MANIPAL INSTITUTE OF TECHNOLOGY
(A constituent unit of MAHE, Manipal 576104)

III SEM B. Tech (BME) DEGREE END-SEMESTER EXAMINATIONS, NOV-DEC 2018.

SUBJECT: ANALOG ELECTRONICS (BME 2102)
(REVISED CREDIT SYSTEM)
Tuesday, 20th November, 2018, 9 AM to 12 NOON

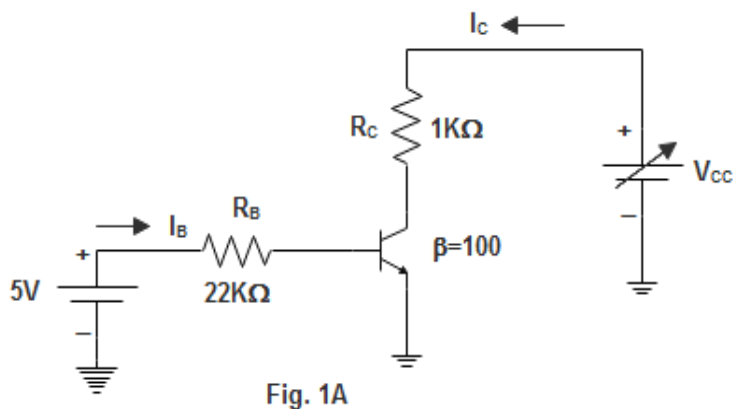**TIME: 3 HOURS**   **MAX. MARKS: 50**

Instructions to Candidates:

1. Answer ALL questions.
2. Draw labeled diagram wherever necessary

1A. For the circuit shown in Fig 1A, find base current, collector current and the power   3
dissipation by the transistor. Determine the maximum supply voltage and the maximum
power. Given $V_{CE\,max} = 15V$ and $I_{C\,max} = 100mA$.

Fig. 1A

1B. How different is self-bias circuit from a collector to base bias circuit? Provide reasons   3
with the help of circuits and expression for stability factor.

1C. For the FET oscillator shown in Fig 1C determine $\dfrac{V_{f1}}{V_0}$, frequency of oscillations and minimum gain of the source follower required for oscillation.   4
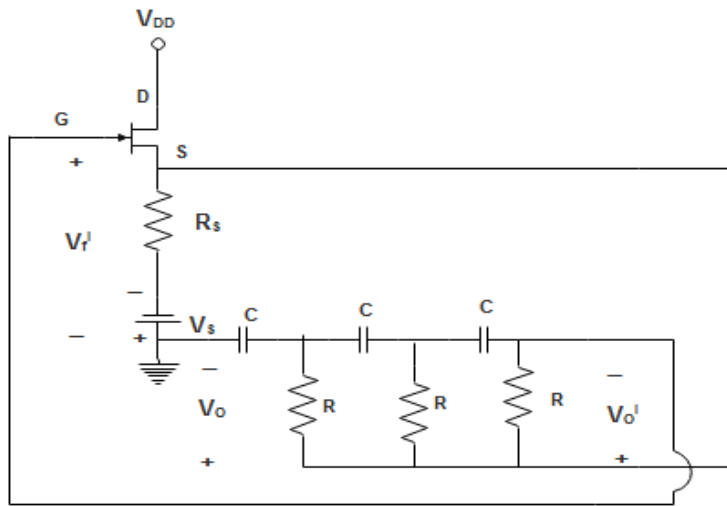

Fig 1C

2A. Why direct coupling is effective for very low frequencies in a multistage amplifier? How RC coupling is different from direct coupling in the case of multistage amplifiers? Give reasons with the help of circuit.   3

2B. Derive an expression for the frequency of oscillation of a RC phase shift oscillator. Use field effect transistor as the active device.   3

2C. For the Colpitts oscillator circuit given in Fig 2C, arrive at this expression   4

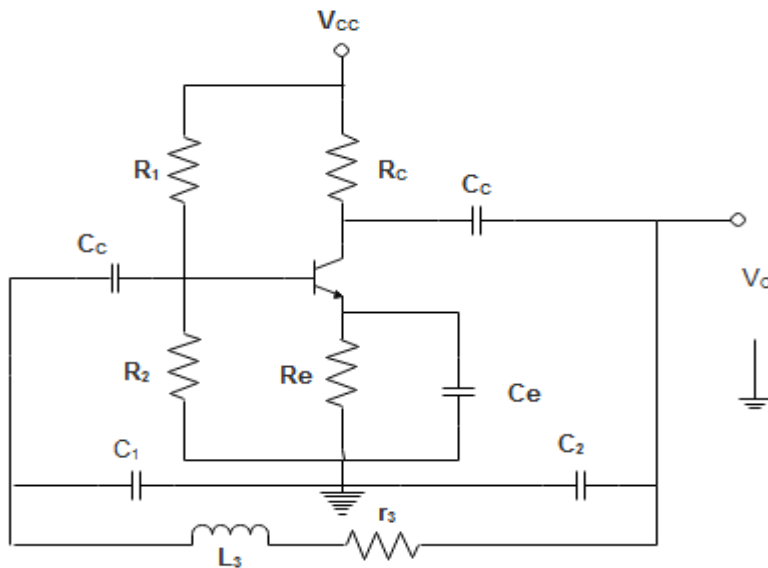$$\omega^2 = \frac{1}{L_3}\left[\frac{1}{C_1} + \frac{1}{C_2}\left(1 + \frac{r_3}{R_o}\right)\right]$$

Fig. 2C

3A. What is the reason for Darlington amplifier circuit having improved amplifier characteristics? Provide mathematically the expressions for current gain and input impedance.   3

3B. With the help of frequency responses compare the three inter stage coupling schemes used in multistage amplifiers. Explain the effect of various capacitors on the low frequency and high frequency part of the frequency response.   3

3C. For the RC coupled amplifier circuit shown in Fig 3C, calculate voltage gain, current gain, input and output impedances. The $h-parameter$ values are: $h_{fe}=100$, $h_{ie_1}=1.16K\Omega$ and $h_{ie_2}=0.451K\Omega$.   4

Fig. 3C
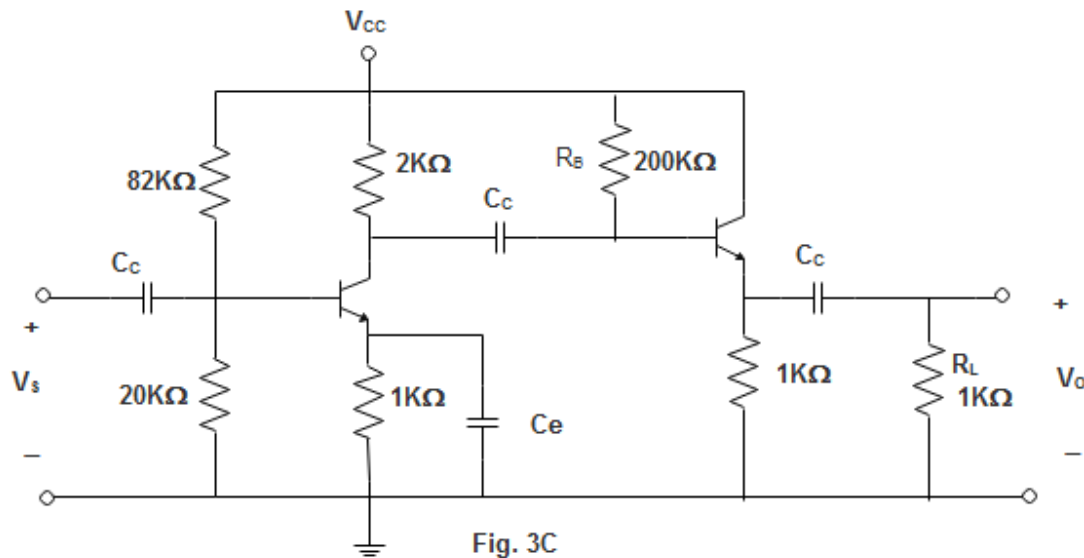
4A. Design a common source FET amplifier to operate from a 12V supply with a gain of at least 5. The bias is at $V_{DQ}=8V$, $I_{DQ}=0.25mA$, $V_P=-2V$, $I_{DSS}=0.5mA$.   3

4B. Design a suitable feedback amplifier circuit that is required to provide a gain of one and input impedance with feedback 50 KΩ.   3

4C. A transformer coupled class A amplifier drives a 8Ω speaker. The coupling transformer 4 has 3:1 step down turns ratio. The circuit component values result in a dc base current of 6 mA, the input signal results in a peak base current swing of 4 mA. The values from the characteristics are: $V_{CE\,min} = 1.7V$, $V_{CE\,max} = 18.3V$, $I_{C\,min} = 25mA$ and $I_{C\,max} = 255mA$. The quiescent values are: $V_{CEQ} = 10V$ and $I_{CQ} = 140mA$. Determine output power, input power and the efficiency. Calculate V_{Lrms}, I_{Lrms} & output ac power at the load.

Fig.4C
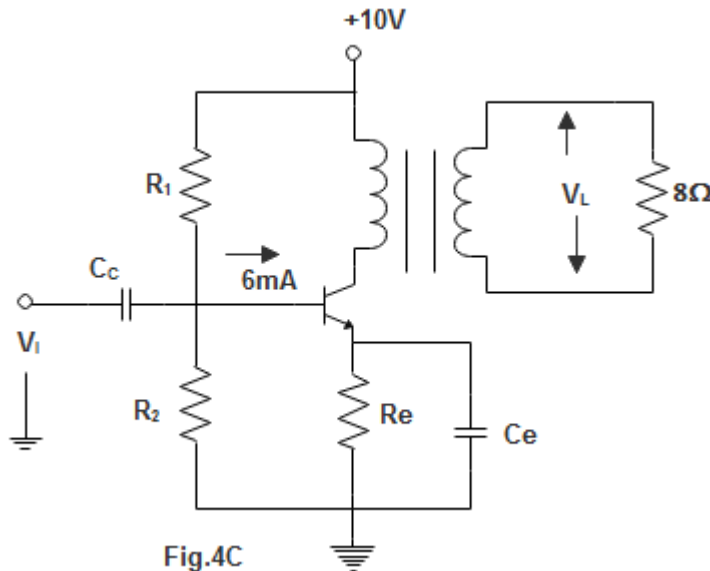
5A. How class AB power amplifier is different from Class B power amplifier? Discuss with the help of circuit diagram and suitable waveforms. 3

5B. Arrive at the expression for the efficiency of a class A transformer coupled power amplifier. Find the maximum efficiency for the same. 3

5C. Design a suitable radio frequency oscillator circuit that is required to provide oscillations with the help of stability factor 6. 4