**INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY**

**SPRING 2018-19**

**E2.103 ANALOG ELECTRONIC CIRCUITS**

**QUESTION 1** A NPN transistor has an emitter area of 10 micron x 1 micron.The doping concentrations are : , , . At T = 300o K , The diffusion coefficients of holes in emitter .and electrons in base are 21.3 cm2/sec and 1.7cm2/s respectively. The diffusion length od holes in base is 0.6 micron. The minority carrier life time in base is 1700 microsec. Calculate the saturation current Is and when the base width W is 2 micron.

**QUESTION 2** Derive and sketch the small signal equivalent circuit of a bipolar transistor at IC = 0.2 ma , VCB = 3 volts, VCS = 4 volts. Device parameters are Cjeo = 20 fF , Cjco = 10 fF, , = 5, Early voltage = 25 volts. Assume that Vbi = 0.55 volts for all junctions. Neglect spreading resistors in base, emitter and collector

**QUESTION 3** An integrated circuit NPN transistor has the following characteristics: , = 5 , = 50 Kohm **at I**C = 1 ma, fT = 600 MHz at IC = i ma and VCB= 10 volts and fT = 1 GHz at IC = i0 ma and VCB= 10 volts, = 0.15 pf with VCB= 10 volts . Vbi = 0.55 volts for all junctions.Also assume Cje is constant under forward bias

Using the data above derive the small signal equivalent circuit for the transistor at **I**C = 5 ma and VCB= 2 volts

**QUESTION 4** Sedra 4.5

**QUESTION 5** Sedra 4.6

**QUESTION 6** Sedra 4.7

(Q2 and Q3 are taken from Gray with modifications Q4,5,6 are from Sedra International Edition with acknowledgement)