RAN-1013

T.Y.B.Sc (PHYSICS) SEM: V (ID.) Examination

March / April - 2019

General Elective- Electronics (Can)

(Old or New to be mentioned where necessary)

[Total Marks: 50

સૂચના : / **Instructions**

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of ☛ signs on your answer book

Name of the Examination:

☛ T.Y.B.Sc (PHYSICS) SEM: V (ID.)

Name of the Subject :

☛ General Elective- Electronics (Can)

Subject Code No.: | 1 | 0 | 1 | 3 |

Seat No.:

Student's Signature

(2) The Marks shown on right is the full marks of Question.

(3) The symbols used in the question paper have their usual meaning.

Q-I Give short answer of the following. 8

1 When the maximum power is transferred?

2 The energy of wave is directly proportional to its _____ .

3 A differential amplifier does not amplify _____ signals.

4 Modulation factor m is the ratio of _____ .

5 Side band power depends upon the _____ . (m, fc, fs).

6 A differential amplifier is sometimes called _____ .

[A] short-tail pair   [B] long - tail pair

[C] open-tail pair   [D] close-tail pair

7 Write the conditions to find d.c. equivalent circuit for transistor amplifier circuit.

8 What is the ideal value of CMRR?

Q.2 A For CE transistor amplifier circuit, explain phase reversal process at the collector w.r.t. input signal at base. Also explain it with graphical demonstration.   10

OR

A Draw the circuit diagram of a two-stage RC coupled transistor amplifier. Explain the working and operation of the circuit in detail. Explain the frequency response and disadvantages.   10

B If the overall gain of the two-stage RC coupled transistor amplifier is 80 dB and the voltage gain of second stage is 150, calculate the voltage gain of first stage in dB.   4

OR

B Determine the transformer turn ratio for transforming maximum, power to 10 Ω load from source that has, output impedance of 1kΩ. Also calculate the voltage across the external load if the terminal voltage is 10 V_{rms}.   4

Q.3 A Explain differential amplifier. Explain working of differential inputs to get differential output.   10

Explain **non inverting** input with differential type output and single ended type output.

Explain **inverting** input with differential type output and single ended type output.
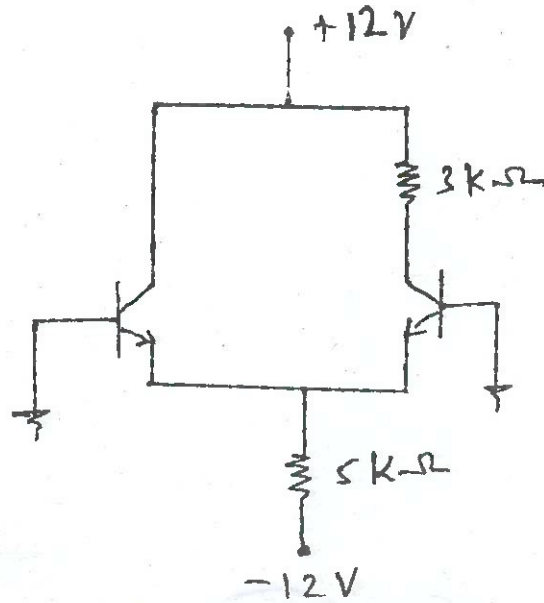
OR

A Explain AC analysis of differential amp. for non inverting input, single ended output. Derive the equation for voltage gain.   10

B Explain common mode gain and CMRR.   4

OR

B What are the currents and voltages in the single ended output circuit. Ignore V_{BE}.   4

+12 V

3 kΩ

5 kΩ

−12 V

Q.4 A What is AM? With analysis of AM wave, show that AM wave contains three frequencies viz. fc, fc+fs and fc-fs. Write down important points.   10
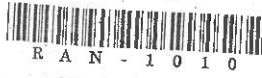
OR

A Explain the power in AM wave, deriving the necessary equations. Explain limitations of Amplitude Modulation.   10

B A carrier of 140V and 320 kHz is modulated by 70V, 300 Hz sine wave 4 signal. Find modulation index, side-band frequencies and bandwidth.

OR

B A 50 kW carrier wave is to be modulated to a level of (i)80% and (ii)10%. What is the total sideband power in each case?   4

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RAN-1010

Third Year B. Sc. Sem V Examination

March / April - 2019

Physics : Paper - IX

(Old or New to be mentioned where necessary)

[Total Marks: 50

સૂચના : / **Instructions**

નીચે દર્શાવેલ ☞ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
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Name of the Examination:
☞ Third Year B. Sc. Sem V

Name of the Subject :
☞ Physics : Paper - IX

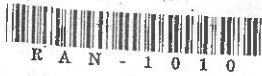Subject Code No.: | 1 | 0 | 1 | C |

Seat No.:

Student's Signature

Instructions:

(1) Draw neat diagrams wherever necessary.
(2) Symbols used in the paper have their usual meaning.
(3) Figures to the right indicate full marks of the question.
(4) Scientific calculator may be used.

1. **Answer the following questions in brief:** (08)

   1. What is an inertial reference frame?
   2. What do you mean by proper time?
   3. What is the value of the velocity of photon?
   4. What do you mean by microcanonical ensemble?
   5. What do you mean by ensemble?
   6. On which variables the density of phase point depends?
   7. Why the Lorentz transformation is called space time transformation?
   8. Give the set of Hamiltonian dynamical equation.

RAN-1010

RAN-1010

Third Year B. Sc. Sem V Examination

March / April - 2019

Physics : Paper - IX

(Old or New to be mentioned where necessary)

[Total Marks: 50

સૂચના : / Instructions

નીચે દર્શાવેલ ☞ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of ☞ signs on your answer book

Name of the Examination:
☞ Third Year B. Sc. Sem V

Name of the Subject :
☞ Physics : Paper - IX

Subject Code No.: | 1 | 0 | 1 | 0 |

Seat No.:

Student's Signature

Instructions:
(1) Draw neat diagrams wherever necessary.
(2) Symbols used in the paper have their usual meaning.
(3) Figures to the right indicate full marks of the question.
(4) Scientific calculator may be used.

1. **Answer the following questions in brief:** (08)

   1. What is an inertial reference frame?
   2. What do you mean by proper time?
   3. What is the value of the velocity of photon?
   4. What do you mean by microcanonical ensemble?
   5. What do you mean by ensemble?
   6. On which variables the density of phase point depends?
   7. Why the Lorentz transformation is called space time transformation?
   8. Give the set of Hamiltonian dynamical equation.

2. **(a)** Classify an ensembles and derive the equation of probability distribution function for canonical ensemble. **(10)**

OR

(a) Derive the equation of fluctuations in the number of particles of a system in a grand canonical ensemble. **(10)**

(b) Calculate the fractional fluctuation in energy for a perfect gas for N=1. **(04)**

OR

(b) Discuss the condition for statistical equilibrium. **(04)**

3 **(a)** Prove that mass-less particles must travel at the speed of light. **(10)**

OR

(a) Derive the Lorentz Transformation equation. **(10)**

(b) A rocket leaves the earth at a speed of 0.6c. A second rocket leaves the first at a speed of 0.9c with respect to the first. Calculate the speed of second rocket with respect to earth if it is fired in a direction opposite to the first. **(04)**

OR

(b) The average lifetime of μ-mesons at rest is 2.3 x 10⁻⁶ s. A laboratory measurement on μ-meson gives an average lifetime of 6.9 x 10⁻⁶ s, then what is the speed of the meson in the laboratory. **(04)**

4. **Attempt any Two.** **(14)**

1. Write a short note on phase space.
2. Explain the microscopic state and macroscopic state with examples.
3. Derive the Einstein's law of addition of velocities.
4. Explain relativity of simultaneity.

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RAN-1007

Third Year B.Sc. Semester - V Examination

March / April - 2019

Physics: Paper - VI

Mechanics and Mathematical Method

[Total Marks: 50

સૂચના : / Instructions

નીચે દર્શાવેલ ☞ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
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Name of the Examination:
☞ **Third Year B.Sc. Semester - V**

Name of the Subject :
☞ **Physics: Paper - VI**

Subject Code No.: | 1 | 0 | 0 | 7 |

Seat No.:

Student's Signature

1) Draw neat diagrams wherever necessary.
2) Symbols used in the paper have their usual meaning.
3) Figures to the right indicate full marks of the question.
4) Scientific calculator may be used.

1.   **Answer the following questions in brief:**   (08)

[1] What do you mean by constrain motion?

[2] Give physical significance of a curl of a vecor point function?

[3] Write any one limitation of Newton's law

[4] If 'a' is a constant vector then value of $\vec{\nabla}(\vec{a} \times \vec{r}) =$ ....

[5] What is an isolated system?

[6] Define line integral of a vector field.

[7] When the vector is said to be solenoidal vector?

[8] Define scleronomic constrain.

2   (a)   **Attempt any one of the following in details:**   (1

    (i) Derive Langrange's equation of motion for conservative system from D'Alembert's principle.

    (ii) Explain the conservation of momentum and angular momentum of the system of particle.

  (b)   **Attempt any one of the following in details:**   (

    (i) show that angular momentum is conserved in motion under a central force.

    (ii) A particle of mass m = 1g moves with a uniform velocity $v = (3\hat{i} + 4\hat{j})$ m/s. At time t, the particle passes through the point (1, 2, 0)m. Find the direction and the magnitude of the angular momentum about the origin at time t.

3   (a)   **Attempt any one of the following in details:**   (10

    (i) Derive expression for Grad, Divergence and curl in term of Cylindrical co-ordinate system.

    (ii) State and prove Stoke's theorem.

3   (b)   **Attempt any one of the following:**   (04)

    (i) Prove that div $(\vec{A} \times \vec{B}) = \vec{B} \cdot (\text{curl}\vec{A}) - \vec{A} \cdot (\text{curl}\vec{B})$

    ii) If $\vec{v} = (x + 2y + 4z)\,\hat{i} + (2ax + by - z)\,\hat{j} + (4x - y + 2z)\,\hat{k}$ is the irrotational field where a and b are constants. Find constant b.

4   **Attempt any two of the following in details:**   (14)

    (i) Verify green's theorem in plane for $\oint_c [(xy + y^2)\,dx + x^2\,dy]$ where C is the close curve of the region bounded by y = x and y = x², y = x and y = x² intersect (0,0) and (1,1)

    (ii) Find the total work done in moving a particle in a force field given by F = 3xy $\hat{i}$ - 5z $\hat{j}$ + 10x $\hat{k}$ along the curve C given by x = t² + 1, y = 2t² z = t³ from t = 1 to t = 2.

    (iii) Derive Newton's second law of motion from Hamilton's Principle.

    (iv) Derive Gauss' formula of electrostatic from Gauss Divergence theorem.

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RAN-1008

RAN-1008

Third Year B. Sc. (Semester -V) Examination

March / April - 2019

Physics : Paper - VII

Electromagnetism and Optics

(New Course)

[**Total Marks: 50**

સૂચના : / **Instructions**

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Name of the Examination:
☛ Third Year B. Sc. (Semester -V)

Name of the Subject :
☛ Physics : Paper - VII

Subject Code No.: | 1 | 0 | 0 | 8 |

Seat No.:

Student's Signature

Instructions:

(1) Figures to the right indicate the total marks carried by the question.

(2) Symbols used in the question paper have their usual meanings.

(3) Students are permitted to use non-programmable scientific calculator.

Q:1 **Answer the following in brief. (Any eight).** **(8)**

(1) What is the difference between a dielectric and an insulator?

(2) Which phenomenon of light is responsible for the blue color of the sky during the daytime?

(3) What is motional emf?

(4) State Lenz's law.

(5) What do you understand by Debye length in plasma?

(6) Can white light be used in obtaining interference fringes in Michelson's interferometer?

(7) Magnetic flux associated with a coil varies as

$\phi(t) = 3t^2 - 4t - 1 \, Wb$.

What will be the value of induced emf in it at t = 2s?

(8) What is/are the condition(s) to be satisfied for total internal reflection to take place?

(9) Define: electromagnetic induction.

(10) What are electrets?

Q:2(A) Attempt any one of the following. (10)

(1) State and explain Gauss' law in the presence of dielectric.

Also derive boundary conditions on $\vec{D}$ and $\vec{E}$ across the interface of the dielectrics.

(2) Derive an equation for the self-inductance per unit length of a long straight wire.

(B) Solve any one of the following. (4)

(1) A parallel plate capacitor has square plates with side 5 *cm* kept at a separation of 2 *mm*. The region between the two plates is completely filled with a dielectric of dielectric constant 2.4, what will be value of its capacitance? How much charge will be deposited on its plates if it is connected to a battery of 10 *V*?

(2) A long solenoid has 200 turns per cm. If a current of 5*A* is passed through it, what will be its self-inductance per unit length? The diameter of the solenoid is 4 *cm*.

Q:3(A) Attempt any one of the following. (10)

(1) Explain the principle on which the optical fibers operate. Explain numerical aperture in the case of optical fibers.

(2) Give the construction and working of Michelson's interferometer.

(B) Solve any one of the following. (4)

(1) When the movable mirror in the Michelson's interferometer is moved through a distance of 0.0589 *mm*, 200 fringes cross the field of view. What is the wavelength of the light used in it?

(2) What will be the critical angle when a glass slab having refractive index 1.68 is (i) kept in air and (ii) immersed in water? The refractive index of water is 4/3.

Q:4   Write short note on any two of the following.   (14)

(i) Polarization charge density

(ii) Skin effect

(iii) Pinch effect in plasma

(iv) Losses in optical fibers

(v) Haidinger's fringes

RAN-1009

T.Y.B.Sc. (Sem. V) Examination

March / April - 2019

Physics Paper VIII

(Atomic and Nuclear physics)

Time: 2 Hours]   **[Total Marks: 50**

સૂચના : / Instructions

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Name of the Examination:
☞ **T.Y.B.Sc. (Sem. V)**

Name of the Subject :
☞ **Physics Paper VIII**

Subject Code No.: | 1 | 0 | 0 | 9 |

Seat No.:

☐ ☐ ☐ ☐ ☐ ☐

Student's Signature

Instructions:

(1) Figures to the right indicate total marks carried by the question.

(2) All symbols used have their usual meaning.

(3) Students are allowed to use a non-programmable scientific calculator.

Q1   **Answer in brief:**   **[8]**

(1) Why the spectrum of sunlight has dark lines?

(2) What is Bohr radius?

(3) State De Broglie hypothesis.

(4) Which series of hydrogen spectrum falls into infrared region?

(5) What is pair production?

(6) Define the range of the particle.

(7) What is a frequency modulated cyclotron?

(8) What are the mesons?

Q2 (A) **Answer any one in detail:** [10

    (1) Discuss energy levels and spectra for Hydrogen atom

    (2) Write Schrodinger's equation in three dimensions for hydrogen atom. Discuss spherical polar co-ordinates and write Schrodinger's equation in spherical polar co-ordinates.

(B) **Answer any one :** [4]

    (1) If energy of hydrogen atom in its excited state is -7.19 x 10^{-5} eV. Find the quantum number of the Bohr orbit in a hydrogen atom. (Energy of hydrogen atom in its ground state is = -13.6 eV.)

    (2) Smallest Wavelength of the line in Paschen series is 820.3 nm. Calculate value of the Rydberg's constant.

Q3 (A) **Answer any one in detail:** [10]

    (1) Describe the construction and working of a cyclotron in detail. Derive equation of the energy of the ion.

    (2) Explain in detail about the proportional counter.

(B) **Answer any one :** [4]

    (1) Calculate the ionization current produced by 3 MeV deuterons passing through a gas at 1000 per second. Assuming that 25 eV is required to produce an ion pair

    (2) A cyclotron in which the flux density of 2.0 weber/m² is employed to accelerate protons. How rapidly should the electric field between the dees be reversed? (Proton mass = 1.67×10^{-27} kg and charge = 1.6 x 10^{-19} C)

Q4 **Answer any two** [14]

    (1) Explain space quantization using the uncertainty principle.

    (2) Discuss selection rules.

    (3) Discuss primary and secondary cosmic rays.

    (4) Write short note on solid-state detectors.

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RAN-1011

Third year B.Sc (Sem V) Examination

March / April - 2019

PHYSICS : Paper-X

PHY-5010 (Instruments and Digital Electronics)

સૂચના : / **Instructions**

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Fill up strictly the details of ☛ signs on your answer book

Name of the Examination:

☛ Third year B.Sc (Sem V)

Name of the Subject :

☛ PHYSICS : Paper-X

Subject Code No.: | 1 | 0 | 1 | 1 |

Seat No.:

Student's Signature

Instructions:-
1. Draw neat diagrams wherever necessary.
2. Symbols used in the paper have their usual meaning.
3. Figures to the right indicate full marks of the question.
4. Non programmable scientific calculators may be used.

Q1   Answer the following questions in brief: 08

(1) What is meant by magnetic condensing lens?

(2) Why does the deflection suffered by positive rays is much smaller than cathode rays when subjected to same electric field ?

(3) What is the function of liquid air trap in camera part of Thomson's apparatus?

(4) For which isotope the packing fraction is zero?

(5) Name two digital IC families in which basic logic gates are available.

(6) A four input AND gate is to be designed using diodes and resistances only. Give minimum number of diodes required.

(7) According to Boolean algebra ; $(A + B)(\overline{A} + B) =$ _____ (Fill in the blank)

(8) What is meant by quads and octets of 1s in K- map? .

Q2 (a)   **Attempt any one of the following in detail:**   10

(1) What is a mass spectrograph? Describe construction and working of Bainbridge mass spectrograph in detail with necessary formulae. Give its advantages.

(2) What is meant by visible and ultraviolet spectroscopy? Describe in detail (i) Constant deviation spectrograph technique for visible region and (ii) ultraviolet spectroscopic technique.

(b)   **Attempt any one of the following:**   04

(1) A beam of singly ionized atoms of mass 25 amu comes out of the velocity selector with velocity 3×10^7 m/s and enters into the chamber D of a Bainbridge mass spectrograph to trace a path of diameter 1.2 m. If the electric field in velocity selector is 600 KV/m then find (i) Magnetic induction in the chamber (ii) The path followed by isotope of mass 26 amu. $(1 \; amu = 1.67 \times 10^{-27} \; kg)$

(2) If mass of a proton is 1.008 amu and mass of a neutron is 1.009 amu then find mass defect, packing fraction and binding energy per nucleon for ${}^{9}_{4}Be$ (mass of ${}^{9}_{4}Be = 9.012 \; amu$).

Q3 (a)   **Attempt any one of the following in detail:**   10

(1) What is Boolean algebra? Describe symbols used in it and explain Boolean laws in detail. State De-Morgan's laws and its significance.

(2) What is meant by universal gates? Name the universal gates and explain realization of basic logic gates using them with necessary circuits.

(b)   **Attempt any one of the following:**   04

(1) What is logic of XNOR gate. Describe its use as word comparator with necessary circuit.

(2) Distinguish between two variable k-map and three variable k-map with suitable example.

Q4   **Answer any Two of the following:**   14

(1) Explain electrostatic and magnetic lenses and its use in electron microscope.

(2) Discuss working of Dempster's mass spectrograph and its advantages.

(3) Write detailed note on sum of product and product of sum methods for development of logic circuits.

(4) Write detailed note on binary adders.

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RAN-1012

Third Year B.Sc. Sem-V Examination

March / April - 2019

Physics : Paper XI

Numerical Analysis and Materials Science

[Total Marks: 50

સૂચના : / Instructions

1) Draw neat diagrams wherever necessary.
2) Symbols used in the paper have their usual meaning.
3) Figures to the right indicate full marks of the question.
4) Scientific calculator may be used.

1. **Answer the following questions in brief:** (08)

(1) What are significant figures? How many significant figures does the following numbers have: 3.1416; 0.66667 and 4.0687

(2) If thickness of a beam is 0.611 cm, then calculate the relative error in this measurement.

(3) Define a backward difference operator.

(4) Define interpolation.

(5) What do you mean by electrical resistivity? On what factors does it depend?

(6) What are superconductors?

(7) On what factors does magnetic susceptibility depend?

(8) Define Curie temperature for a ferromagnetic material.

2 (a) **Attempt any one of the following in details:**

(10)

(i) What are polynomials? Explain the iteration method to obtain the real root of an equation $f(x) = 0$

(ii) Define a forward difference operator. Derive the Newton's forward interpolation formula.

(b) **Attempt any one of the following:**

(04)

(i) Given that the equation $f(x) = tanx + x = 0$ has a root between 2 and 2.1, find the root using the bisection method correct to two decimal places.

(ii) Using the Newton-Raphson method, find the root of $f(x) = xSinx + Cosx$ correct to three decimal places.

3 (a) **Attempt any one of the following in details:**

(10)

(i) Discuss the relation between electrical conductivity and thermal conductivity for a metal and hence obtain the Wiedemann-Franz law.

(ii) Define critical current and critical magnetic field for a superconductor. Also discuss in details a type - I and a type - II superconductor.

(b) **Attempt any one of the following:**

(04)

(i) If the electrical conductivity and thermal conductivity of Cu at 25^0C is $0.641 \times 10^{+8}$ Ω^{-1} m^{-1} and 395 $W\text{-}m^{-1}$ K^{-1} respectively, then calculate Lorentz number (L).

(ii) If the conductivity of a metal at 20^0 C is 0.5×10^8 Ω^{-1} m^{-1} and the relaxation time of free electrons in it is 0.01 ns, then calculate the number density of free electrons in it. ($m_e = 9.11 \times 10^{-31}$ kg; $e = 1.6 \times 10^{-19}$ C)

4   **Write a short note on any two of the following**   (14)

(i) The bisection method for obtaining the real root of an equation $f(x) = 0$.

(ii) Construct a backward difference table for the following data.

x	0	5	10	15	20	25
y	7	11	14	18	24	32

(iii) Potential applications of a superconductor.

(iv) Properties of a paramagnet and a diamagnet.

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RAN-1153

BSC(Physics) Sem-VI Examination

March / April - 2019

ID-CAN-Electronics (Generic elective)

Time: 2 Hours]   [Total Marks: 50

સૂચના : / Instructions

1)

(10)

(04)

2)   Draw neat diagram wherever necessary.

3)   Symbols used in the question paper have their usual meaning.

(14)

4)   Figures to the right indicate full marks of the question.

5)   Scientific calculator may be used.

Q-1   Answer the question in short.   (8)

1)   Define Unity Buffer.

2)   What is input bias current?

3)   What are types of class of the amplifiers?

4)   Draw the symbol of Tunnel diode.

5)   Define solar cell and thermister of semi conductor device.

6)   Draw the block diagram of a feedback network.

7)   If $c_1 = 75\mu F$ and $c_2 = 750$ nf, what is the value of A_f and β ?

8)   Draw the circuit diagram of colpits oscillator using OP-AMP.

Q-2 (A) Answer any one of the following in details (10)

1) Explain the "OP-AMP basics". Derive expression for the voltage gain for inverting amplifier.

2) Explain offset voltages in OP-AMP .Derive the expression for the output voltage $V_{O(0ffset)}$ for a specific input voltage V_{IO} for OP-AMP.

(B) Answer any one of the following in details (4)

1) Determine the output voltage of an OP-AMP for input voltages of $V_{i1}=150\mu V$ and $V_{i2}=140\mu V$. The amplifier has a differential gain of $A_d=4000$. Calculate voltage for CMRR of (i) 10^2 (ii)10^4

2) Explain differential and common mode operation amplifier.

Q-3 (A) Answer any one of the following in details (10)

1) What is amplitude and harmonic distortion? Derive an equation for second harmonic distortion.

2) Explain the construction and working of SCR. Also draw and explain the I-V characteristic of SCR.

(B) Answer any one of the following in details (4)

1) Explain in detail 'Solar Cell'

2) For UJT for $V_{BB}=12V$, $\square=0.65$, $R_{B1}=2.2k\Omega(I_E=0)$ and $V_D=0.7V$, deterimine R_{B2}, R_{BB}, V_p.

Q-4 (A) Answer any one of the following in details (10)

1) Draw the transistorise circuit diagram of a Colpitts oscillator and explain its action. Obtain the equation to calculate frequency and condition of oscillation.

2) What is concept of feedback? Obtain an equation for gain, output and input impedance with feedback in case of voltage series feedback amplifier.

(B) Answer any one of the following in details (4)

1) In Colpitts oscillator for $C_1=250pF$, $C_2=375pF$, $L=37\mu H$ calculate the frequency of oscillation.

2) What are four possible topologies of a feedback amplifier? Draw block diagrams of all feedback amplifier configurations showing output and feedback signal.

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RAN-1147

T.Y.B.Sc. (Sem-VI) Examination

March / April - 2019

Physics : Paper-VI

Mechanics and Mathematical Method

[**Total Marks: 50**

Instruction:
(1) Draw neat diagrams wherever necessary.
(2) Symbols used in the paper have their usual meaning.
(3) Figures to the right indicate full marks of the question.
(4) Scientific calculator may be used.

1. **Answer the following questions in brief:** (08)

[1] Represent the addition of a complex number to its complex conjugate yields twice of the real part of the quantity.

[2] What is the modulus of $\frac{1-i}{1+i}$?

[3] Define neighbourhood of a point

[4] Which of the following term is an odd function ?
[a] Cosx [b] x^4 [c] xcosx [d] x^2

[5] What is the Newtonian principle of relativity.

[6] Mention the relation of their principle moment of inertia for 'asymmetric top'

[7] Write the unit of an angular momentum ?

[8] What is nutation?

2. **(a)** **Attempt any one of the following in details:** (10

   (i) Discuss rotating co-ordinate systems and obtain expression for effective force acting on a body accelerating in a uniformly rotating frame.

   (ii) Obtain Euler's equation of motion for rigid body.

(b) **Attempt any one of the following:** (04

   (i) A body is falling freely from a height of 1km above the surface of the earth Calculate the time of flight and displacement due to coriolis force at the north pole.

   (ii) 2 kg disc with a radius of 1 m rotates at a constant angular speed of 4 rad/s. What is the rotational kinetic energy of the disc ?

3. **(a)** **Attempt any one of the following in details** (1(

   (i) Explain geometrical representation of the sum, difference and product of the complex numbers.

   (ii) Obtain Fourier series for $f(x) = x\sin x$ in the interval $-\pi \prec x \prec \pi$.

(b) **Attempt any one of the following:** (0

   (i) Prove that modulus of sum of two complex number does never exceed the sum of their moduli.

   (ii) Determine the given function $f[z] = x + i\,xy2$ is analytic or not at any point.

4. **(a)** **Attempt any two of the following in details:** (1

   (i) Derive general expressions for rotational kinetic energy of a rigid body.

   (ii) Write a note on Focult pendulum.

   (iii) State and prove the necessary condition for function to be an analytic.

   (iv) Write a Fourier expansion of a function $f(x)$ as a summation of infinite sine and cosine terms. Obtain the expression for their coefficients.

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RAN-1148

T.Y.B.Sc. (Semester - VI) Examination

March / April - 2019

Physics Paper-VII

Electromagnetism and Optics

[Total Marks: 50

(10)

(04)

(10)

(04)

(14)

Instruction:

(1) Figures on the right indicate the total marks carried by the question.
(2) Symbols used in the question paper have their usual meanings.
(3) Students are permitted to use non-programmable scientific calculator

Q:1   **Answer the following in brief (Any eight).**   (8)

  (1) On which factors does the value of magnetic susceptibility of a substance depend?
  (2) What is the unit and dimensional formula of magnetic moment?
  (3) What is a domain in a ferromagnetic substance?
  (4) Define: Energy density.
  (5) How is any vector field completely characterized?
  (6) Distinguish between steady current and non-steady current?
  (7) Define: Coherence time.
  (8) What is meant by metastable state?
  (9) Name the components required to generate LASER.
  (10) Explain in brief the word the letter "A" represents in LASER.

Q:2 (A) Attempt any ONE of the following. (10)

(1) Derive an ,expression for the resultant magnetic induction in the presence of a magnetic material as
$B = \mu_0 H + \mu_0 M$.

(2) Considering an example of an RC circuit, discuss how the concept of displacement current was introduced by Maxwell.

(B) Attempt any ONE of the following. (4)

(1) The magnetic moment per atom of iron is 2.22 μ_B.
Calculate its magnetization by assuming perfect alignment of all of its magnetic moments. The density of iron is 7.9 X 10^3 $\frac{kg}{m^3}$. Atomic mass of iron is 56.
$N_A = 6.023$ x 10^{23} mol^{-1}.

(2) Show that the dimensions of $\frac{1}{\sqrt{\varepsilon_0 \mu_0}}$ are same as those of speed.

Q:3 (A) Attempt any ONE of the following. (10)

(1) Discuss the interactions between an atom and an electromagnetic radiation.

(2) Explain construction and working of He-Ne LASER.

(B) Attempt any ONE of the following. (4)

(1) Calculate mean spontaneous life time of the upper level for $2P \rightarrow 1S$ transition in an element, given that A = 6 x 10^8 s^{-1}.

(2) A distant star has an angular diameter of 10^{-7} rad and it emits light of average wavelength 5000 Å. Calculate the minimum distance between pinholes for which fringes will disappear in Michelson stellar interferometer.

Q:4 Write short note on any TWO of the following. (14)
(i) Bohr magneton
(ii) Properties of electromagnetic waves
(iii) Applications of LASER
(iv) Components required to generate LASER
(v) Temporal coherence

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RAN-1149

B.Sc. (Sem. VI) Examination

March / April - 2019

Physics Paper VIII

(Atomic and nuclear physics)

Time: 2 Hours]   **[Total Marks: 50**

સૂચના : / **Instructions**

(1)

(2) Figures to the right indicate total marks carried by the question.
(3) All symbols used have their usual meaning.
(4) Students are allowed to use a non-programmable scientific calculator.

Q1   **Answer in brief:**   **[8]**

(1) The range of strong interactions is about _____ m
(2) What is a Lorentz unit?
(3) Total number of electrons required to complete the M-shell is _____
(4) What is the vector atom model?
(5) What are alpha particles?
(6) Define disintegration energy of alpha particle.
(7) Write Geiger's law in the form of range and energy of alpha particle.
(8) Name the quarks that combine to form a neutron.

Q2   **(A) Answer anyone in detail:**   [10]
  (1) Explain experimental arrangement for the normal Zeeman effect. Using classical theory of normal Zeeman effect show

  that the Zeeman shift is $\pm \dfrac{Be\lambda^2}{4\pi mc}$.

  (2) Explain in detail about the quantum numbers associated with vector atom model.

  (B) Answer anyone :   [4]
  (1) An electron beam enters a uniform magnetic field of flux density 1.2 Wb/m^2 . Find the energy difference between electrons having spins parallel and anti-parallel to the field. Planck's constant $h = 6.62 \times 10^{-34}$ J-S ,

  Mass of electron $m = 9.1 \times 10^{-31}$ kg ,
  Charge of electron $e = 1.6 \times 10^{-19}$ C and $c = 3 \times 10^8$ m/S.

  (2) The experimental values of e/m of electron and the Bohr magneton are 1.76×10^{11} C/kg and 9.21×10^{-24} J/T respectively. Calculate the value of Planck's constant.

Q3   **(A) Answer any one in detail:**   [10]
  (1) Explain in detail about the Neutrino theory of β decay.

  (2) Explain Geiger-Nuttal experiment to measure the range of the α particle. Discuss Geiger-Nuttal law.

  (B) Answer any one :   [4]
  (1) α-particles from Polonium travel along a semicircle of radius 20 cm in magnetic field of intensity 1.763 Wb/m^2. Find the energy of α-particles?

  E/M of α-particle is 4.824×10^7 C/kg. Mass of α-particle is 6.643×10^{-27} kg

  (2) How charge of the α particle can be determined?

Q4   **Answer any two**   [14]
  (1) Write short note on range and velocity of α particle
  (2) Bucherer's experiment
  (3) Explain Pauli exclusion principle
  (4) Explain Paschen-Back effect

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RAN-1150

RAN-1150

T.Y.B.Sc. Sem-VI Examination

March / April - 2019

Physics Paper - IX

Time: 2 Hours]   [Total Marks: 50

સૂચના : / Instructions

નીચે દર્શાવેલ ☞ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of ☞ signs on your answer book

Name of the Examination:
☞ T.Y.B.Sc. Sem-VI

Name of the Subject :
☞ Physics Paper - IX

Subject Code No.: | 1 | 1 | 5 | 0 |

Seat No.:

Student's Signature

Q-1.   **Answer in Short.**   **[08]**

1) If all the particles in systems are fixed at definite position then what is the value of entropy?
2) What is meant by the system in thermodynamics?
3) What do you mean by Eigen value?
4) Write down the equation of pressure in terms of partition function.
5) What do you mean by anti-symmetric wave function?
6) Give an example of Boson.
7) What do you mean by four vector?
8) What do you mean by null line?

Q-2. (A)   Obtain the expression for average number of particles for B. E. Statistics. **[10]**

<div align="center">OR</div>

Q-2. (A)   What is Gibbs' paradox? How can it be resolved?   **[10]**

Q-2. (B)   Derive the equation : $S = -k \sum_{s} Ps \ln Ps$ **[04]**

<div align="center">OR</div>

Q-2. (B) Show how the work done by ideal gas during the isothermal expansion can be expressed in terms of change in entropy?

Q-3. (A) Find the relativistic Hamiltonian of a single particle.

OR

Q-3. (A) Derive the Lorentz gauge condition for Maxwell's equation to be invariant.

Q-3. (B) Derive the position four vectors.

OR

Q-3. (B) Represent the Lorentz Transformation geometrically.

Q-4.   **Attempt any TWO.**
   1) Give the physical interpretation of α.
   2) Write a short note on velocity four vector.
   3) State and prove equipartition theorem of energy.
   4) Derive the mean occupation number for fermions.

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RAN-1151

Third year B.Sc. (Sem VI) Examination

March / April - 2019

Physics : Paper - X

સૂચના : / Instructions

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of ☛ signs on your answer book

Name of the Examination:
☛ Third year B.Sc. (Sem VI)

Name of the Subject :
☛ Physics : Paper - X

Subject Code No.: | 1 | 1 | 5 | 1 |

Seat No.:

Student's Signature

Instruction:

1. Draw neat diagrams wherever necessary.
2. Symbols used in the paper have their usual meaning.
3. Figures to the right indicate full marks of the question.
4. Non programmable scientific calculators may be used.

Q1 1. **Answer the following questions in brief:** 08

(1) What is meant by "exhaust pressure" and "attainable pressure" in vacuum pumps?

(2) To what value does the pumping speed approaches when pressure in pump approaches attainable pressure?

(3) What normally is the range of fore-vacuum required for working of diffusion pumps?

(4) The scale in McLeod gauge is kept non linear for better accuracy. Why?

(5) What is the difference between combinational and sequential logic circuits?

(6) Why do we need to clock a flip-flop?

(7) Draw pin diagram of IC DAC 0800 for digital to analog converter.

(8) Give truth table for a NAND RS Flip-Flop.

Q2 (a) **Attempt any one of the following in detail:** 10

(1) What do you mean by a vacuum pump? Describe construction and working of Gaede's Rotary Oil Pump in detail. Discus its advantages and limitations.

(2) What do you mean by a pressure gauge? Describe construction and working of Pirani Gauge in detail. Discuss its merits and drawbacks.

(b) **Attempt any one of the following:**
(1) Give account of (i) chemical process of gettering and (ii) de-gassing process as pressure reducing methods.
(2) State four points showing advantages of Knudsen Gauge over others?

Q3 (a) **Attempt any one of the following in detail:**
(1) State importance of encoder and decoder circuits in a digital system. Discuss design and operation of encoder and decoder circuits in detail.
(2) What are counters? Explain operation of 4-bit ripple up-counters and down-counters in with necessary block diagrams and truth tables.

(b) **Attempt any one of the following:**
(1) Draw circuit of master slave JK flip-flop. Explain its operation.
(2) Draw circuit of 1 to 4 demultiplexer using logic gates. Explain its operation

Q4 **Write detailed note on any two of the following:**
(1) Pumping speed and its significance.
(2) Ionization Gauge.
(3) Digital comparators.
(4) Master slave JK flip-flop.

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RAN-1152

Third Year B. Sc. (Semester-VI) Examination

March / April - 2019

Physics : Paper -XI

(Old or New to be mentioned where necessary)

(New Course)

[Total Marks: 50

Instructions:
(1) Draw neat diagrams wherever necessary.
(2) Symbols used in the paper have their usual meaning.
(3) Figures to the right indicate full marks of the question.
(4) Scientific calculator may be used.

1.   Answer the following questions in brief: (08)
   (1) State the cosmological principle.
   (2) What is doppler's effect?
   (3) What are WIMP's? Give few examples.
   (4) What are neutron stars?
   (5) What do you mean by a compiler?
   (6) What are compound statements in C - language?
   (7) What is the significance of writing the void main () statement in a
       C-program?
   (8) What is the significance of the header files in a C - program?

2   (a)   **Attempt any one of the following in details:**   (10)

     (i)   Discuss the cosmic microwave background radiation and the present day temperature of the universe.

    (ii)   Discuss the circumstances that leads to the prediction of existence of large quantity of invisible matter in galaxies and hence discuss dark matter.

   (b)   **Attempt any one of the following:**   (04)

     (i)   If Sun is at a distance of 8.5 kpc from the center of our Milky way galaxy, and if the mass contained within the region of its circular path is 10^{11} solar masses, then calculate its tangential velocity.
(1 pc = 3.084 x 10^{11} km ; G = 6.67 x 10^{-11} SI; Mass of Sun = 2 x 10^{30}kg)

    (ii)   If the approximate value of Hubble parameter is taken as $75 \dfrac{km/s}{Mpc}$, then estimate the age of universe in years.
(Take 1 yr = 3.15 x 10^7 s & 1 pc = 3.086 x 10^{13} km)

3   (a)   **Attempt any one of the following in details:**   (10)

     (i)   Discuss the different types of numeric constants which are used in C alongwith the rules to be followed.

    (ii)   Explain the *"while"* loop and the *"for"* loop in C - programming.

   (b)   **Attempt any one of the following:**   (04)

     (i)   Write a program in C to read the mass and radius of a sphere and hence calculate its density.

    (ii)   Write the algorithm and draw the flow chart for picking up the largest of three given numbers.

4   **Discuss any two of the following in details:**   (14)

     (i)   Echoes of big bang.

    (ii)   Expansion of universe on the basis of observed Doppler's shift.

   (iii)   Operator precedence and the use of parentheses in C programming.

   (iv)   Output functions in C - programming.

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