PHYSICS

BOOKS - OSWAAL PUBLICATION PHYSICS (KANNADA ENGLISH)

SEMI-CONDUCTORS ELECTRONICS

Topic 1 Energy Bands Short Answer Type Questions I

1. Give three differences between intrinsic and extrinsic semiconductors

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2. How are p-type n-type semiconductors formed ?

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3. Draw energy band diagrams of n-type and p-type semiconductors at temperature T > O K. Mark the donor and acceptor energy levels with their energies.

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Topic 1 Energy Bands Short Answer Type Questions Ii

1. Classify metals, semiconductors and insulators on the basis of energy bands.

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2. Give three differences between intrinsic and extrinsic semiconductors

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3. Distinguish between conductors, insulators and semiconductors on the basis of band theory.

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Topic 1 Energy Bands Long Answer Type Questions Ii

1. Classify metals, semiconductors and insulators on the basis of energy bands.

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2. Explain the working of a forward biased p-n junction diode.

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Topic 2 Semiconductor Diodes And Their Applications Very Short Answer Type Questions

1. Why is photodiode used in reverse bias ?

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2. Give the expansion of LED.

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3. How biasing in diode, used in rectification ?

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4. The graph shown here represents the V-I characteristics of a device. Identify the region, if any, over which this device has a negative resistance.

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5. The graph shown in the figure represents a plot of current versus voltage for a given semiconductor. Identify the region, if any, over which the semiconductor has a negative resistance.

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6. What happens to the width of depletion layer of a p-n junction when it is (i) forward biased, (ü) reverse biased ?

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Topic 2 Semiconductor Diodes And Their Applications Short Answer Type Questions I

1. What is Rectification? Describe with a circuit diagram the working of a p-n junction diode as half wave rectifier with input and output waveforms.

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2. Mention the important considerations required while fabricating a p-n junction diode to be used as a Light Emitting Diode (LED). What should be the order of band gap of an LED if it is required to emit light in the visible range ?

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3. Assuming that the two diodes D_1, and D_2, used in the electric circuit shown in the figure

are ideal, find out the value of the current flowing through 2.5 Ω resistor.

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4. For the circuit shown here, find the current flowing through the 1Ω resistor. Assume that the two diodes D_1 and D_2 are ideal diodes.

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5. The current in the forward bias is known to be more (mA) than the current in the reverse bias (~μA). What is the reason, then why photo diodes is to operate in reverse bias.

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6. Name the semiconductor device that can be used to regulate an unregulated d.c. powersupply. With the help of I-V characteristics of this device, explain its working principle.

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7. Draw the circuit diagram of an illuminated photodiode in reverse bias. How is photodiode used to measure light intensity ?

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8. In the figure given below the input waveform is converted into the output waveform by a device 'X'. Name the device and

draw its circuit diagram.

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9. What is a light emitting diode? Write an advantage of using it over conventional low power lamps.

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Topic 2 Semiconductor Diodes And Their Applications Short Answer Type Questions Ii

1. Explain the use Zener diode as a voltage regulator.

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2. Explain the working of a zener diode as a voltage regulator.

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3. Give reasons

The Zener diode is fabricated by heavily doping both the p and n sides of the junction.

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4. Why is photodiode used in reverse bias ?

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5. Give reasons

The band gap of the semiconductor used for fabrication of visible LED's must at least be 1.8 eV.

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6. How is a photodiode Fabricated ?

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7. Briefly explain its working. Draw its V-I characteristics for two different intensities of illumination.

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8. Give reasons

The Zener diode is fabricated by heavily doping both the p and n sides of the junction.

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9. Explain the working of a zener diode as a voltage regulator.

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Topic 2 Semiconductor Diodes And Their Applications Long Answer Type Questions

1. Explain with the help of a diagram, how a depletion layer and barrier potential are formed in a junction diode.

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2. What is a rectifier ? With suitable circuit describe the action of a full wave rectifier by drawing input and output waveforms.

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3. Draw the circuit arrangement for studying the V - I characteristics of a p-n junction diode in (i) forward and (ii) reverse bias. Briefly explain how the typical V - I characteristics of a

diode are obtained and draw these characteristics.

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4. With the help of necessary circuit diagram explain the working of a photo diode used for detecting optical signals.

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5. Describe briefly, with the help of a diagram, the role of the two important processes involved in the formation of a p-n junction.

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6. Name the semiconductor device that can be used to regulate an unregulated d.c. powersupply. With the help of I-V characteristics of this device, explain its working principle.

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Topic 3 Transistors And Their Applications Very Short Answer Type Questions

1. Draw the circuit symbol of n-p-n transistor

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2. Draw the circuit symbol of p-n- p transistor.

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3. In a transistor, doping level in base is increased slightly. How will it affect (i) collector current and (ii) base current ?

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4. Draw the transfer characteristic curve of a base biased transistor in CE configuration. Explain clearly how the active region of the V_0 versus V_F curve in a transistor is used as an amplifier.

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Topic 3 Transistors And Their Applications Short Answer Type Questions I

1. Draw a neat labelled diagram of a transistor amplifier in a CE mode.

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2. In the given circuit diagram, a voltmeter 'V' is connected across a lamp 'L'. How would (i)

the brightness of the lamp and (ii) voltmeter reading 'V' be affected, if the value of resistance 'R' is decreased ? Justify your answer.

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3. Describe briefly with the help of a circuit diagram, how the flow of current carriers in a p-n-p transistor is regulated with emitter-base

junction forward biased and base-collector junction reverse biased

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Topic 3 Transistors And Their Applications Short Answer Type Questions Ii

1. Draw a neat labelled diagram of a transistor amplifier in a CE mode.

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2. Output characteristics of an n-p-1 transistor in CE configuration is shown in the figure. Determine : (i) Dynamic output resistance (ii) d.c. current gain and (iii) a.c. current gain at an operating point $V_{CE} = 10V$, when $I_8 = 30\mu A$

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Topic 3 Transistors And Their Applications Long Answer Type Questions

1. What is amplification? With a circuit diagram, explain the working of npn transistor as an amplifier in CE configuration.

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2. What is a rectifier ? With suitable circuit describe the action of a full wave rectifier by drawing input and output waveforms.

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3. (a) Draw the circuit diagrma of an 1-p-transistor with emitter-base junction forward biased and collector-base junction reverse biased. Describe briefly how the motion of charge carriers in the transistor constitutes the emitter current (I_E), the base current (I_B) and the collector current (I_C). Hence deduce the relation $l_E = I_B + I_C$

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4. What is amplification? With a circuit diagram, explain the working of npn transistor as an amplifier in CE configuration.

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5. What is amplification? With a circuit diagram, explain the working of npn transistor as an amplifier in CE configuration.

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6. Describe briefly the underlying principle of a transistor amplifier working as an oscillator. Hence, use the necessary circuit diagram to explain how self sustained oscillations are achieved in the oscillator.

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7. Differentiate between three segments of a transistor on the basis of their size and level of doping,

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8. How is a transistor biased to be in active state ?

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9. With the help of necessary circuit diagram, describe briefly how h-p-n transistor in CE configuration amplifies a small sinusoidal input voltage. Write the expression for the ac current gain.

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10. Draw a simple circuit of a CE transistor amplifier. Explain its working. Show that the voltage gain, A_V of the amplifier is given by $A_v = -\frac{\beta_{ac} R_L}{I_i}$ where β_{Ac} is the current gain, R_L is the load resistance and r_1 is the input resistance of the transistor. What is the significance of the negative sign in the expression for the voltage gain?

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Topic 3 Transistors And Their Applications Numerical Problems

1. The current gain β of the silicon transistor used in the circuit as shown in figure is 50. (Barrier potential for silicon is 0.69 V) Find (i) I_B (ii) I_E. (iii) I_C and (iv) V_{CE}

Data :

$V_{BB} = 2V, V_{CC} = 10V, \beta = 50$

$R_B = 10K\Omega, R_C = 1K\Omega$

The barrier potential for silicon transistor

$V_{BE} = 0.69V$

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2. A transistor is connected in CE configuration. The voltage drop across the load resistance (R_C) 3 ks is 6 V. Find the base current. The current gain α of the transistor is 0.97 Data : Voltage across the collector load resistance (R_C) = 6 V .

$\alpha = 0.97 : R_C = 3k\Omega$

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3. When the negative feedback is applied to an amplifier of gain 50, the gain after feedback falls to 25. Calculate the feedback ratio. Data : $A = 50, A_f = 25$

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4. Find the output of the ideal operational amplifier shown in the figure for each of the following input signals

$V_{In} = 120mVdC$

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5. Find the output of the ideal operational amplifier shown in the figure for each of the following input signals

$V_{In} = 0.5 \sin \omega t$

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6. Find the output of the ideal operational amplifier shown in the figure for each of the following input signals

$V_{In} = -2.5Vdc$

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7. Find the output of the ideal operational amplifier shown in the figure for each of the following input signals

$V_{In} = 0.8\sin(\omega t + 70^\circ)V$

$V_{In} = 0.8\sin(\omega t + 75^\circ)V$

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8. Find the output of the ideal operational amplifier shown in the figure for each of the following input signals

$data: R_f = 39K\Omega, R_1 = 15k\Omega$

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9. Find the output of the circuit given below

Data :

$R_f = 740K\Omega, R_f = 650K\Omega, R_1 = 10k\Omega$

$R_1 = 100k\Omega$

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Topic 4 Logic Gates Very Short Answer Type Questions

1. Give the logic symbol, Boolean expression and truth table of a NOR gate.

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2. write the symbol of NAND gate .

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3. Write the truth table for logic OR gate.

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Topic 4 Logic Gates Short Answer Type Questions I

1. Give the circuit symbol and truth table for OR gate

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2. Give the logic symbol, Boolean expression and truth table of a NAND gate?

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3. The outputs of two NOT gates are fed to a NOR gate. Draw the logic circuit of the combination of gates. Give its truth table. Identify the gate represented by this combination.

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4. The input waveforms 'A' and 'B' and the output waveform 'Y' of a gate are shown

below. Name the gate it represents, write its truth table and draw the logic symbol of this gate.

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5. Identify the logic gates marked 'P' and 'Q' in the given circuit. Write the truth table for the combination.

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6. Identity the equivalent gate represented by the circuit shown in the figure. Draw its logic symbol and write the truth table.

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7. Write the truth table for the combination of the gates shown. Name the gates used.

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8. In the circuit shown in the figure, identify the equivalent gate of the circuit and make its truth table.

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9. Show the output waveforms (Y) for the following inputs A and B of (i) OR gate, (ii)

NAND gate.

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10. In the circuit shown in the figure, identify the equivalent gate of the circuit and make its truth table.

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11. For the digital circuit given below, write the truth table showing outputs Y_1 and Y_2 for all possible inputs of A and B.

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12. Show output waveform for all possible inputs of A and B.

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13. Draw the output waveform at X, using the given inputs A and B for the logic circuit shown below. Also, identify the logic operation performed by this circuit.

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14. Identity the logic gate represented by the circuit as shown and write its truth table.

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Topic 4 Logic Gates Short Answer Type Questions Ii

1. A student has to use an appropriate number of (i) NAND gates (only) to get the output Y_1 (ii) NOR gates (only) to get the output Y_2 From two given inputs A and B as shown in the diagram.

Identify the 'equivalent gate' needed in each case. Show how one can connect an

appropriate number of (i) NAND (ii) NOR gates respectively in the two cases to get these 'equivalent gates'.

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2. You are given a circuit below. Write its truth table. Hence, identify the logic operation carried out by this circuit. Draw the logic symbol of the gate, it corresponds to.

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Topic 4 Logic Gates Numerical Problems

1. Prove the Boolean identity :

$$(A + B)(A + C) = A + BC$$

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2. The outputs of two NOT gates are NORed, as shown in figure. What is this combination equivalent to?

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3. Construct a logic circuit using NAND gates only for $Y = \overline{A} + \overline{BC}$.

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4. Determine the output wave form for the circuit given below, if the input waveforms are as indicated by A and B.

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