

2008**2nd Semester Examination****ELECTRONICS****PAPER—EL-1204****Full Marks : 40****Time : 2 Hours**

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Answer Q. No. 1 and any four from the rest.

- 1. Answer any five questions : 5×2**
- (a) Define the terms delay time and rise time in connection with transistor.
 - (b) How electron mobility can be increased in 'HEMT' using two heterojunction ?
 - (c) How does the impact ionization differ from field ionization ?
 - (d) Write down the charge neutrality condition associated with the metal-semiconductor junction.
 - (e) What do you mean by the 'Pinch off' of the channel in MESFET ?
 - (f) What do you mean by surface states pinning effect ?
 - (g) What is IMPATT diode ?
 - (h) Explain on what factors the speed of response of a switching transistor depends.

(Turn Over)

2. (a) Draw the basic circuit diagram of Ebers-Moll model and follow the model to derive the expression for the emitter and collector currents of a bipolar transistor. 5+5
- (b) Draw the structure of a unijunction transistor and explain its operation. 5+5
3. State the basic assumptions of thermionic emission model and derive an expression for the thermionic current density flowing over a Schottky barrier diode under the application of bias voltage V . 2+8
4. Develop a graphical method to determine the density of interface states and neutral level of a metal-semiconductor contact with interface states and interfacial layer. Explain how the barrier height and doping concentration of a metal-semiconductor diode can be determined from capacitance-voltage characteristics. Show that the sum of the barrier heights of metal-semiconductor contacts on n and p-type semiconductor is the band gap of the semiconductor. 4+4+2
5. Draw the structure of an n-channel junction field effect transistor under the application of gate voltage V_g and drain voltage V_d . Obtain the depletion layer widths at the source and drain ends and derive an expression for the drain current of the device as a function of V_d and V_g . 2+8
6. How does a MESFET differ from a JFET? Explain why the electrical characteristics of a short channel MESFET deviate from those of a long channel MESFET. Derive an expression for the drain current of a short channel MESFET. 1+3+6