. Calculate the distance between two adjacent atoms. Atomic weight of sodium = 23 and that of chlorine = 35.5. Given: Avogadro number = 6.02×10^{26} kg/mol.

24. Find the interplanar spacing of (3 2 1) planes of copper which has an fcc structure having atomic radius 0.1278 nm.

25. The first order spectrum of a beam of X-rays diffracted by a silicon crystal corresponds to an angle 3°. The distance between the corresponding parallel planes is 3Å. Calculate the wavelength of X-rays used.

26. 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 63.5 a.m.u. (Given: m_e = 9.11 × 10^{-31}kg/m^3 Plank's constant h = 6.6260715 × 10^{-34} JS; 1 a.m.u. = 1.66 × 10^{-27} kg)

27. Calculate the characteristic Einstein temperature θ_E for copper if Einstein frequency $v_E = 4.8 \times 10^{12}$ Hz. Given h = 6.6×10^{-34} Js and k= 1.4×10^{-23} J/K.

28. Estimate the paramagnetic susceptibility of a substance, which has 5×10^{28} atoms per unit value m^3 placed in the magnetic field of 1 T at 300K. [Given: permeability of free space $\mu_0 = 4\pi\times10^{-7}$ H/M; magnetic moment $\mu = 9.27 \times 10^{-24}$ Am^2 Boltzmann constant $k_B = 1.38 \times 10^{-23}$ J/K]

29. A rod of magnetic material, 0.5 m in length has a coil of 200 turns wound over uniformly. If a current of 2 A is sent through it, calculate:

    (a) Magnetizing field

    (b) intensity of magnetization

30. The transition temperature of an element with an average mass of 200 amu is 4 K. Determine the transition temperature of its isotope having the atomic mass 206 amu.

31. Define type I and type II superconductors.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two**; each question carries **15** marks

[For partial answers reduce marks accordingly]

32. Derive Bragg's law of X-ray diffraction in crystals. Explain the principle behind the powder X-ray diffraction method.

33. Using Debye model, derive the expression for the specific heat of a solid. Discuss its merits.

34. Derive an expression for susceptibility of a paramagnetic material on the basis of Langevin's theory.

35. What is Josephson tunneling? Describe DC Josephson effect and AC Josephson effect.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS
Physics with Computer Applications
Core Course
PC 1641 : SOLID STATE PHYSICS
(2018 and 2019 Admission)

Time : 3 Hours   Max. Marks : 80

PART – A

Answer **all** questions. Each question carries **1** mark.

1. What is a space lattice?

2. Why are x-rays used for the analysis of crystal structure?

3. Define electron mean free path.

4. Define Fermi energy.

5. What is meant by effective mass of a electron?

6. What is forbidden gap?

7. Write down the expression for Electric Displacement.

8. What is a Bohr magneton?

9. Write down the relation for relative permeability and magnetic susceptibility.

10. What are Type I Superconductors?

(10 × 1 = 10 Marks)

PART – B

Answer **any eight** questions. Each question carries **2** marks.

11. What is atomic packing factor?

12. What is Bravais lattice?

13. How are X-rays generated?

14. What is electron diffraction?

15. How does the electrical conductivity of a metal vary with its temperature?

16. What is electronic heat capacity? What are the parameters on which it depend?

17. How can the difference between electronic specific heat of metal according to classical and quantum theory of free electron be explained? Which value is correct?

18. What are phonons?

19. Mention the limitations of the theory propounded by Einstein regarding the specific heat of solids.

20. What do you mean by lattice vibration?

21. Explain electronic polarizability.

22. Explain Clausius-Mosotti relation.

23. What is the origin of permanent magnetic moment in an atom?

24. What is a Cooper pair?

25. Discuss the effect of magnetic field on superconductivity.

26. What is London penetration depth?

(8 × 2 = 16 Marks)

PART – C

Answer **any six** questions. Each question carries **4** marks.

27. KCl is of FCC crystal structure having density 1.98×10^3 kg/m^3. If its molecular weight is 74.6, calculate (a) the distance from one atom to the next atom of the same kind (b) the distance between adjacent atoms.

28. Calculate the number of atoms per unit cell in the case of (a) Simple Cubic (b) Face Centred Cubic and (c) Body Centred Cubic lattices.

29. Draw the crystal plane (022) in an FCC lattice.

30. Define density of states and write down its expression.

31. A semiconducting crystal 12mm long, 5mm wide and 1mm thick has a magnetic flux density of 0.5 Wb/m^2 applied from front to back perpendicular to largest faces. When a current of 20 mA flows lengthwise through the specimen, the voltage measured across its width is found to be 37 μV. Find the Hall coefficient of the conductor.

32. Compare Einstein's and Debye's theory of specific heat of solids.

33. Write a note on lattice heat capacity.

34. The density of carbon dioxide is 1.977 kg m^{-3} and its susceptibility is 0.985×10^{-3}. Calculate the polarizability. Given that molecular weight of CO_2 = 44 and Avogadro Number = 6.02×10^{23} mol^{-1}.

35. The dielectric constant of Si is 12. The length of the edge of its cubic unit cell is 5.43 Å. Find the electronic polarizability of Si atoms, employing the Clausius-Mosotti relation. Given that there are 8 atoms per unit cell in Si.

36. A paramagnetic material has 10^{28} atoms/m^3. Its susceptibility at 350K is 2.8×10^{-4}. Calculate the susceptibility at 300K.

37. For a superconductor, the critical field at 0K is 6.39×10^4 A/m and the critical temperature for zero magnetic field is 7.18K. What is the critical filed for the material at 4K?

38. The diameter of a lead wire at 4.2K is 1mm. If the critical temperature for lead is 7.18K and zero magnetic field H$_0$ = 6.5×10^4 A/m, find the critical current.

(6 $\times$ 4 = 24 Marks)

PART – D

Answer **any two** questions. Each question carries **15** marks.

39. (a) Derive Bragg law (b) Explain the concept of reciprocal lattice. Express the reciprocal lattice vectors in terms of the primitive translation vectors.

40. Explain: (a) Nuetro diffraction (b) Hall effect.

41. Describe the Einstein model of lattice heat capacity.

42. Give an account of the quantum theory of paramagnetism and explain how it removes the shortcomings of Langevin's theory.

43. (a) Explain the sources of polarizability (b) Explain ferromagnetism and anti-ferromagnetism.

44. Discuss: (a) London equations (b) Josephson effect.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Physics With Computer Applications

Core Course

PC 1642 – QUANTUM MECHANICS

(2014 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** the questions. **Each** carries **1** mark.

1.   What is the basis of Einstein's theory of photoelectric effect?

2.   Write the equation of Compton effect.

3.   Draw black body radiation curve.

4.   What was the conclusion of the experiment of Franck and Hertz?

5.   What is uncertainty principle?

6.   Mathematically explain the wave packet.

7.   Write 1D time dependent Schrödinger equation.

8.   Write the expectation value of position coordinate.

9. What is Hilbert space?

10. Write the quantum mechanical operators of energy and momentum.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Give the important conclusion of photoelectric effect.

12. What are the hydrogen spectral series? Table them with their quantum number and region.

13. Write a note on inadequacy of quantum theory.

14. Give two applications of uncertainty principle.

15. What is the statistical interpretation of wave function? Explain it with figure.

16. Explain eigen value and eigen functions. When the eigen value is said to be degenerate?

17. What are the postulates of Bohr model of hydrogen atom?

18. Explain correspondence principle.

19. What are the postulates of quantum mechanics?

20. Briefly explain probability density and probability current density.

21. What is linear operator? Explain commuting and anti-commuting operators.

22. Explain Heisenberg picture.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** carries **4** marks.

23. A metallic surface when illuminated with light of wavelength 3333 Å. emits electrons with energies upto 0.6 eV. Calculate the work function of the metal.

24. If the position of a 5 keV electron is located within 2 Å. what is the percentage uncertainty in its momentum?

25. A particle constrained to move along the x-axis in the domain $0 \le x \le L$ has a wave function $\psi(x) = \sin(n\Pi x/L)$, where n is an integer. Normalize the wave function.

26. The wave function of a particle in a state is $\psi = N\exp\{-x^2/2\alpha\}$, where $N = \{1/\pi\alpha\}^{1/4}$. Evaluate $\langle x^2 \rangle$ and $\langle p \rangle$.

27. A photon of wavelength 4 Å strikes an electron at rest and is scattered at an angle of 150° to its original direction. Find the wavelength of the photon after collision.

28. What is the ratio of kinetic energy of an electron to that of a proton if their de Broglie wavelengths are equal?

29. For an electron in a 1D infinite potential well of width 1 Å, calculate

    (a) the separation between two lowest energy levels

    (b) the frequency and wavelength of the photon corresponding to a transition between these two energy levels.

30. A harmonic oscillator is in the ground state:

    (a) Where is the probability density maximum?

    (b) What is the value of maximum probability density?

31. Prove the following commutation relation:

    $$[[A,B],C] + [[B,C],A] + [[C,A],B] = 0$$

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** carries **15** marks.

32. Obtain energy eigen value and eigen function of a linear harmonic oscillator.

33. Derive the eigen value and eigen function of a square well potential with rigid wall.

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34. Obtain time dependent and independent Schrödinger equations.

35. Explain Bohr model of hydrogen atom. Obtain the expression for energy and frequency of spectral line for hydrogen like atom.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

Core Course

PC 1642 : STATISTICAL MECHANICS AND QUANTUM MECHANICS

(2017 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. Each carries **1** mark.

1. What is photoelectric effect?

2. What is de Broglie hypothesis?

3. What is Weins displacement law?

4. Define ensemble.

5. What is uncertainty principle?

6. State Boltzmann's entropy relation.

7. Write one dimensional time dependent Schrödinger equation.

8. Explain phase space.

9. What are stationary states?

10. Write the quantum mechanical operators of energy and momentum.

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions. Each carries **2** marks.

11. Give the important conclusion of photoelectric effect.

12. Explain the Rutherford planetary model.

13. Explain correspondence principle.

14. Give two applications of uncertainty principle.

15. What is the Plank's quantum hypothesis?

16. Explain microcanonical ensemble.

17. What are the postulates of Bohr model of hydrogen atom?

18. Explain thermodynamic probability.

19. What are the postulates of quantum mechanics?

20. Discuss the concept of normalization.

21. Explain microstates and macrostates.

22. Explain Compton effect.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions . Each carries **4** marks.

23. A metallic surface when illuminated with light of wavelength 3333 Å emits electrons with energies upto 0.6 eV. calculate the work function of the metal.

24. If the position of a 5 keV electron is located within 2 Å, what is the percentage uncertainty in its momentum?

25. What is the work function of a metal if the threshold wavelength for it is 580 nm? If light of 475 nm wavelength falls on the metal, what is its stopping potential?

26. Write a note on indistinguishability of identical particles.

27. A photon of wavelength 4Å strikes an electron at rest and is scattered at an angle of 150° to its original direction. Find the wavelength of the photon after collision?

28. The uncertainty in the velocity of a particle is equal to its velocity. If $(\Delta p)\cdot(\Delta x) \approx h,$ show that the uncertainty in its location is its de Broglie wavelength.

29. Calculate the Fermi energy of sodium assuming that the metal has one free electron per atom. (Given $h = 6.625 \times 10^{-34}$ Js; mass of electron = 9×10^{-31} kg ; density of sodium = 970 kg/m^3; Avogadro's number : 6.02×10^{26} and atomic weight of sodium = 22.99)

30. If a photon has wavelength equal to the Compton wavelength of the particle, show that the photon energy is equal to the rest energy of the particle.

31. An electron gas obeys the Maxwell-Boltzmann statistics. Calculate the average thermal energy (in eV) of an electron of the system at 300 K. (Given Boltzmann's constant = 1.38×10^{-23} J/K)

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. Each carries **15** marks.

32. Obtain energy eigen value and eigen function of a linear harmonic oscillator

33. Obtain time dependent and independent Schrödinger equations.

34. Explain Bose-Einstein and Fermi-Dirac distribution function and write the applications of BE and FD statistics.

35. Derive Maxwell-Boltzmann velocity distribution law.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

Core Course

PC 1642 – STATISTICAL MECHANICS AND QUANTUM MECHANICS

(2018 & 2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. Answer should not exceed **two** sentences; **each** question carries **1** mark.

1. Define microstate in statistical mechanics.

2. Define entropy.

3. Write two examples of Fermions.

4. How many particles can be accommodated in a single energy state of bosons?

5. Write the equation for energy of a photon, with explanation of notations.

6. Define de Broglie hypothesis.

7. What are the uncertainty products?

8. Define the zero point energy of a harmonic oscillator.

9. Write the time dependent Schrodinger equation of a particle in one dimension.

10. Prove that the probability $\psi * \psi$ in quantum mechanics is real and positive.

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions in a paragraph. **Each** question carries **2** marks.

11. Define momentum space in statistical mechanics.

12. Explain phase space.

13. Explain bosons with example.

14. Distinguish between bosons and Fermions based on their wave functions.

15. Explain Bose Einstein condensation.

16. Write the postulates of free electron model.

17. Explain Rutherford's planetary model of atom and its drawbacks.

18. Explain how work function of a metal changes the kinetic energy of photo electrons.

19. Explain the postulates of Bohr atom model.

20. What is black body?

21. Explain the properties of a wave function.

22. Explain box normalisation.

23. How the quantum mechanical probability is related the wave function?

24. Explain stationary states.

25. Write and explain the uncertainty principle.

26. Explain Delta function potential.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions in a sentence or two, **each** question carries **4** marks.

27. Distinguish between canonical and grand Canonical ensembles.

28. A coin is tossing 8 times. Calculate the probability to get 6 heads and 2 tails.

29. Distinguish between a microstate and a macrostate.

30. Given that Boltzmann constant is 1.38×10^{-23} JK^{-1} and Avogadro number is 6.6×10^{23} Calculate the value of root mean square speed of molecules of Oxygen molecule at 300K. Oxygen has an atomic weight of 16 u.

31. Calculate the fermi velocity of an electron if it's the Fermi energy is 3.2 eV, mass of an electron is 9.1×10^{-31} kg.

32. Calculate the wavelength of a photon to just emit an electron from a metallic surface of work function 2.6 eV. Given that Planck's constant is 6.602×10^{-34} Js and charge on an electron is 1.6×10^{-19} C.

33. Compare the de Broglie wavelengths of an electron and a proton when they are moving at a speed of 10000 m/s in vacuum. Mass of electron is 9.1×10^{-31} kg and mass of a proton is 1.66×10^{-27} kg.

34. Calculate the wavelength of light emitted due to the transition from n=4 state to n=2 state in a hydrogen atom. Given that the ionization potential of hydrogen atom is -13.6 eV.

35. The average life time of an excited atomic state is 10^{-10} s. The spectral line associated with the decay of the state is 500nm. Estimate the uncertainty in measuring the wavelength of the width of the line. Planck's constant is 6.602×10^{-34} Js.

36. The uncertainty of the velocity of particle is equal to half of its actual velocity. If $\Delta p.\Delta x = h,$ show that the uncertainty in its position is its de Broglie wavelength. Given that the mass of the particle is constant and no relativistic variation of mass is assumed.

37. Normalize the wave function $\psi(x) = A\exp(-ax^2)$ where a and A are constants over the domain $-\infty \leq x \leq \infty$. Given that $\int\limits_{-\infty}^{+\infty}\exp(-2ax^2)\,dx = \sqrt{\pi/2a}$.

38. Find the expression for probability of a particle trapped in a box of width L. The particle can be found between $x_1 = 0.45L$ and $x_2 = 0.55L$.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions, **each** question carries **15** marks.

39. Write a note on the Maxwell Boltzmann distribution and velocity distribution of ideal gas molecules. Write the expressions for average speed, most probable speed and root mean square speed. Compare these velocities of a H_2 molecule.

40. What is quantum statistics? Derive Bose - Einstein statistical distribution.

41. What is ultraviolet catastrophe of the theory of a blackbody and how it was resolved by Planck's theory?

42. Prove that in Compton scattering, the change in wavelength is independent of the energy of radiation collide with the electron. Write the expression for Compton wavelength.

43. Explain the particle in a box problem in quantum mechanics.

44. Discuss the theory of quantum mechanical oscillator. Find its energy eigen value and zero point energy.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Group2(a) – PHYSICS AND COMPUTER APPLICATIONS

PC 1671 – COMPUTER NETWORKS AND SECURITY

(2018 & 2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. What is networking?

2. What do you mean by bit rate?

3. Who invented PGP protocol?

4. DNS stands for?

5. What is public key cryptography?

6. Expand FTP.

7. CSMA stands for?

8. What is router?

9. What is a packet?

10. What is a plane text?

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions. Each question carries **2** marks.

11. What is gateway?

12. List the type of data flows.

13. What are datagrams?

14. What is the difference between hub and switch?

15. Given the bit rate, how can we calculate baud rate?

16. What is the use of file transfer protocol?

17. What is message digest?

18. List any four advantages of fibre optics.

19. What is the role of application layer?

20. What is a block cipher?

21. What is Ethernet?

22. What do you mean by pipelining?

23. What is the use of DES?

24. What is firewall?

25. What is a virus?

26. Why do we use encryption?

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. Each question carries **4** marks.

27. What are the three types of switching in networks? Explain.

28. Explain various interfacing devices.

29. Why network security is important?

30. Differentiate TCP and UDP.

31. Write a note on cyclic redundancy check.

32. Explain briefly about IP security.

33. How radio transmission is done?

34. Write a note on digital signatures.

35. Explain CSMA/CD.

36. What is symmetric key cryptography? Explain with examples.

37. Write a note on leaky bucket algorithm.

38. What are the applications of S/MIME?

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. Each question carries **15** marks.

39. Explain in detail the OSI model.

40. Discuss in detail, private key cryptography. Illustrate with examples.

41. Write a paragraph on distance vector routing.

42. What is the use of RSA algorithm?

43. What is the relevance of information security?

44. Discuss about Multiple Access Protocols.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Group 2(a) – Physics and Computer Applications

Core Course

PC 1672 : OPERATING SYSTEM

(2018 & 2019 Admission)

Time : 3 Hours   Max. Marks : 80

PART – A (Very Short Answer Questions)

Answer **all** questions. **Each** question carries **1** mark.

1.   What is a process?

2.   What you mean by sequential access in a file?

3.   What is a system call?

4.   What do you mean by preemptive scheduling?

5.   Write need for process synchronization.

6.   What do you mean by operating system interfaces?

7.   What is a critical section?

8.   What is the use of Operating System?

9. Expand the term PCB.

10. Write about free space management.

PART – B (Brief Answer Questions)

Answer any **eight** questions. **Each** question carries **2** marks.

11. Explain any one type of Operating system.

12. Write note on Critical section problem.

13. Explain process synchronisation.

14. Write notes on swapping technique used in memory management.

15. What do you mean by deadlock avoidance?

16. Write notes on any one memory management technique.

17. Write notes on various security threats.

18. What is the use of a disk scheduling?

19. What is dining philosopher's problem?

20. Mention two preemptive scheduling mechanism.

21. Mention two operations that can be performed on process?

22. What do you mean by kernel I/O subsystem?

23. Explain physical address space.

24. What is a RAG?

25. Differentiate between fork() and clone() system calls.

26. Write note on access matrix.

(8 × 2 = 16 Marks)

PART – C (Short Essay Type Questions)

Answer any **six** questions. **Each** question carries **4** marks.

27. Short note on real time OS.

28. Explain bounded buffer problem.

29. Explain disk structure.

30. Explain the concept of paging.

31. Explain about memory mapping mechanisms

32. Explain any one deadlock avoidance algorithm.

33. Short note on multi threading.

34. Explain various principles of OS protection.

35. Write note on operating system functions.

36. Short note on fragmentation.

37. Short note on address binding.

38. Short note on inter process communication.

(6 × 4 = 24 Marks)

PART – D (Long Essay)

Answer any **two** questions. **Each** question carries **15** marks.

39. Explain various protection and security mechanism.

40. Explain critical section problems

41. Explain the concept of virtual memory.

42. Explain non contiguous memory allocations.

43. Explain various file management mechanisms.

44. Explain the concept of thread and multithreading.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

PC 1661.1 : ASTRONOMY AND ASTROPHYSICS

(2014 & 2017 Admission)

Time : 3 Hours　　　　　　　　　　　　　　　　　　Max. Marks : 80

SECTION – A

Answer **all ten** questions. **Each** carry of **1** mark.

1. What is Astrophysics?

2. Discuss "superforce" during the earliest Gamowian.

3. The temperature at which energy transforms into mass, and vice versa, is?

4. Which is the home galaxy to our solar system?

5. Name the process by which energy is produced in stars

6. What are dark matters?

7. The critical black hole radius is called as ———— .

8. What is the speed with which, the Earth rotate in its axis?

9. A perfect emitters is called as ———— .

10. Define light year.

(10 × 1 = 10 Marks)

SECTION – B

Short answer type questions (Answer any **eight** questions of **2** marks each)

11. What are microwave background radiations?

12. How does the mass of a star is related to its life-style?

13. What are neutron stars?

14. How energy is produced in Sun?

15. Give Planck radiancy law and explain terms.

16. Write a note on black body emitter.

17. What are solar flares and solar wind?

18. What are the characteristics of main sequence stars?

19. Explain triple-alpha process.

20. Discuss Chandrasekhar limit.

21. What are the types of meteorites?

22. What is the basis for the calendars?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. Outline the H-R diagram.

24. What are the limitations of standard model? How the inflation theory does explained these phenomenon?

25. Briefly discuss different layers of Sun.

26. Explain the classification of stars based on their spectral types.

27. Stale and explain Stefan-Boltzmann law. How it is related to the luminosity?

28. Explain

    (a)   White dwarf

    (b)   Brown dwarf

    (c)   Dark dwarf

29. What are galaxies? Discuss the types of galaxies.

30. Discuss Kepler's laws of planetary motion.

31. Give a note ons

    (a)   Moon

                             Or

    (b)   Jupiter

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. (a) Give a note on the scope and importance of Astronomy.

    (b) Brief the methods of Astrophysics.

33. Give a note on the following

    (a) The Sun

    (b) Comets

    (c) Black holes.

34. What are planets? Explain the formation of planets.

35. (a) Give a note on the evolution of calendar.

    (b) Discuss the celestial coordinate system.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

PC 1661.1 : ASTRONOMY AND ASTROPHYSICS

(2018 & 2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all ten** questions. **Each** question carries **1** mark.

1. What is Astrophysics?

2. Discuss "superforce" during the earliest Gamowian.

3. The temperature at which energy transforms into mass, and vice versa, is?

4. Which is the home galaxy to our solar system?

5. Name the process by which energy is produced in stars.

6. What are dark matters?

7. The critical black hole radius is called as _____

8. What is the speed with which, the Earth rotate in its axis?

9. A perfect emitter is called as _____

10. Define light year.

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions of **2** marks each.

11. What happen to mass of a particle, when temperature increases? Why?

12. According to the inflation theory, what is visible universe?

13. What are microwave background radiations?

14. How does the mass of a star is related to its life-style?

15. What are neutron stars?

16. How energy is produced in Sun?

17. Give Planck radiancy law and explain terms

18. Write a note on black body emitter.

19. What are solar flares and solar wind?

20. What are the characteristics of main sequence stars?

21. Explain RR Lyrae variables.

22. Explain triple-alpha process

23. Discuss Chandrasekhar limit.

24. What do you mean by invariable plane?

25. What are the types of meteorites?

26. What is the basis for the calendars?

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions, not exceeding a paragraph. **Each** question carries **4** marks.

27. Outline the H-R diagram.

28. What are the limitations of standard model? How the inflation theory does explained these phenomenon?

29. Briefly discuss different layers of Sun.

30. In a Star,.13.6 eV of energy is required to ionize hydrogen from ground state.

    (a) What will be the temperature inside the star?

    (b) Find out the possible wavelength and nature of the emitted radiation?

31. Explain the classification of stars based on their spectral types.

32. State and explain Stefan-Boltzmann law. How it is related to the luminosity?

33. Explain
    (a) White dwarf
    (b) Brown dwarf
    (c) Dark dwarf

34. What are galaxies? Discuss the types of galaxies.

35. Discuss Kepler's laws of planetary motion.

36. Give a note on

    (a) Moon

                    OR

    (b) Jupiter

37. Give a detailed note on Asteroids.

38. Discuss the celestial coordinate system.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. **Each** question carries **15** marks.

39. (a) Give a note on the scope and importance of Astronomy.

    (b) Brief the methods of Astrophysics.

40. Write a brief note on the birth and evolution of the universe.

41. Briefly explain stellar evolution.

42. Give a note on the following :
    (a) The Sun
    (b) Comets
    (c) Black holes

43. What are planets? Explain the formation of planets.

44. (a) Give a note on the evolution of calendar.

    (b) "The inclination of the Earth cause seasons." Comment on the statement.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Physics with Computer Applications

Elective Course

PC 1661.5 : NANOSCIENCE AND TECHNOLOGY

(2018 & 2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Very short answer type questions (Answer **all** 10 questions of **1** mark each)

1.   List the factors affecting electrical conductivity of nanomaterials.

2.   What is the Quantum Size effect?

3.   What is inert gas expansion?

4.   What do you mean by rapid solidification?

5.   Write the application of Quantum Cascade Laser.

6.   What is the full form of AFM?

7.   What is SPR in UV-visible studies of nanomaterials?

8.   What is a Buckyballs?

9. What is graphene?

10. Give any one of the application of single electron transistor.

(10 × 1 = 10 Marks)

SECTION – B

Short answer type questions (Answer any **eight** questions of **2** marks each)

11. Write a short note on electronic energy levels of nanoparticles.

12. Define Milling and mechanical alloying.

13. Define Specific surface area.

14. Mention some effects of size reduction of nanoparticles.

15. Briefly explain the Sol-Gel method.

16. Define the principle of XRD analysis of NPs.

17. How is TEM used for nanomaterials characterization?

18. What properties can be analyzed by FTIR studies?

19. Which is a better method TEM or SEM for nanoparticles analysis?

20. Write a short note Raman spectroscopy.

21. Why objects in the nanoscale cannot be seen by visible light?

22. Briefly explain the structure of Buckyballs.

23. Give some important properties of carbon nanotubes.

24. How to improve the performance of fuel cells by using carbon nanotubes?

25. Write a short note on quantum well infrared photodetector.

26. Explain the operation of single electron transistor.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks.

27. Explain Surface Plasmon Resonance (SPR) exhibited by nanoparticles.

28. List out the different processes used to make nanomaterials

29. Explain Scherer powder method in nanoparticles size analysis with a suitable XRD diagram.

30. Explain Bottom-up synthesis of nanoparticles.

31. List out some important application of quantum dots.

32. Explain with a neat diagram TEM setup and its use in analyzing nanostructures

33. Explain the principle of XRD analysis of NPs.

34. Explain the structure of carbon nanotubes?

35. Explain UV-Vis studies on nanoparticles.

36. Write short note on

    (a) Buckminsterfullerene

    (b) graphene

37. Find the de Broglie wavelength of electrons accelerated through a potential difference of $30\,keV$.

38. Briefly explain the Sensing and Ultrafast Free Space Communication Applications of Quantum Cascade Lasers.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks.

39. Compare the quantum confinement and resulting structures like Quantum dots, quantum wells and their physical significance.

40. Explain in detail Electrical, magnetic, optical, thermal and mechanical properties of Nanostructured materials.

41. Explain the operating principle, technology and application of Resonant Tunneling Diodes.

42. Briefly explain the synthesis of nanoparticles by using Chemical vapour Deposition (CVD) technique.

43. Explain the working of Scanning Tunneling Microscope with a neat diagram. Give its important applications.

44. Explain the synthesis and applications of carbon nanotubes.

(2 × 15 = 30 Marks)

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