

8. Write short notes on :

- (a) UJT 4
(b) Barkhausen criterion 4

94135- (P-4)(Q-8)(17) (4)

Roll No.

94135

B. Sc. 6th Semester Physics (Hons.)

Examination – April, 2017

ELECTRONICS DEVICES : PHYSICS & APPLICATION - II

Paper : Phy-605

Time : Three Hours] [Maximum Marks : 40

Before answering the question, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting at least *two* questions from each Unit.

UNIT – I

1. (a) Draw the circuit diagram of transistor in common base configuration. Sketch its output characteristics also. 4
(b) Discuss the advantages of negative feedback over positive feedback. 4

94135-500-(P-4)(Q-8)(17)

P. T. O.

2. (a) Draw and explain the circuit of RC coupled amplifier. Discuss its advantages, Disadvantages and applications also. 4

(b) A negative feedback amplifier in voltage series configuration feeds 10% of the output back to the input. Voltage gain of the amplifier without feedback is 100. Input and output resistances are $10K\ \Omega$ and $1K\ \Omega$ respectively. Find percentage reduction in voltage gain, input resistance and output resistance with feedback. 4

3. (a) What is biasing ? Write in detail about potential divider method of transistor biasing. 4

(b) An amplifier with an open loop voltage gain of 1000 delivers 10 W of output power at 10% second harmonic distortion, when the input signal is 10 m V. If 40 dB negative voltage series feedback is applied and the output power is to remain at 10 W, determine : 4

(i) The required input signal

(ii) Percentage second harmonic distortion

(iii) Closed loop voltage gain.

4. (a) Write in detail about current series and current shunt feedback. 4

94135- (P-4)(Q-8)(17) (2)

(b) Draw the circuit and explain the operation of class B push pull amplifier. 4

UNIT - II

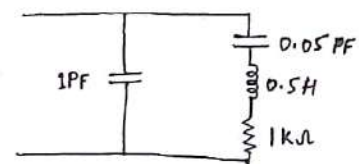
5. (a) Draw and explain the circuit diagram of Colpitt's oscillator and obtain the expression for the frequency of oscillation. 4

(b) A phase shift oscillator uses three identical RC sections with $R = 800\ K\Omega$ and $C = 100\ pF$. Determine the frequency of oscillation. 4

6. Explain the working of a bistable multivibrator with the help of neat circuit diagram and waveforms. 8

7. (a) Write in detail about monostable multivibrator. 4

(b) The equivalent circuit of a quartz crystal is shown below. Calculate the series and parallel resonant frequencies. 4



94135- (P-4)(Q-8)(17) (3)

P. T. O.

Roll No.

94131

**B. Sc. 6th Semester Physics (Hons.)
Examination – April, 2017**

MATHEMATICAL PHYSICS - VI

Paper : Phy-601

Time : Three Hours] [Maximum Marks : 40

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt five questions in all, selecting at least two questions from each Unit.

UNIT – I

1. (a) Show that the array $T = \begin{pmatrix} -xy & -y^2 \\ x^2 & xy \end{pmatrix}$ is a second

rank tensor while the array $\begin{pmatrix} -xy & -y^2 \\ x^2 & -xy \end{pmatrix}$ is not a

tensor.

6

94131-500-(P-3)(Q-8)(17)

P. T. O.

- (b) Show that every tensor of second rank can be resolved into symmetric and antisymmetric parts. 2
2. (a) Components of a first rank tensor in rectangular Cartesian coordinate system are given as xy , $2y - z^2$, xz . Write its covariant components in spherical coordinates. 5
- (b) Write short notes on Dirac Delta function. 3
3. (a) Find the fourier transform of rectangular pulse function. $F(+)=\begin{cases} Ae^{i\omega t} & \text{for } |t| < \tau/2 \\ 0 & \text{for } |t| > \tau/2 \end{cases}$ 6
- (b) State Parseval's Theorem. 2
4. (a) Find the Fourier sine transform of $\cos ax$, where $0 < x < \pi$. 4
- (b) Find finite cosine transform of $\sin ax$. 4

UNIT - II

5. Find Laplace transform of :
- (a) $t^2 \cos at$ 4
- (b) $\left(\sinh \frac{t}{2} \cdot \sin \frac{\sqrt{3}}{2} t \right)$ 4

94131- (P-3)(Q-8)(17) (2)

6. Find the laplace transform of $f(+)$ defined as $F(+)=\begin{cases} t+1 & 0 \leq t \leq 2 \\ 3 & t > 2 \end{cases}$ and also determine $L(f'(+))$. 8

7. (a) Solve $t \frac{d^2 y}{dt^2} + (1-2t) \frac{dy}{dt} - 2y = 0$

$y(0) = 1, y'(0) = 2.$ 5

- (b) Evaluate $\int_0^{\infty} \frac{\sin mt}{t} dt$. 3

8. State and prove convolution theorem. 8

94131- (P-3)(Q-8)(17) (3)

Roll No.

94133

**B. Sc. Physics (Hons.) 6th Semester
Examination – April, 2017**

STATISTICAL PHYSICS - II

Paper : Phy-603

Time : Three Hours]

[Maximum Marks : 40

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt five questions in all, selecting at least two from each Unit.

UNIT – I

1. Write down the postulates of Bose-Einstein statistics and derive the relation $n_i = \frac{g_i}{e^{\alpha} e^{U_i/KT} - 1}$, where symbols have their usual meaning. 8
2. Discuss the phenomenon of Bose-Einstein condensation and how it differs from ordinary condensation. To what extent does this explain the properties of He⁴? 8

94133-500 -(P-3)(Q-8)(17)

P. T. O.

3. What are ortho and para states ? Express rotational and vibrational partition functions. How nuclear spin affects the rotational partition function. 8
4. (a) Explain thermodynamic functions of an ideal weakly degenerate gas. 6
- (b) What are the constraints which are obeyed by a photon gas at a given temperature ? 2

UNIT – II

5. Show that the specific heat of a strongly degenerate perfect Fermi gas is given by $C_V = \frac{1}{2} \frac{\pi^2 k^2 T}{E_f}$ Indicate how the above result can be useful to understand the low temperature experimental data on the specific heat of metals. 8
6. (a) What is the difference between a Boson and a Fermion ? Find an expression for the energy distribution function for electron gas in metal. 6

94133- (P-3)(Q-8)(17) (2)

- (b) Write down the Richardson's equation of thermoionic emission. 2

7. Obtain the Fermi-Dirac distribution law. Show that the pressure of a weakly degenerate Fermi-Dirac gas is greater than that of ideal gas. 8

8. Write short note on :

- (a) Third law of thermodynamics 5
- (b) Entropy and disorder 3

94133- (P-3)(Q-8)(17) (3)

Roll No.

94134

**B. Sc. Physics (Hons.) 6th Semester
Examination – April, 2017**

PHYSICS OF MATERIALS - II

Paper : Phy-604

Time : Three Hours]

[Maximum Marks : 40

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt five questions in all, selecting at least two questions from each Unit.

UNIT – I

1. (a) What do you mean by polarization mechanism in dielectrics ? Discuss the different polarization mechanisms in dielectrics and explain their temperature dependence. 5

- (b) A parallel plate air capacitor has a capacitance of $4 \mu\text{F}$. When it is immersed in a liquid of dielectric

94134-500-(P-3)(Q-9)(17)

P. T. O.

constant K its capacitance becomes $9 \mu\text{F}$. Find the value of K. 3

2. Explain depolarization factor. What is the difference between Maxwell's field and Lorentz field of dipoles inside a cavity. 2,6
3. (a) What are the main characteristics of ferroelectric materials? Explain the ferroelectric property on the basis of domain theory. 5
(b) Short note on hysteresis loop. 3
4. What is meant by local field in a dielectric and how is it calculated for a cubic structure. Deduce Clausius-Mosotti relation and explain its use in predicting the dielectric constant of solids. 8

UNIT - II

5. (a) Write the equation relating mobility of charge carriers in a semiconductors with temperature. 5
(b) Write short note on effective mass of an electron. 3

94134- (P-3)(Q-9)(17) (2)

6. Discuss the Kronig-Penney model for the motion of electrons in a periodic potential. Show from E-K graph that the material can be classified into conductors, insulators and semi-conductors. 8
7. (a) Discuss the breakdown of classical theory with special reference to specific heat of electrons in metals. 6
(b) The number density of holes and electrons in an intrinsic semiconductor at a given temperature is $4.94 \times 10^{16} \text{ m}^{-3}$. Calculate the conductivity of the semiconductor if mobility of electrons and holes are 0.11 and $0.14 \text{ m}^2 \text{ v}^{-1} \text{ s}^{-1}$ respectively. Given that $e = 1.6 \times 10^{-19} \text{ C}$. 2
8. (a) State and prove the Bloch-theorem. Explain the importance of Bloch-theorem in the band theory. 6
(b) What is Hall effect? 2

94134- (P-3)(Q-9)(17) (3)

Roll No.

94132

**B. Sc. Physics (Hons.) 6th Semester
Examination – April, 2017**

ELECTROMAGNETIC THEORY - II

Paper : Phy-602

Time : Three Hours] [Maximum Marks : 40

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Note : Attempt five questions in all, selecting at least two question from each Unit.

UNIT – I

1. Show that in an anisotropic media energy is not propagated in the direction of normal to the wave. 8
2. What is double refraction ? How Nicol prism polarizes and analyses the light ? 8

94132-500 -(P-3)(Q-8)(17)

P. T. O.

3. Describe linear, circular and elliptical polarization of e.m. waves. 8
4. (a) What is a Babinet Compensator ? Explain its construction and working to produce plane polarized light. 5
- (b) Find the thickness of doubly refracting crystal to make a quarter wave plate for $\lambda = 6000 \text{ \AA}$. Given $\mu_o = 1.53$ and $\mu_e = 1.55$ for the crystal. 3

UNIT – II

5. Explain Transverse Electric (TE) mode of a hollow cylindrical wave guide. 8
6. (a) What are resonant cavities ? 4
- (b) There is a rectangular wave guide with dimensions $2.28 \text{ cm} \times 1.01 \text{ cm}$. What TE modes will propagate in this wave guide, if the deriving frequency is $1.7 \times 10^{10} \text{ Hz}$? 4

94132- (P-3)(Q-8)(17) (2)

7. Discuss phase shift on total reflection of optical wave guides. 8
8. Explain power transmission in guided waves and hence define confinement factor. 8

94132- (P-3)(Q-8)(17) (3)

Roll No.

94131

B. Sc. 6th Semester Physics (Hons.)

Examination – April, 2017

MATHEMATICAL PHYSICS - VI

Paper : Phy-601

Time : Three Hours] [Maximum Marks : 40

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94131-500-(P-3)(Q-8)(17)

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94131- (P-3)(Q-8)(17) (2)

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$$y(0) = 1, y'(0) = 2. \quad 5$$

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94131- (P-3)(Q-8)(17) (3)

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**B. Sc. Physics (Hons.) 6th Semester
Examination – April, 2017**

ELECTROMAGNETIC THEORY - II

Paper : Phy-602

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94132- (P-3)(Q-8)(17) (2)

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94132- (P-3)(Q-8)(17) (3)

Roll No.

94133

**B. Sc. Physics (Hons.) 6th Semester
Examination – April, 2017**

STATISTICAL PHYSICS - II

Paper : Phy-603

Time : Three Hours] [Maximum Marks : 40

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94133-500-(P-3)(Q-8)(17)

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