JHARKHAND UNIVERSITY OF TECHNOLOGY

Diploma 3rd Semester Examination

ANALOG ELECTRONICS (ECE 301)

Time: 3 Hours **Full Marks: 70** **SET: 1**

INSTRUCTIONS:

1. Question No. 1 is Compulsory.
2. Answer any **FOUR** questions from the remaining (Q.2 to Q.7).
3. Figures in the margin indicate full marks.

Q.1. Multiple Choice Questions [2 × 7 = 14]

(i) The leakage current in a semiconductor is due to:

(a) Majority carriers (b) Minority carriers

(c) Junction capacitance (d) None of the above

(ii) A Zener diode is mostly used as:

(a) An amplifier (b) A voltage regulator

(c) An oscillator (d) A rectifier

(iii) In a CE amplifier, the phase difference between input and output is:

(a) 0° (b) 90°

(c) 180° (d) 270°

(iv) Ideally, the CMRR of an Op-Amp should be:

(a) Zero (b) Infinity

(c) Unity (d) 100

(v) Which oscillator is used for high-frequency applications?

(a) RC Phase Shift (b) Wein Bridge

(c) Hartley Oscillator (d) Crystal Oscillator

(vi) Pin number 3 of IC 555 is used for:

(a) Trigger (b) Reset

(c) Output (d) Discharge

(vii) The efficiency of a Class B push-pull amplifier is approximately:

(a) 25% (b) 50%

(c) 78.5% (d) 100%

SECTION B (LONG ANSWER TYPE)

Q.2. (a) Explain the working of **Class B Push-Pull Power Amplifier** with a neat circuit diagram. **[7]**

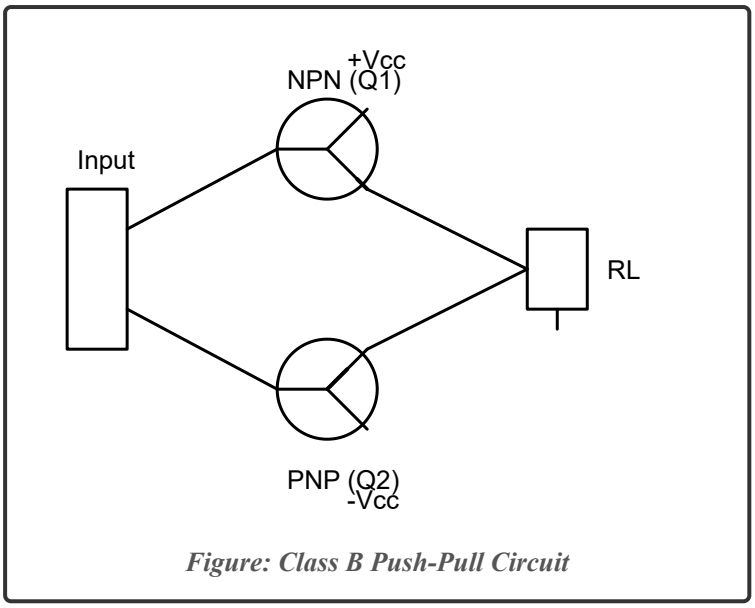

Figure: Class B Push-Pull Circuit

Q.2. (b) Derive the expression for the maximum conversion efficiency of a Class B amplifier. **[7]**

Q.3. (a) Draw the circuit diagram of **RC Phase Shift Oscillator** using a BJT. Explain how phase shift is achieved. **[7]**

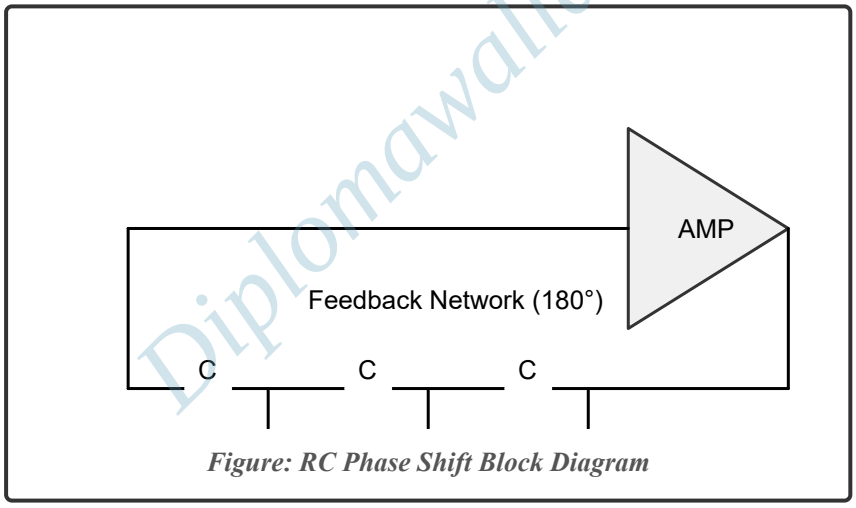

Figure: RC Phase Shift Block Diagram

Q.3. (b) Determine the frequency of oscillation for an RC phase shift oscillator if R = 10kΩ and C = 0.01μF. **[7]**

Q.4. (a) Explain the working of an Op-Amp as an **Integrator** with a circuit diagram. **[7]**

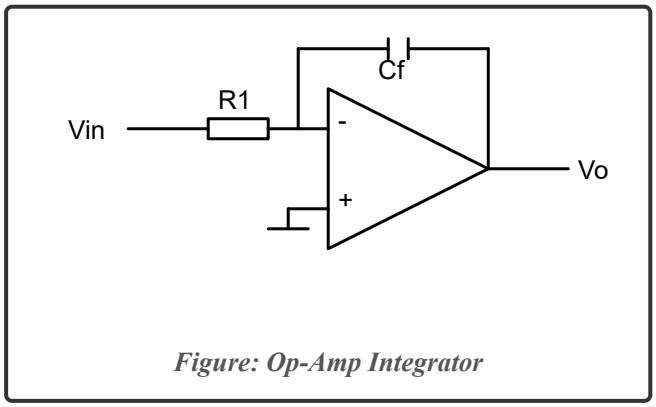

Figure: Op-Amp Integrator

Q.4. (b) Draw the **Functional Block Diagram of IC 555 Timer**. **[7]**

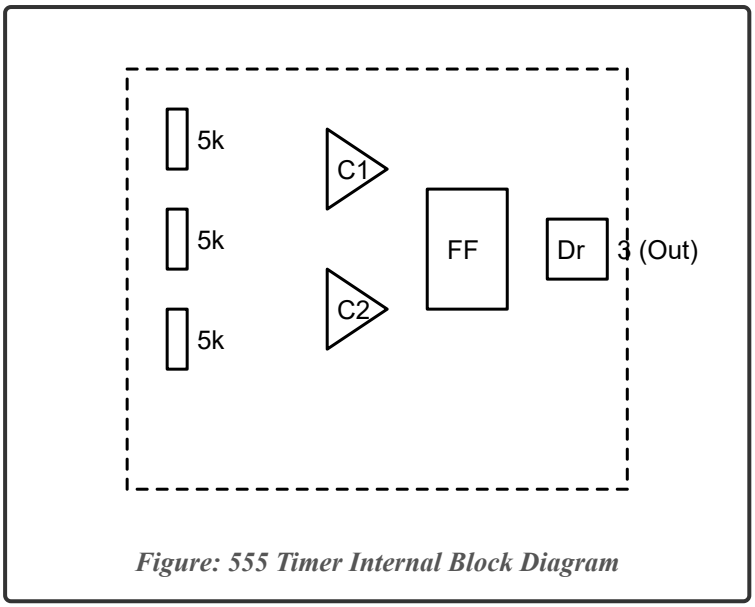

Figure: 555 Timer Internal Block Diagram

Q.5. (a) Draw the circuit diagram of a **Voltage Divider Bias** circuit. **[7]**

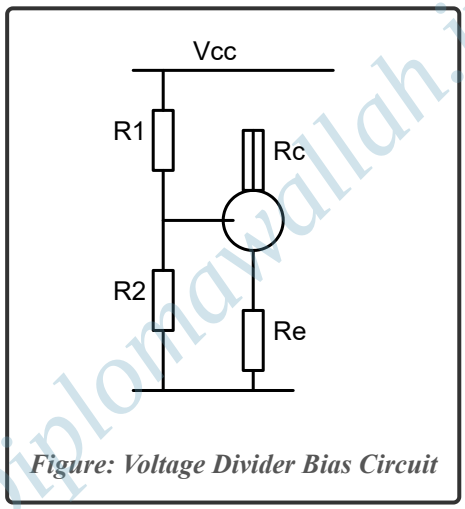

Figure: Voltage Divider Bias Circuit

Q.5. (b) NUMERICAL: For the fixed bias circuit shown below, determine $\mathbf{I_B}$ and $\mathbf{I_C}$.
Given: Vcc = 12V, Rb = 240kΩ, Rc = 2.2kΩ, β = 50. **[7]**

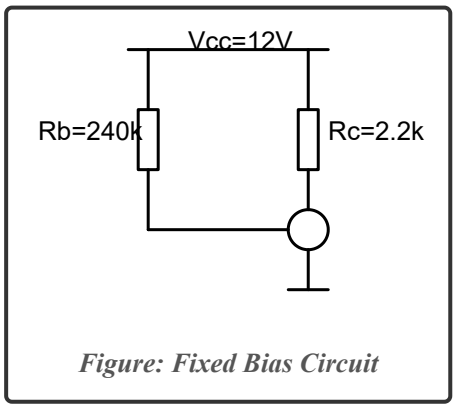

Figure: Fixed Bias Circuit

Q.6. Define **Schmitt Trigger**. Draw its circuit diagram using an Op-Amp and explain its working with the help of a Hysteresis Loop. **[14]**

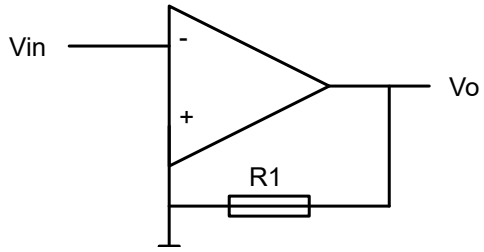

Figure: Schmitt Trigger Circuit

Q.7. Write Short Notes on (Any FOUR): **[3.5 × 4 = 14]**

a. SMPS (Switch Mode Power Supply)

b. Barkhausen Criteria

c. Active vs Passive Filters

d. Zener Diode Characteristics

e. Thermal Runaway

Diploma Wallah: Solutions Key

Q1 (MCQ Answers): (i) b, (ii) b, (iii) c, (iv) b, (v) c, (vi) c, (vii) c.

Q3(b) Numerical Hint:
Formula: $f = 1 / (2\pi RC\sqrt{6})$
Values: R=10k, C=0.01µF. Result ≈ **650 Hz**.

Q5(b) Numerical Hint:
Step 1: $I_B = (Vcc - 0.7) / Rb$ = (11.3 / 240k) = **47.08 µA**
Step 2: $I_C = \beta \times I_B$ = 50 × 47.08 µA = **2.35 mA**.

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