C 4395 (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION, APRIL 2021

Physics/Applied Physics

APH 2C 02—BASIC ELECTRONIC DEVICES AND CIRCUITS

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. What is meant by forward bias ?
2. Explain how Collector, base and emitter are doped ?
3. Obtain the relation between β and α .
4. If biasing is not done in a circuit, what happens ?
5. Write a note on feedback circuits.
6. Explain faithful amplification.
7. What do you understand by single stage transistor amplifiers ?
8. Explain the terms Frequency response.
9. What is a JFET ?
10. What is an oscillator ?
11. What are the drawbacks of LC oscillators ?
12. How will you get undamped oscillations from a tank circuit ?

(8 × 3 = 24 marks)

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. (i) Differentiate between NPN and PNP transistors.

    (ii) Draw the circuit of a Common Base circuit.

Turn over

14. In a common base connection, IE = 1 mA, IC = 0.95 mA. Calculate the value of IB.

15. Draw and explain Input characteristic of a CB connection.

16. In a common base connection, the emitter current is 1 mA. If the emitter circuit is open, the collector current is 50 μA. Find the total collector current. Given that α = 0.92.

17. What do you understand by stabilisation of operating point ?

18. What do you understand by d.c. and a.c. load lines ? How will you construct them on the output characteristics ?

19. Explain the following terms : (i) Frequency response ; (ii) Decibel gain ; and (iii) Bandwidth.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. With a neat circuit diagram, explain the working of transformer-coupled transistor amplifier.

21. Briefly explain the following :

    (i) RC oscillators.

    (ii) Wien bridge oscillators.

    (iii) Colpitt's Oscillator.

(1 × 11 = 11 marks)

C 4394 (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION, APRIL 2021

Physics/Applied Physics

PHY 2C 02—OPTICS, LASER, ELECTRONICS

Time : Two Hours Maximum : 60 Marks

The symbols used in the question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. What is meant by destructive interference ?
2. Explain, why very thin film appears black in reflected light ?
3. What is Fraunhofer class of diffraction ?
4. What is meant by resolving power of a grating ?
5. State and explain Brewster's law.
6. Define optical activity.
7. What is a zener diode ? Explain its characteristics.
8. Define ripple factor of rectifier circuit. What is the value of ripple factor for full wave rectification ?
9. What are the different types of transistor configurations ? Explain.
10. Describe the action of a capacitor-filter circuit.
11. Explain OR function with a two input OR gate.
12. Explain population inversion. How it is achieved ?

(8 × 3 = 24 marks)

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Explain constructive and destructive interference using Young's experiment.
14. Describe the principle and working of He-Ne laser.

Turn over

15. How are unpolarized, plane circularly polarized and elliptically polarized light distinguished ?

16. Distinguish between Positive and Negative crystals.

17. Obtain the relation between current amplification factors α , β and γ .

18. A diffraction grating has 0.15 m of surface ruled with 6×10^5 lines per meter. What is its resolving power in the first order ?

19. A transistor is connected in common emitter (CE) configuration in which collector supply is 8 V and voltage drop across resistance $R_C = 800\,\Omega$ connected in the collector circuit is 0.5V and $\alpha = 0.96$. Determine the collector-emitter voltage and base current.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Derive an expression for the radius of n^{th} ring in a Newton's ring arrangement in the reflected system. Describe an experiment to determine the wavelength of monochromatic light using Newton's ring arrangement.

21. Describe principle and working of any oscillator with neat diagram and explain how it produces sustained oscillation. Derive the necessary formula.

(1 × 11 = 11 marks)

C 4393-B (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2021

Physics/Applied Physics

PHY 2B 02/APH 2B 02—MECHANICS—II

(2020 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in the question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Define fictious force ? Deduce an expression for the force experienced by a particle in a co-ordinate system with uniform acceleration A.
2. State and explain the principle of equivalence.
3. Define inertial and non-inertial frame of references with proper examples.
4. Explain what is meant by the Galilean transformations.
5. What is a central force ? Show that the motion of a particle under central force is always confined to a single plane.
6. State law of equal areas. How is it related to angular momentum ?
7. Establish the differential equation of a harmonic oscillator and write down its general solution.
8. Explain Simple Harmonic Motion and discuss its characteristics.
9. Briefly explain about (a) Phase velocity ; and (b) Group velocity
10. Differentiate between dispersive and non-dispersive sinusoidal waves.
11. Write down the general expression for a plane progressive wave traveling :
    (a) Positive x direction ; and
    (b) Negative x direction.
12. Write two important properties of travelling waves.

(8 × 3 = 24 marks)

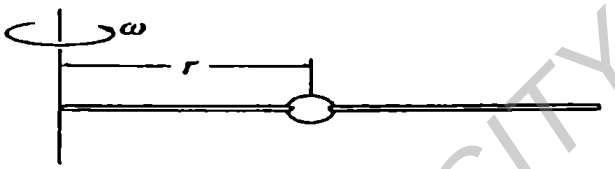
Turn over

Section B (Paragraph / Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. A small weight of mass m hangs from a string in an automobile which accelerates at rate A. What is the static angle of the string from the vertical, and what is its tension ? Analyze the problem both in an inertial frame and in a frame accelerating with the car.

14. A bead slides without friction on a rigid wire rotating at constant angular speed ω. Find the force exerted by the wire on the bead.



15. Define the Foucault Pendulum. If m is the mass and l is the length of the pendulum, find the time for the plane of oscillation to rotate once.

16. A satellite of mass m = 2000 kg is in elliptic orbit about the earth. At perigee (closest approach to the earth) it has an altitude of 1100 km and at apogee (farthest distance from the earth) its altitude is 4100 km. Calculate the energy needed to put the satellite into orbit by neglecting losses due to friction.

17. What are stationary satellites ? Calculate the height at which such a satellite must revolve in its orbit around the earth.

18. Evaluate the time average values of the potential and kinetic energies of a frictionless harmonic oscillator.

19. Define Q factor of an oscillator. A musician's tuning fork rings at A above middle C, 440 Hz. A sound level meter indicates that the sound intensity decreases by a factor of 5 in 4 s. Calculate the Q of the tuning fork.

(5 × 5 = 25 marks)

Section C (Essays)

Answer any **one** *question.*
The question carries 11 *marks.*

20. What is a Pulse ? Discuss Fourier analysis of a non-periodic function with suitable plots.

21. State and prove Kepler's laws of planetary motion. Show that the areal velocity of a planet around the sun is constant.

C 4393 (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2021

Physics/Applied Physics

PHY 2B 02/APH 2B 02—MECHANICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Write Galilean transformation equations for position and velocity for inertial frames of reference.
2. What do you mean by fictitious force ?
3. State and explain Kepler's second law of planetary motion.
4. What do you mean by centre of mass of a system ? Write the expression for position vector of centre mass of a system of two particles with masses m_1 and m_2 and position vectors r_1 and r_2 respectively.
5. State and explain the principle of equivalence.
6. What is the condition for the periodic motion of a damped harmonic oscillator ?
7. Define simple harmonic motion. Give two examples.
8. Write the equation for an undamped forced harmonic oscillator and explain the terms in it.
9. Show that the transverse wave on a continuous string is non-dispersive.
10. What is Refraction ? Why does it happen ?
11. Show that the total energy of a simple harmonic oscillator is constant.
12. What is Modulation ?

(8 × 3 = 24 marks)

Section B (Paragraph/Problem)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Deduce an expression for the apparent force on a particle of mass m in a rotating co-ordinate system with angular velocity Ω.

14. What is a Foucault pendulum ? Find the time for the plane of oscillation to rotate once at a latitude 45°for a pendulum with mass m, length l and frequency $\sqrt{\frac{g}{l}}$.

15. For what values of n are circular orbits stable with the potential energy $U(r) = -A/r^n$, where $A > 0$?

16. A satellite of mass m = 2000 kg is in elliptical orbit about the earth. At perigee, it has an altitude 1,100 km and at apogee its altitude is 4,100 km. What is the energy required to put the satellites into orbit ?

17. Perform Fourier analysis of a travelling wave in a homogeneous non-dispersive medium.

18. Derive an expression for the superposition of two sinusoidal travelling waves. Find out the expression for modulation frequency and average frequency.

19. Obtain the relation between group velocity and the phase velocity.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. (a) Explain the general properties of central force motion.

    (b) Plot and explain energy diagram for planetary motion.

21 Set up the equation of motion for the undamped forced oscillator. Analyse the system and explain the variation of amplitude with the driving frequency.

(1 × 11 = 11 marks)

C 4172 (Pages : 3) Name.....

Reg. No.....

SECOND SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, APRIL 2021

Physics/Applied Physics

APY 2C 02—BASIC ELECTRONIC DEVICES AND CIRCUITS

Time : Three Hours Maximum : 64 Marks

Section A

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

1. At room temperature, an intrinsic silicon crystal acts approximately as :

   (a) Battery. (b) A conductor.

   (c) An insulator. (d) A piece of copper wire.

2. The barrier voltage at a *pn* junction for germanium is about :

   (a) 3.5V. (b) 3V.

   (c) Zero. (d) 0.3V.

3. The ripple factor of half wave rectifier is :

   (a) 2. (b) 1.21.

   (c) 2.5. (d) 0.48.

4. Efficiency of a full wave rectifier is :

   (a) 81.2%. (b) 40%.

   (c) 50%. (d) None of the above.

5. Zener diodes are used primarily as :

   (a) Amplifiers. (b) Voltage regulators.

   (c) Rectifiers. (d) Oscillators.

6. If the value of α is 0.9, then value of β is :

   (a) 9. (b) 0.9.

   (c) 900. (d) 90.

7. In a P-channel JFET, the charge carriers are:

   (a) Electrons. (b) Holes.

   (c) Both electrons and holes. (d) None of the above.

8. An oscillator converts :

   (a) a.c power into d.c. power.
   (b) d.c.power into a.c. power.
   (c) Mechanical power into a.c. power.
   (d) Mechanical power into d.c. power.

9. An oscillator employs ———— feedback.

   (a) Positive.
   (b) Negative.
   (c) Neither positive nor negative.
   (d) None of the above.

10. An SCR has three terminals viz :

   (a) Cathode, anode, gate.
   (b) Anode, cathode, grid.
   (c) Anode, cathode, drain.
   (d) None of the above.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Each question carries 2 *marks.*

11. What do you understand by a *n*-type semiconductor ?
12. Explain the formation of potential barrier in a PN junction.
13. What are filter circuits ? Explain the filtering action of capacitor filter.
14. Define β. Show that $\beta = \frac{\alpha}{1-\alpha}$.
15. What is JFET ? Sketch the basic structure of a P-channel JFET.
16. Briefly explain amplitude modulation.
17. What are the advantages of negative voltage feedback ?

(7 × 2 = 14 marks)

Section C

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

18. With a neat circuit diagram explain the working of a centre-tap full wave rectifier. Derive an expression for the ripple factor for a full wave rectifier.
19. Briefly explain the classification of power amplifiers.
20. With a circuit diagram explain the principle and working of a Hartley oscillator.
21. Briefly explain the construction and working of a UJT.
22. With a circuit diagram explain the working of a RC coupled transistor amplifier.

(3 × 4 = 12 marks)

Section D

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

23. An a.c. supply of 230V is applied to a half wave rectifier circuit through a transformer of turns ratio 10 : 1. Find (i). the output d.c. voltage ; and (ii) PIV. Assume the diode to be ideal.

24. The collector leakage current in a transistor is 300 μ A in CE arrangement. If now the transistor is connected in CB arrangement, what will be leakage current ? Given that $\beta = 120$.

25. A JFET has the following parameters $I_{DSS} = 32mA$; $V_{GS(off)} = -8V$; $V_{GS} = -4.5$ V. Find the value of drain current.

26. The voltage gain of an amplifier without feedback is 3000. Calculate the voltage gain of the amplifier if negative voltage feedback is introduced in the circuit. Given that feedback fraction is 0.01.

27. A phase shift oscillator uses 5pF capacitors. Find the value of R to produce a frequency of 800 kHz.

(3 × 4 = 12 marks)

Section E

Answer any **two** *questions.*
Each question carries 8 *marks.*

28. Name the three possible transistor configurations. Flow will you determine the input and output characteristics of CE connection experimentally.

29. (i) Define JFET parameters. Obtain the relation between them. (4 marks)

    (ii) Write a short note on MOSFET. (4 marks)

30. What do you understand by transistor biasing ? Explain biasing with emitter and voltage divider bias.

31. (i) Describe with a neat diagram the working of a tuned collector oscillator. (6 marks)

    (ii) What are the limitations of amplitude modulation ? (2 marks)

[2 × 8 = 16 marks]

C 4171-B (Pages : 3) Name.....

Reg. No.....

SECOND SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, APRIL 2021

Physics/Applied Physics

PHY 2C 02—MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

Time : Three Hours Maximum : 64 Marks

Symbols used in this question paper have their usual meanings.

Section A (Answer in a word or phrase)

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

1. A rocket is based on the principle of conservation of :

   (a) Linear momentum. (b) Angular momentum.

   (c) Energy. (d) Mass.

2. The necessary and sufficient condition for a particle executing S.H.M is :

   (a) Constant period.

   (b) Proportional between acceleration and displacement from mean position.

   (c) Constant acceleration.

   (d) Proportional between restoring force and displacement from mean position.

3. The rest mass of a photon is :

   (a) $\frac{h\upsilon}{c^2}$. (b) $\frac{h\upsilon}{c}$.

   (c) $\frac{h}{c\lambda}$. (d) Zero.

4. According to Schrodinger a particle is equivalent to a :

   (a) Single wave. (b) Wave packet.

   (c) Light wave. (d) Cannot behave as wave.

5. Define Simple Harmonic motion.

6. What are the postulates of quantum mechanics ?

7. At what velocity the mass of a particle would be 10 times its rest mass ?

   (a) 0.5c. (b) 0.20c.

   (c) 0.125c. (d) 0.995c.

8. A central force is an example of :

   (a) Conservative force. (b) Non-conservative force.

   (c) Fictitious force. (d) Frictional force.

9. When a clock is placed in a moving rocket, the clock runs :

   (a) Slow.

   (b) Fast.

   (c) At same rate.

   (d) Show when rocket moves farther and fast when it approaches.

10. What is the relation between conservative force and potential energy ?

(10 × 1 = 10 marks)

Section B

Answer in a short paragraph- three or four sentences.
Answer **all** *questions.*
Each question carries 2 *marks.*

11. What are the postulates of special theory of relativity ?
12. What is Corioli's force ? Explain its orgin.
13. Write down the Lorentz transformation equations.
14. What do you mean by inertial and non-inertial frames ? Explain with examples.
15. State the law of conservation of angular momentum.
16. Write down an expression for equation of plane progressive wave and explain each term.
17. Write the total energy of a simple harmonic oscillator and explain the terms.

(7 × 2 = 14 marks)

Section C

Answer in **a paragraph** *of about* **half a page to one page.**
Answer any **three** *questions.*
Each question carries 4 *marks.*

18. With suitable example explain Eigen value and Eigen function.
19. Write a note on Scanning Tunneling Microscope.
20. What is centrifugal force? Show that the effect of centrifugal force due to rotation of the earth on the acceleration due to gravity is maximum at the equator and minimum at the poles.

21. What were the explanations given for the negative result of the Michelson Moreley experiment ?

22. Explain the concept of time dilation.

(3 × 4 = 12 marks)

Section D

Problems-write all relevant formulas.
All important steps carry separate marks.
Answer any **three** *questions.*
Each question carries 4 marks.

23. A 4kg block extends a spring 0.16 metre from its unstretched position. The block is removed and a 0.50kg body is hung the same spring. If the spring is then stretched and released, what is its period of motion ?

24. In the Michelson - Morley experiment, the wavelength of the monochromatic light used is 4800Angstrom unite. What will be the fringe-shifit on the basis of stationary ether hypothesis if effective length of each path be 6 meters.(Given the velocity of the earth = 3×10^4 m/s and $c = 3 \times 10^8$m/s)

25. In the laboratory the life time of a particle moving with speed 2.8×10^8 m/s, is found to be 2.5×10^{-7}sec. Calculate the proper life-time of the particle.

26. Calculate the Coriolis force on a mass of 100g placed at a distance of 20cm from the axis of a rotating frame of reference if the angular speed of the frame is 10 rad/s.

27. What is the increase in the relativistic mass of a particle of mass 1g when it is moving with 0.8c ?

(3 × 4 = 12 marks)

Section E (Essays)

Answer in about **two pages.**
Answer any **two** *questions.*
Each question carries 8 marks.

28. Derive Lorentz transformation equations.

29. What are the fundamental postulates of Quantum Mechanics ? Explain their significance.

30. Derive the expressions with graphical representations for kinetic energy potential energy and total energy of a simple harmonic oscillator.

31. Derive the time dependent Schrodinger equation of matter waves. Give the Physical interpretation of wave function.

(2 × 8 = 16 marks)

C 4170 (Pages : 3) Name.....

Reg. No.....

SECOND SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
APRIL 2021

Physics/Applied Physics

PHY 2B 02/APY 2B 02—PROPERTIES OF MATTER WAVES AND ACOUSTICS

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions.*
1 *mark each.*

1. State Hook's law.
2. The reciprocal of Bulk modulus is ————————.
3. The bending moment for a circular cross section is ————————.
4. At what value of x, the velocity of a harmonic oscillator becomes maximum ?
5. Define Frequency.
6. Is the total energy E of harmonic oscillator a constant ?
7. State Fourier's theorem.
8. Give an example of damping in physical systems.
9. Define group velocity.
10. What is intensity of sound ?

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Write in two **or** *three sentences.*
2 *marks each.*

11. Give the relation connecting three elastic constants.
12. What are the limiting values of Poisson's ratio ?
13. What is the acceleration of a particle executing SHM ?

14. Write the expression for kinetic energy of a harmonic oscillator.

15. What is damping force ?

16. What are longitudinal waves ?

17. What is Reverberation ?

(7 × 2 = 14 marks)

Section C

Write any **five** *questions.*
Write in one **paragraph.**
4 marks each.

18. Explain I form of Girders.

19. Obtain the differential equation for SHM.

20. Describe quality factor and power dissipation.

21. Explain about an anharmonic oscillator.

22. Describe the modes of transverse vibrations in a string.

23. Write a note on energy density of a plane progressive wave.

24. Describe acoustic grating.

(5 × 4 = 20 marks)

Section D

Solve any **four** *problems.*
4 marks each.

25. Determine the force per unit area required to compress a volume of water by one percent. Bulk modulus of water is 2×10^{10} dynes/cm^2.

26. A harmonic oscillator has a total energy E. Determine the kinetic and potential energies when the displacement is one half the amplitude.

27. If the amplitude of a seconds pendulum with a bob of mass 0.2 kg is reduced to half its undamped value in 200 seconds. What is its quality factor Q ?

28. A particle executing SHM has an acceleration 0.02 m/s^2 when its displacement is 0.08 m. Find its time period of oscillation.

29. The frequency of the fourth harmonic in a stretched string of length 20 cm is 600 Hz. What is the velocity of the wave in the string ?

30. A brass rod of length 3 m is clamped at the centre. It emits a note of frequency 600 Hz, when it vibrates longitudinally. If the density of brass is 8.3×10^3 Kg/m^3. Calculate the Young's modulus.

31. A load 2 kg produces a certain extension in a wire of length 6 m and diameter 1 mm. What is the lateral contraction produced if $\sigma = 0.25$ and $Y = 7.48 \times 10^{10}$ N/m^2.

(4 × 4 = 16 marks)

Section E

Write any **two** *questions.*
10 *marks each.*

32. What is a Cantilever ? Discuss about the depression of a beam supported at the ends and loaded at the centre.

33. Discuss the theory of forced harmonic oscillator.

34. Explain piezo electric crystal method and determination of velocity of ultrasonic waves in a liquid.

35. Obtain an expression for the velocity of longitudinal waves in gases.

(2 × 10 = 20 marks)