Time: 01 hour.

Answer ALL Questions

1) In an amplifier feedback circuit, show that closed-loop voltage gain is given by $A_f = \dfrac{A_0}{1 - \beta A_0}$, where A_0 is the open-loop voltage gain of the amplifier and β is the voltage feedback factor. Hence, describe "negative" and "positive" feedback.

Explain how positive feedback can be used to produce oscillations. Using the suitable RC-phase-shift circuit network, show that oscillations can be produced with frequency $\dfrac{1}{2\pi RC\sqrt{6}}$, and hence find the corresponding gain A_0 of the amplifier for this frequency.

2) (a) State the features of an ideal Operational Amplifier (Op-Amp). By means of circuit diagrams and derivations, show how Op-Amps can be used to add, integrate and differentiate.

(b) (i) Convert the decimal number 5.625 into binary number. Find the decimal equivalent of the binary number 1110.101.

(ii) By means of truth tables, describe the three basic binary logic gates which constitute all digital system. Using these basic logic gates, construct the logic circuit diagram and the truth table for 'exclusive OR' (XOR) gate. Hence find the pulse train at the output of the XOR gate shown in figure 1.
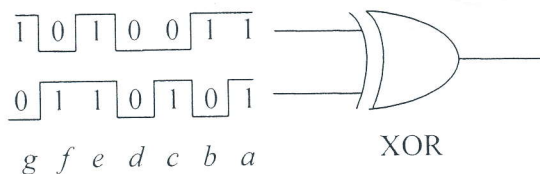

g f e d c b a   XOR

Figure 1