PAPER ID-421623

Subject Code: KEC402

Roll No: | | | | | | | | | | | | | |

# BTECH
## (SEM IV) THEORY EXAMINATION 2021-22
## ANALOG CIRCUITS

***Time: 3 Hours*** ***Total Marks: 100***

**Note:** Attempt all Sections. If you require any missing data, then choose suitably.

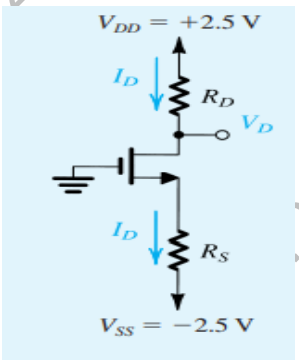
### SECTION A

**1. Attempt *all* questions in brief. 2x10 = 20**

| Qno | Questions | CO |
|---|---|---|
| (a) | Define stability factor for a biasing scheme. | 1 |
| (b) | Draw the high frequency model of BJT. | 1 |
| (c) | Define the efficiency of power amplifiers. | 2 |
| (d) | If open loop gain of an amplifier is **1000** and feedback factor of the system is **.01**, calculate the closed loop gain for negative feedback. | 2 |
| (e) | Define a stable and monostable multivibrator. | 3 |
| (f) | Explain the Barkhausen's Criterion for oscillators. | 3 |
| (g) | The output impedance of a current mirror should be infinite, justify the statement. | 4 |
| (h) | If differential mode gain of a differential amplifier is **1000** and common mode gain is **10**, calculate the CMRR in decibel for it. | 4 |
| (i) | Explain the concept of virtual short in operational amplifier. | 5 |
| (j) | List the properties of an ideal operational amplifier. | 5 |

### SECTION B

**2. Attempt any *three* of the following: 10x3 = 30**

| Qno | Questions | CO |
|---|---|---|
| (a) | Determine the values of $R_D$ and $R_S$ so that the following transistor operates at $I_D = 0.4\ mA$ and $V_D = 0.5\ V$. The NMOS transistor has $V_t = 0.7\ V, \mu_n C_{ox} = 100\frac{\mu A}{V^2}, L = 1\ \mu m$ and $W = 32\ \mu m$.   | 1 |
| (b) | Discuss the advantages of negative feedback in detail with explanation. | 2 |
| (c) | Derive the frequency of oscillation and condition of gain for sustained oscillations for Wein Bridge oscillator. | 3 |
| (d) | Explain current steering and properties of a current mirror. Also derive the relation between output current and reference current in current mirror. | 4 |
| (e) | Derive the transfer functions and cut off frequency for the followings:<br>(i) Low pass active filter, (ii) High pass active filter | 5 |

### SECTION C

**3. Attempt any *one* part of the following: 10x1 = 10**

| Qno | Questions | CO |
|---|---|---|
| (a) | Derive the expressions for input impedance, output impedance, open circuit voltage gain, overall voltage gain and short circuit current gain after completing the AC analysis of common emitter amplifier with emitter resistance. | 1 |

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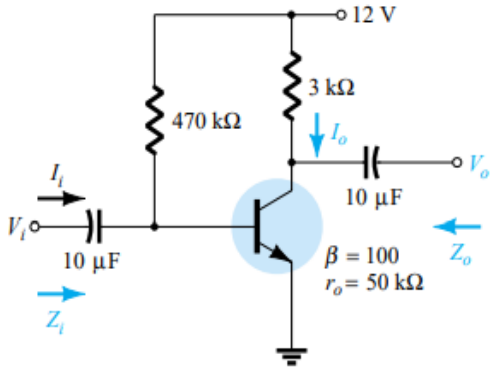
| | | |
|---|---|---|
| (b) | For the following circuit determine $r_e$, input impedance ($Z_i$), output impedance ($Z_0$), voltage gain ($A_v$), current gain ($A_i$). Neglect $r_0$ in all calculations.   | |

**4. Attempt any *one* part of the following: 10x1 = 10**

| Qno | Questions | CO |
|---|---|---|
| (a) | Explain the various feedback topologies, with their circuit models and properties. | 2 |
| (b) | Discuss the working of class B power amplifiers with its efficiency and nonlinearity. Also discuss the remedy of nonlinear distortion associated with class B power amplifier. | 2 |

**5. Attempt any *one* part of the following: 10x1 = 10**

| Qno | Questions | CO |
|---|---|---|
| (a) | Explain the operation of astable multivibrator with circuit and output waveforms. Also design an astable multivibrator which can generate a square wave of **10 KHz** frequency. | 3 |
| (b) | Explain the working of a tank circuit. Also derive the frequency of oscillation and condition of gain to get sustained oscillations for Colpitts oscillator. | 3 |

**6. Attempt any *one* part of the following: 10x1 = 10**

| Qno | Questions | CO |
|---|---|---|
| (a) | Derive the mathematical expressions for common mode gain, differential mode gain, input impedance and CMRR for differential amplifier. | 4 |
| (b) | Explain the transfer characteristics of differential amplifier. Also derive the necessary mathematical expression required for it. | 4 |

**7. Attempt any *one* part of the following: 10x1 = 10**

| Qno | Questions | CO |
|---|---|---|
| (a) | Design a circuit using a single operational amplifier for the following mathematical operations: ($V_1$ and $V_2$ are the available inputs)<br>i. $V_0 = 4V_1 + 3V_2$<br>ii. $V_0 = 2V_1 - 5V_2$ | 5 |
| (b) | State the advantage of Super diode. Explain the operation of precision full wave rectifier with proper circuit and output waveform. | 5 |