53 (EC 301) ELDC

2018

ELECTRONIC DEVICES AND CIRCUITS

Paper : EC 301

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions from **seven**.*

1. *(a)* A common collector amplifier can work as a voltage buffer. Justify with proper derivation and explanation. 10

   (b) Calculate the value of Open circuit voltage gain, Input resistance and output resistance for the amplifier shown in *Fig.* 1 [$\beta = 100$, $V_A = 60V$] 10

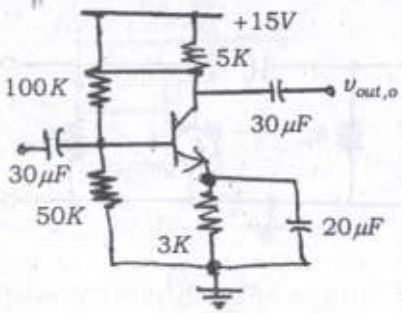

Fig. 1

Contd.

2. *(a)* Determine the minimum value of R_C to bias the transistor in Active mode. [in *Fig.* 2] 4

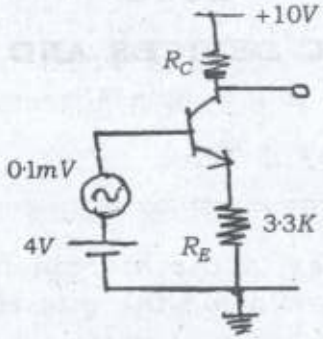

Fig. 2

(b) Describe the operation of Zener diode based series regulator and write the expression for output voltage. 6+2

(c) Derive the expression for $-3dB$ frequency for the amplifier circuit shown below and plot the frequency response. [*Fig.* 3] 6+2

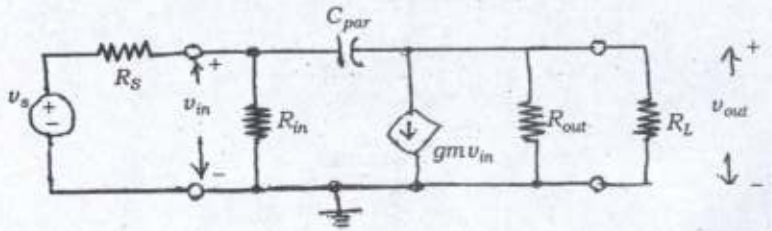

Fig. 3

3. *(a)* How multi-stage amplifiers are different from single stage amplifiers ? Draw a basic block diagram of a 2-stage amplifier and discuss the various features of R–C coupled CE–CE cascaded amplifier. 2+2+6

(b) Discuss the operation of Buck Regulator and derive the expression for its duty cycle. 8+2

4. *(a)* Calculate the value of R_D that produces a drain voltage of $0{\cdot}7V$; where $V_{TH} = 0{\cdot}5V$, $\mu_n cox = 0{\cdot}4\frac{mA}{V^2}$, $W/L = 4$ and $\lambda = 0$ for the circuit shown in *Fig.* 4. 4

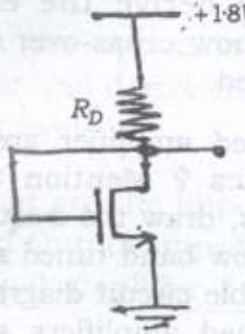

Fig. 4

(b) Derive the expression for open-circuit voltage gain, input resistance and output resistance for the amplifier shown in *Fig.* 5. 3+3+2

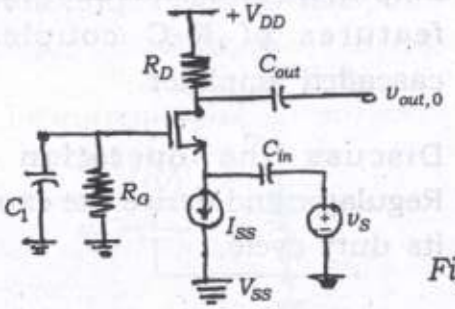

Fig. 5

(c) Describe the operation of an Emitter-follower as a Class A power amplifier with voltage transfer characteristics and derive its efficiency. 4+1+3

5. (a) Describe the operation of Class B power amplifier derive the efficiency and discuss how cross-over distortion can be avoided. 6+3+3

(b) Why tuned amplifier are necessary in Electronics ? Mention type of tuned amplifiers, draw the frequency response of a narrow band tuned amplifier. Draw the possible circuit diagrams for narrow band tuned amplifiers and derive the expressions for maximum small signal voltage gain. 1+1+1+5

6. (a) Describe the operation of class AB amplifier with proper circuit diagram and voltage transfer characteristics. Hence derive the expressions for its efficiency. 6+4

(b) Draw the circuit diagram of common drain amplifier [both DC coupled and RC coupled] and derive the expression for its small sized voltage gain, input resistance and output resistance. 2+3+5

7. (a) Draw the high frequency model of a BJT is active mode and *n*-MOSFET in saturation mode and mention each of the parasitic capacitances. 2+2

(b) Discuss the operation of Buck-boost regulator and derive the expression for its duty cycle. 4+4

(c) (i) What are the importance of Input and Output Impedance in a small signal amplifier ?

(ii) How can you change the center frequency of a tuned amplifier ?

(iii) Which amplifier topology can work as a voltage buffer and which one can work as a current buffer ?

(iv) If DC collector current of a BJT increases by twice what will happen to the voltage gain and output impedance of a CE amplifier [Voltage divider bias without R_E] ?

4×2
