Ref : Ex/PE/IEE/T/215/2019

B.E. POWER ENGINEERING, SECOND YEAR, FIRST SEMESTER - 2019

Subject : ELECTRONICS | Time : Three Hours | Full Marks : 100

Instructions :
1) This paper contains **eight** questions and an **APPENDIX**. Answer any **five** questions
2) Answers of sub-questions of any question to be written in **one place**. Do not be haphazard.
3) Write 'Answer' beside the final answer of numerical problem.
4) Justified marks will be given for neat presentation.

Q1. **a)** Segregate the following elements into Active and Passive groups: PN-diode, Capacitor, Inductor, BJT, Transformer, FET, IC741, Zener diode. **(4)**

b) Copy the circuit of the Fig.-I of APPENDIX. Apply Thevenin's Theorem to find current (value and direction) in the branch AB. Also find the same if the polarity of 12V battery be reversed? **(6+4)**

c) Each Amplifier of Group A is **Closely related** with **One** of the terms of Group - B. Find out the **best** matches. (**No Explanations**) **Group – A** : Voltage Amplifier, Power Amplifier, Audio Frequency Amplifier, Radio Frequency Amplifier, R-C Coupled Amplifier, Transformer Coupled Amplifier.

Group – B : 10Hz to 20kHz, Handles large I/P signal, Good impedance matching, Handles small I/P signal, 300kHz to 30MHz, Almost flat frequency response. **(1x6=6)**

Q2. **a)** Define α-cut-off frequency, f_T frequency of BJT .
What is the value of h_{Fb} at f_T frequency? **(1x3=3)**

b) Draw neat circuit diagram of a Bridge Rectifier showing proper direction of current at each half cycle of the I/P signal.(no detailed description) **(4)**

c) A 2-diode fullwave rectifier uses **Si-diodes** of r_f=10Ω with a load of 200Ω. I/P AC voltage across the half secondary winding is 35.4V, 50Hz. Draw the circuit. Calculate DC O/P Voltage, % efficiency, O/P frequency. **(2+3+1+1=7)**

c) Fig-II of **APPENDIX** shows the O/P waveform of a half wave rectifier with I/P Voltage: $V = V_0 \sin\omega t$ ($0 \le t \le T$, $\omega T = 2\pi$). Determine the dc-value and ac-value of the O/P. Show your mathematical steps. **(3+3=6)**

Q3. **a)** Draw circuit of a negative clipper. Show the I/P, O/P and explain the typical nature of the "clipped O/P" (i.e. How it forms?) **(2+3=5)**

b) How do you use a Clipper Circuit to estimate 'turn on voltage' (barrier potential) of a real diode? —describe briefly. You may be provided with a CRO. **(5)**

c) How do you differentiate between Si-diode and Ge-diode by their FB/RB characteristics ? Which is more stable device? – Si or Ge? Why? **(1+1+1=3)**

d) Deduce that forward dynamic resistance (r_e) is of a PN-diode is inversely proportional to the FB current. Estimate the value of r_e for a forward current of 5mA. **(4+1=5)**

e) What are two specification parameters of PN-diode? **(2)**

Q4. **a)** It is well known that an Emitter follower has voltage gain less than unity. Can you call it an amplifier? Justify. State two major uses of emitter follower **(3+2=5)**

b) Copy the circuit of Fig.-III which consists of a Si-BJT. Find out its' voltage gain (Av); hence justify that it is truly an emitter follower. **(7+2=9)**

c) Convert decimal 75.9296875 to Octal, then to binary. **(2+2=4)**

d) What is the full form of the term "Bit". **(2)**

Q5. **a)** Take V_{CE} - I_C axes. Draw an arbitrary load line and graphically present the operations of Class-A, Class-B, Class-C amplifiers. Use three separate diagrams. No detail descriptions. Only neat drawings needed . **(2x3=6)**

b) one of the above three classes provides "amplification as well as rectification". __ Which one ? **(2)**

c) Define Stabilization factor (S). Draw a simple voltage stabilizer circuit using a series resistance (R_S), Zener resistance (r_z) and load resistance (R_L). Deduce an expression for "S" in terms of above resistances. Express 'S' in its' simplest form by approximation. Hence, establish a simple relation between I/P(E_i) and O/P (E_o) voltages. **(1+2+4+2=9)**

d) In the same circuit, as above, $r_z = 5\Omega$, $V_z = 10V$, $R_S = 100\Omega$, $R_L = 1k\Omega$ and E_i varies within the range 20V – 25V. Find % regulation. **(3)**

Q6. **a)** You are given three **NAND** gates. Using them construct a circuit with OR as O/P. What would be the O/P if you replace all the **NAND** gates by **NOR** gates ? **(2+2=4)**

b) Copy the Fig.-IV of **APPENDIX**. Find the O/P (X) for A and B both are grounded. **(4)**

c) Copy the Fig.- V of **APPENDIX**. It is a Si-BJT with β-value ranging 100 to 120 for temperature range 25°C - 75°C. Calculate % variations of I_C and V_{CE} ? What is the change in Power dissipation of BJT ? **(5+5+2=12)**

Q7. **a)** Draw neat circuit diagram of a practical BJT amplifier with single battery potential divider bias. Name the various capacitors therein. Draw its' DC and AC equivalent circuits. Write down the expression of voltage gain (A_V) and briefly explain the effect of a particular capacitor on A_V **(3x2+2x2+1x2=12)**

b) Write equation of DC load line of the amplifier, as above, with proper chosen axes. Shade the area representing the power dissipation of BJT. What is Q-point ? Where it should be located for maximum Power dissipation ? **(1x4=4)**

c) X = 1 0 1 1 1 0 1, Y = 1 1 1 1 1 0. Perform the operation (X-Y) using 1's Compliment and 2's compliment. **(2+2=4)**

Q8. a) Suppose A, B are two I/Ps. Construct a logic circuit using **only** NAND gates with A⊕B as O/P. Derive the O/P. **(3+2=5)**

b) Write down Truth Table of a Full Adder and derive Boolean expressions for "Sum" and "Carry-Out". Draw logic circuit of Full Adder. **(2+4+3=9)**

c) Carefully copy the Truth Table of **Fig.-VI** of **APPENDIX**. Express the O/P (X) as a Boolean function of A, B, C. Simplify X and finally draw the logic circuit using the most minimum number of logic gates. **(1+3+2=6)**

APPENDIX

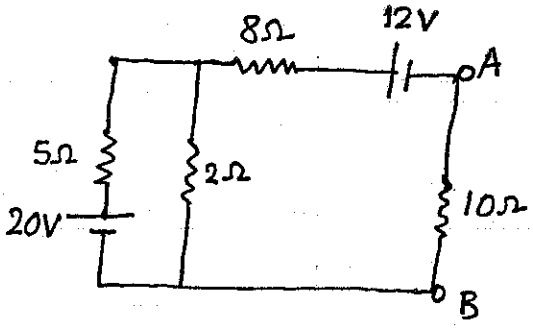

fig - I

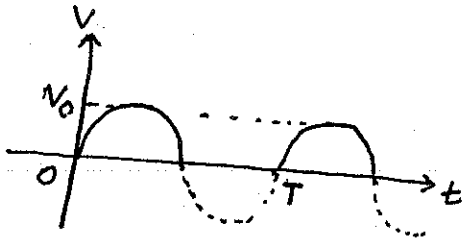

fig - II

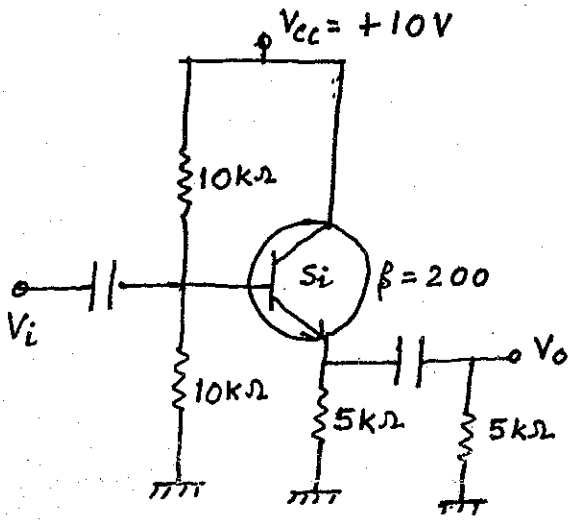

fig - III

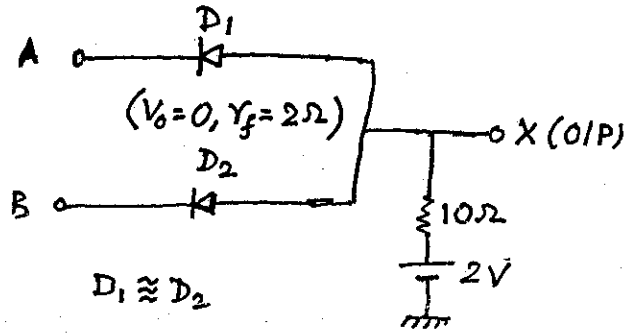

fig - IV

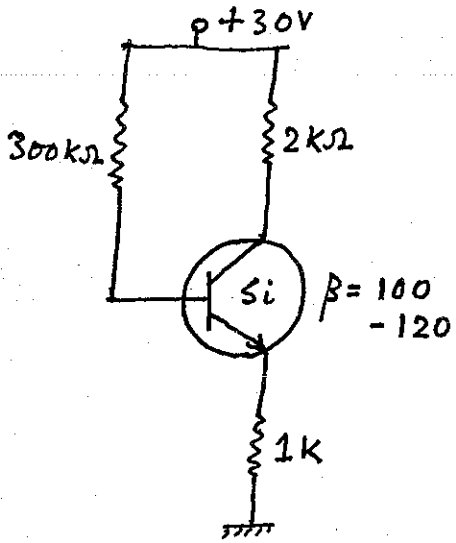

fig - V

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
1	0	0	0
1	1	0	1
1	0	1	1
0	1	1	0
1	1	1	1

fig - VI