Code: DE56/DE106   **Subject: ANALOG ELECTRONICS**

DipIETE – ET (Current & New Scheme)

Time: 3 Hours   **JUNE 2017**   **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.
- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Q2 to Q8 CAN BE ATTEMPTED BY BOTH CURRENT AND NEW SCHEME STUDENTS.**
- **Q9 HAS BEEN GIVEN INTERNAL OPTIONS FOR CURRENT SCHEME (DE56) AND NEW SCHEME (DE106) STUDENTS.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 **Choose the correct or the best alternative in the following:**   **(2×10)**

a. The maximum rate of change of the output voltage in response to a step input voltage is the _____ of an OP-AMP.
   (A) Time Constant   **(B)** Maximum Frequency
   (C) Slew Rate   **(D)** Static Discharge

b. The conversion time of a dual-slope ADC is typically in the range of _____
   (A) 5 to 10 ns   **(B)** 10 to 100 ns
   (C) 100 to 200 ns   **(D)** 2 to 3 ns

c. An audio amplifier is an example of _____
   (A) Digital IC   **(B)** Linear IC
   (C) Both digital and linear IC   **(D)** None of these

d. MOSFET is preferred over BJT in IC components because _____
   (A) MOSFET has low packing density
   (B) MOSFET has medium packing density
   (C) MOSFET has high packing density
   (D) MOSFET has no packing density

e. In a p-channel JFET, the charge carriers are _____.
   (A) Electrons   **(B)** Holes
   (C) Both electrons and holes   **(D)** Neither electrons nor holes

f. One of the following is not the application of a comparator _____.
   (A) Zero crossing detector   **(B)** Window detector
   (C) FSK generator   **(D)** Time marker generator

g. Instrumentation amplifiers using OP-AMP are used to measure _____.
   (A) Temperature   **(B)** Light intensity
   (C) Both **(A)** & **(B)**   **(D)** Neither **(A)** nor **(B)**

h. One of the following is the application of 555 Timer as an astable multivibrator
   _____
   (A) Missing Pulse detector   **(B)** Pulse Width modulator
   (C) Linear ramp generator   **(D)** Pulse Position modulator

i. Class AB operation is _____ operation.
   (A) Similar to class A   **(B)** Similar to class B
   (C) Similar to class C   **(D)** None of these

j. The level of the voltage between the input terminals of an OP-AMP is
   _____
   (A) Virtually zero   **(B)** 5 V
   (C) 18 V   **(D)** 22 V

Answer any FIVE Questions out of EIGHT Questions
Each question carries 16 marks.

Q.2 a. Explain with neat diagrams the fabrication of a typical integrated circuit. **(8)**

  b. Explain the fabrication of monolithic integrated NPN transistor with neat diagram. **(8)**

Q.3 a. Make a brief comparison among CE, CB, and CE configurations with practical applications. **(8)**

  b. A transistor in a circuit has its current levels measured as $I_B = 20\mu A$ and $I_C = 1mA$. Determing $r\pi$ and β, by relating with h-parameters. **(8)**

Q.4 a. Compare the differences between JFETs and MOSFETs with their symbols and applications. **(9)**

  b. Determine g_m for a JFET where $I_{DSS} = 7$ mA, $V_P = -3.5$ V and $V_{DD} = 15V$. **(7)**

Q.5 a. What do you understand by Light Emitting Diode. With neat diagrams, explain the working principle of Light Emitting Diode and also explain its advantages and disadvantages. **(8)**

  b. Explain the working of transformer coupled class-B Power amplifier with neat circuit diagram and waveforms. **(8)**

Q.6 a. Explain the following Configuration by giving their neat sketches. Also draw the circuit diagrams for the following open loop OP-AMP configurations and derive an expression for their output Voltages. **(4+4)**
   (i) Differential Amplifier
   (ii) Inverting Amplifier

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b. What is optocoupler? What are its various types? Give its advantages, disadvantages and applications. **(8)**

Q.7 a. Discuss in detail, the operation of Voltage to current converter using OP-AMP. **(8)**

b. Prove that a non-inverting integrator using OP-AMP has its output voltage given by $V_o = \frac{2}{RC} \int Vin \, (t) dt$. **(8)**

Q.8 a. (i) Consider the pulse generator shown in **Fig.1** in the quiescent state (before a trigger pulse is applied), find V_2, V_O and V_1.
(ii) At $t = 0$, a narrow, positive triggering pulse v whose magnitude exceeds V_R is applied. At $t = 0+$, find V_O and V_1.
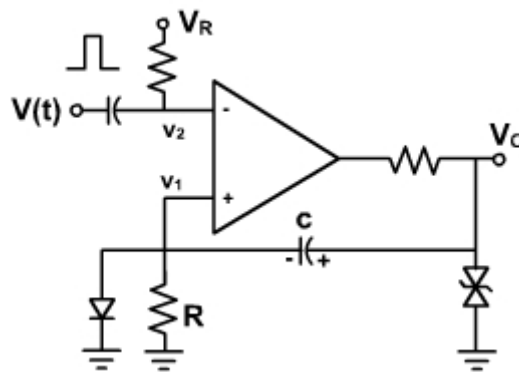(iii) Verify that the pulse width $T = RC \ln (2 V_O) / V_R$. **(8)**

Fig.1

b. With neat circuit diagram and waveforms, explain the working of an Astable Multivibrator using 555 timer IC. **(8)**

Q.9 **(For Current Scheme student i.e. DE56)**
a. Design a series voltage regulator using an operational amplifier and a 6V zener diode to maintain a regulated output of 18V. Assume that the unregulated input varies between 20V and 30V and that the current through the zener diode must be at least 20 mA to keep it in its breakdown region. **(8)**

b. With the help of a neat circuit diagram, explain the working of complementary emitter follower using npn and pnp transistors. **(8)**

Q.9 **(For New Scheme student i.e. DE106)**
a. Write short note on Solar Cells with applications. **(6)**

b. With the help of a neat circuit diagram, explain the working of Dual-Slope ADC. Give its applications. **(10)**