

Level : B.Sc.
Year : II

Course : PHYS 201
Semester: I

Exam Roll No. :

Time : 30 mins.

F.M. : 20

Registration No.

Date : APR 03 2017

SECTION "A"

[20 Q. × 1 = 20 marks]

Choose and tick the most appropriate answer.

Symbols have their usual meanings unless stated and missing parameters can be assumed suitably.

- Thevenin's theorem replaces a complicated circuit facing a load by an
 - ideal voltage source and parallel resistor.
 - ideal current source and parallel resistor.
 - ideal voltage source and series resistor.
 - ideal current source and series resistor.
- Using Superposition Theorem, calculate the current flowing through $R_L = 4\Omega$ resistor of the circuit shown in Figure A-1.

Figure A-1

 - 3 A.
 - 1.5 A.
 - 6 A.
 - 4.5 A
- The merging of a free electron and a hole is called
 - excitation.
 - recombination.
 - pair-creation.
 - covlalent bonding.
- To a second approximation, a forward-biased diode is treated like a(n)
 - open switch with infinite resistance.
 - closed switch with a voltage drop of 0V.
 - closed switch in series with a battery voltage of 0.7V.
 - closed switch in series with a small resistance and a battery.
- The device associated with voltage-controlled capacitance is a
 - LED.
 - photo-diode.
 - Zener diode.
 - varactor diode.
- For a transistor to function as an amplifier,
 - both the EB and CB junctions must be forward-biased.
 - both the EB and CB junctions must be reversed-biased.
 - the EB junctions must be forward-biased and the CB junction must be reversed biased.
 - the CB junctions must be forward-biased and the EB junction must be reversed biased.
- The average value of a half-wave rectified voltage with a peak value of 163 V is
 - 51.8 V.
 - 103.6 V.
 - 115.2 V.
 - 163 V.

8. An RL high-pass filter uses a 60-mH L and a 1-k Ω R. What is its cutoff frequency?
 [a] 2.65 kHz. [b] 256 kHz. [c] 600 kHz. [d] 32 kHz.
9. If the load resistance increases in a Zener regulator, the series current
 [a] decreases. [b] stays the same.
 [c] increases. [d] equals the load current.
10. A JFET is a
 [a] normally on device. [b] normally off device.
 [c] bipolar device. [d] current-controlled device.
11. A D-MOSFET has the values $V_{GS(off)} = -3V$ and $I_{DSS} = 6 mA$. What will the drain current equal when V_{GS} equals +1V ?
 [a] 2.7 mA. [b] 4 mA. [c] 8 mA. [d] 10.7 mA.
12. The forward breakover voltage of an SCR
 [a] decreases as the gate current increases. [b] cannot be controlled by gate current.
 [c] increases as the gate current increases. [d] decreases as the gate current decreases.
13. The triac is equivalent to
 [a] an SCR without a gate lead. [b] two ordinary diodes in parallel.
 [c] two diacs in parallel. [d] two SCRs in parallel.
14. For class C operation of a transistor, collector current flows for?
 [a] only 180° of the ac input cycle. [b] less than 180° of the ac input cycle.
 [c] 360° of the ac input cycle. [d] more than 180° of the ac input cycle.
15. The maximum efficiency of a class B push-pull amplifier
 [a] 25%. [b] 50%. [c] 79%. [d] 98%.
16. The equation of the dc load line for the circuit shown in Figure A-2 is

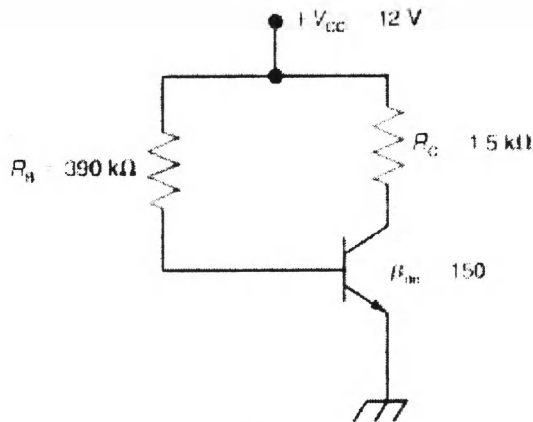
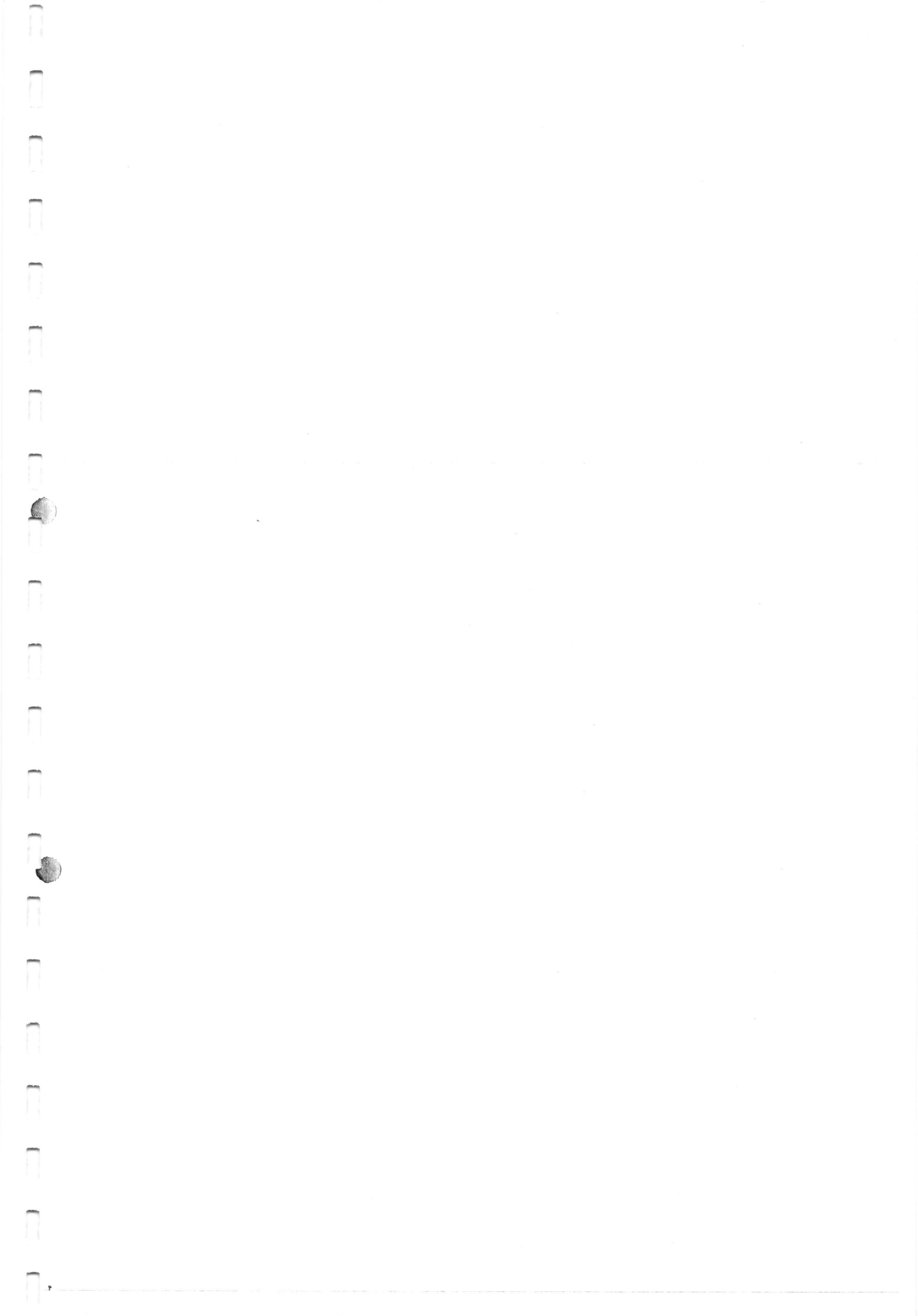


Figure A-2

- [a] $I_C = 6.7 \times 10^{-4} V_{CE} + 8 \times 10^{-3}$. [b] $I_C = -6.7 \times 10^{-4} + 8 \times 10^{-3} V_{CE}$.
 [c] $I_C = -6.7 \times 10^{-4} V_{CE} + 8 \times 10^{-3}$. [d] $I_C = 6.7 \times 10^{-1} V_{CE} + 8 \times 10^{-3}$.
17. A binary number is composed of twelve 1s. What is its decimal equivalent?
 [a] 4,096. [b] 2,047 [c] 8,191. [d] 4,095.



Level : B.Sc.
Year : II
Time : 2 hrs. 30 mins.

Course : PHYS 201
Semester: I
F.M. : 55

SECTION "B"
[5Q. × 4 = 20 marks]

- Describe the proper polarities for (a) forward-biasing a diode, and (b) reverse-biasing a diode. Sketch the complete graph of current versus voltage for a silicon diode with an offset of 0.7 V and a breakdown voltage of 75 V. Explain each part of the graph.

OR

Define α_{dc} and β_{dc} . Derive the equation $\alpha_{dc} = \frac{\beta_{dc}}{1 + \beta_{dc}}$. What is the β_{dc} of a transistor whose $\alpha_{dc} = 0.995$.

- In the circuit shown in Figure B-1, $R_S = 120\Omega$, $V_Z = 12\text{ V}$, and $R_L = 400\Omega$. If $V_{in} = 18\text{ V}$, find (a) the series current, I_S , (b) the load current, I_L , (c) the zener current, I_Z , and (d) the power dissipated in the diode, P_Z .

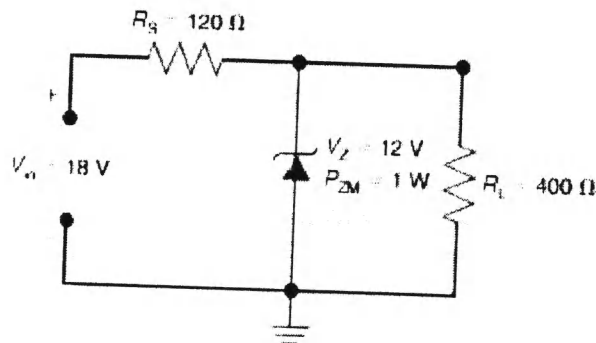


Figure B-1

- Explain the construction, working and the characteristics of a UJT.
- Draw a circuit diagram for the RC-Coupled class A amplifier. Show that the maximum possible efficiency for any RC-Coupled class A amplifier is 8.33 percent.

OR

Derive an accurate formula for the dc emitter current of a voltage-divider biased circuit. Why is voltage-divider bias a stable way to bias a transistor?

- What is the binary equivalent of decimal 363? Add these 8-bit numbers: 0101 0111 and 0011 0101 and show the same number in hexadecimal notation.

SECTION "C"
[5Q. × 7 = 35 marks]

6. State and prove Norton's theorem. A Norton equivalent circuit consists of a $100 \mu\text{A}$ current source, I_N , in parallel with a $10 \text{ k}\Omega$ resistance, R_N . If this circuit is converted into a Thevenin equivalent circuit, how much is V_{th} ?
7. With a neat sketch, explain the working of Centre-tap full-wave rectifier. Derive an expression for the efficiency of a full wave rectifier. How is the output frequency of a full wave rectifier related to the input frequency?

OR

Explain the function of low-pass and high-pass filters. Sketch the circuit of RC low-pass and RL high-pass filters and explain their filter operation. Write the equation for the low-pass filter cutoff frequency.

8. What is the key difference in the way a JFET and MOSFET are constructed? Sketch the structure of an n-channel, depletion-type MOSFET and explain their working in depletion mode. Draw typical drain curves and the transconductance curve for an n-channel, enhancement-type MOSFET.
9. (a) State DeMorgan's theorems. Why NAND gate is called universal gate? Explain.
(b) Show the logic circuit for this Boolean equation:

$$Y = (\bar{A} + B)(A + B)$$

Then, simplify the circuit as much as possible using algebra.

OR

What is a full-adder? Give its symbol. Give the truth table and discuss. Also, give the symbol and the truth table for a half-adder.

10. The 2N3904 of Figure C-1 has a β of 200. What is the ac output voltage and input impedance of the amplifier? Explain why there is phase inversion between input and output.

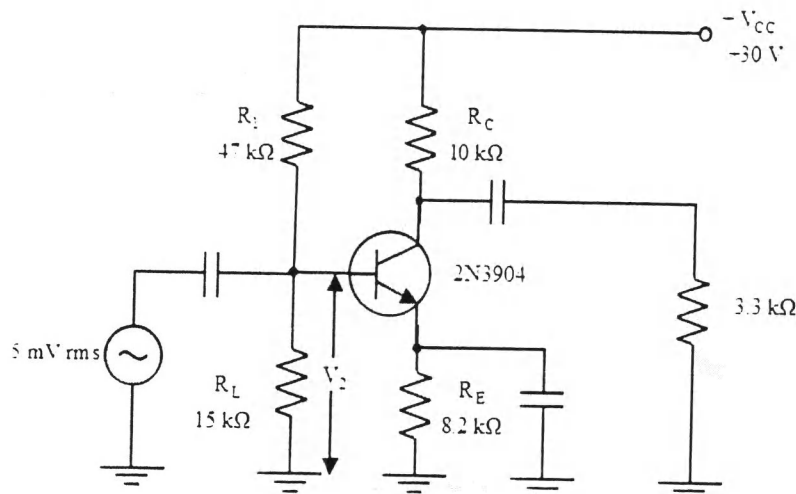


Figure C-1