Ref : Ex/PRN/IEE/T/126/2018

B.E. PRINTING ENGINEERING, FIRST YEAR, 2nd SEMESTER - 2018

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) What is the relation among 'Ohm', 'Sec' and 'Farad' ? **(2)**

b) State the thumb-rule of dependence of reverse saturation current (I_0) of diode on temperature. If value of I_0 = 20nA at 25°C, what is its' value at 20°C ? **(1+2)**

c) An amplifier has the following data :
At f = 2kHz, I/P Power = 10mW, O/P Power = 1.5W
At f = 20Hz, I/P Power = 10mW, O/P Power = 0.3W
Calculate the rise or fall of dB-gain **(3)**

d) Draw circuit diagram of an unbiased **Positive** Clamper. If a voltage, $V = V_0 \sin\omega t$, be fed at the I/P end of such circuit, draw the O/P wave form. Hence explain the principal of action of the circuit. **(2+1+6)**

e) If peak-value of I/P voltage of Q1-(d) be 4V, what are the average values of I/P and O/P voltage ? **(3)**

Q2. a) Draw a **Positive** Clipper circuit using a real Si-diode. Explain its' action for an I/P voltage signal : $V=V_m \sin\omega t$. Draw the O/P wave form. **(3+6+1)**

b) Draw the Circuit diagram of a Combination Clipper showing sketches of I/P and O/P of wave forms (No descriptions). **(3+1)**

c) 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. **(6)**

Q3. a) Draw a simple voltage stabilizer circuit using an ideal Zener-diode, a series resistance and a load. Describe the variation of I_z when (i) I/P voltage varies but load is constant, and (ii) I/P voltage is constant but load varies. (Consider Zener to be ON during the process) **(3+4+4)**

b) Draw RB-Characteristic curves of Zener diode and Avalanche Photo-diode on separate axes. State (in tabular form) four distinct features of Zener diode and Avalanche diode. **(2x1+4x1)**

c) Check the status of Zener in Fig-I of **APPENDIX** (ON or OFF) and find the current through 3kΩ resistor. **(1+2)**

Q4. a) Define dB Power gain and dB Voltage gain. Why do we prefer to express gain in dB-scale rather than by its' absolute value ? **(1+1+3)**

b) Draw frequency response curve of an audio frequency amplifier showing lower cut-off frequency (f_1) and upper cut-off frequency (f_2). Hence define f_1 and f_2. What are the approximate values of f_1 and f_2 for an audio amplifier ? (2+1x2+2)

c) Show that the difference in dB-scale between maximum gain and gain at f_1 and f_2 is 3dB (3)

d) Explain briefly why frequency response curve, as referred in Q4-(a), bends downward at lower frequency as well as at higher frequency range. (6)

Q5. a) Define % Regulation (R) and Stabilization factor (S). A voltage Stabilizer Circuit consists of a series resistor R_S , a Zener diode of resistance r_z and a load R_L . Draw the circuit. Establish a relation of 'S' with these resistances. Hence express 'S' in its' simplest form. What is your final conclusion ? (2+2+5+2)

b) If for a Voltage Stabilizer, R_S = 1kΩ, r_z = 5Ω and I/P varies by ±0.5V about a mean value, what is the variation of O/P voltage ? (3)

c) Copy the Zener Circuit of fig-II of **APPENDIX.** Determine the range of R_L that will result a constant voltage of 10V across R_L. Consider Zener as ideal with maximum Power rating of 320mW. (6)

Q6. a) Define Active and Passive elements. Segregate the following elements in the above two classes: PN-diode, Resistor, BJT, Capacitor, FET, LED, Inductor. (2+7)

b) Copy the circuit of fig-III of **APPENDIX**. Determine the current through the 10Ω resistor by applying Thevenin's principle Or by otherwise. Indicate the true direction of current (A to B Or B to A). Also find close circuit voltage across AB. (8+1+2)

Q7. a) fig-IV 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 of the O/P. Show your mathematical steps. (6)

b) Draw the circuit diagram of a full wave Bridge-rectifier showing the direction of current in each half-cycle of I/P signal (no detailed description). (3+3)

c) Draw double-diode model of a NPN – transistor with 'normal' bias condition. Write transistor equation relating various currents and junction voltages. Hence justify the statement – 'At saturation both BE and BC junctions are forward biased and at cut-off mode both the said junctions are reverse biased'. (2+2+4)

Q8. a) Draw neat and labeled circuit diagram of a practical BJT amplifier with **Single battery bias**. (No detailed description). Briefly describe functions of various capacitors of the circuit. Write the equation of DC-load line of circuit. (2+3+2)

b) Define h_{FE} , h_{FB} , α-cut-off frequency, f_T frequency of BJT. (4)

c) Copy the BJT circuit of fig-V of **APPENDIX,** where, V_{CC} = 20V, V_{BE} = 0.7V, R_B = 1MΩ, $R_C = R_L$ = 10kΩ, β = 50. Determine :I_B, I_E, effective I/P resistance (r_i), effective O/P resistance (r_o), Voltage gain (A_V), Power gain (G_P), dB Power gain, V_{CE} , Power dissipation of BJT. (9x1)

APPENDIX

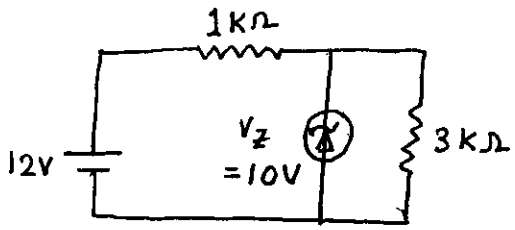

Fig-I

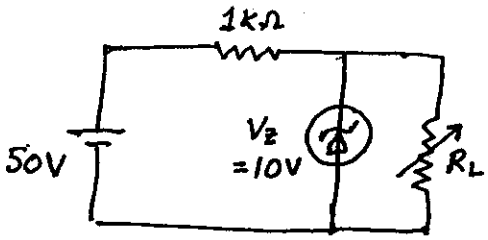

Fig-II

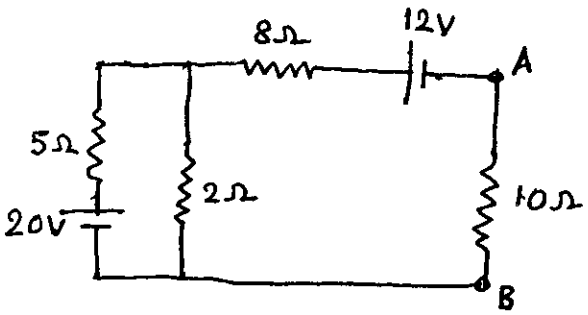

Fig-III

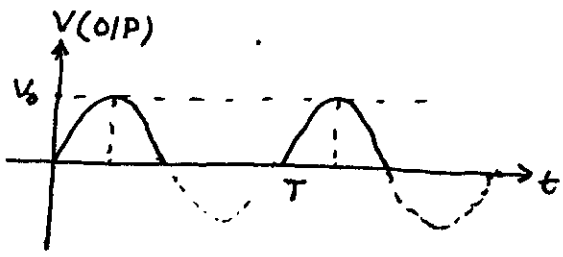

Fig-IV

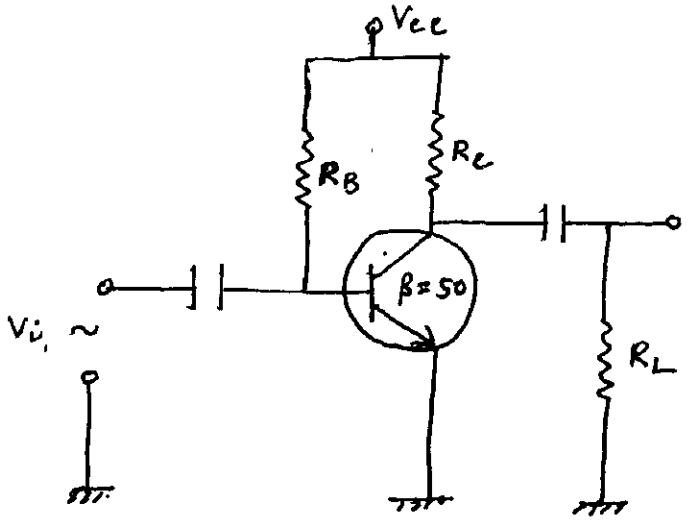

Fig-V