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

DiplETE – ET (Current & New Scheme)

Time: 3 Hours   **December 2016**   **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 HAVE BEEN GIVEN INTERNAL OPTIONS FOR CURRENT SCHEME (CODE DE56) AND NEW SCHEME (CODE 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. Which of the following is not a unipolar device _____
   (A) JFET   **(B)** MOSFET
   (C) IGFET   **(D)** BJT

b. The trans-conductance curve of a JFET is _____
   (A) Linear   **(B)** A straight line
   (C) Non linear   **(D)** Zero

c. The Voltage gain of an inverting amplifier using OP-AMP is _____.
   (A) $-\dfrac{R_f}{R_1}$ **(B)** $\dfrac{R_f}{R_1}$

   (C) $1+\dfrac{R_f}{R_1}$ **(D)** $1-\dfrac{R_f}{R_1}$

d. In a class-AB power amplifier, the output current flows for _____.
   (A) Full-cycle   **(B)** More than half-cycle
   (C) Less than half-cycle   **(D)** Half-cycle

e. A coupling capacitor transmits _____ but blocks _____.
   (A) DC, AC   **(B)** AC, DC
   (C) DC, DC   **(D)** AC, AC

f. A class A amplifier is biased _____
   (A) At the midpoint of load line   **(B)** At cutoff
   (C) At saturation   **(D)** None of these

g. CMMR of a differential amplifier is expressed as _____
   (A) A_d / A_c (B) A_c / A_d
   (C) $A_d . A_c$ (D) $A_d + A_c$

h. Which of the following IC is an OP-AMP _____
   (A) IC 555   (B) IC 741
   (C) IC 7805   (D) IC 723

i. _____ is used to obtain a square waveform from a sawtooth waveform
   (A) Clamper circuit   (B) Monostable multivibrator
   (C) Astable multivibrator   (D) Schmitt trigger

j. The Time period of IC 555 Astable multivibrator is _____
   (A) $T = 0.69(R_A + 2R_B)C$ (B) $T = 1.1(R_A + 2R_B)C$
   (C) $T = 0.69(2R_A + R_B)C$ (D) $T = 1.1RC$

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

Q.2 a. With the help of neat diagrams, explain the various isolation techniques used in IC's. **(8)**

b. Describe the various ways for fabricating P-N-P transistor with the help of diagrams. **(8)**

Q.3 a. Draw the h-parameter equivalent circuit of a Common Emitter Amplifier circuit and derive an expression for its (i) input impedance, (ii) output impedance, (iii) voltage gain and (iv) current gain. **(10)**

b. The transistor in the CE circuit shown in Fig.1 has the following parameters:
   $h_{ie} = 2.1k\Omega$, $h_{fe} = 75$, and $h_{oe} = 1\mu S$. Calculate the
   (i) Circuit input impedance   (ii) Output impedance
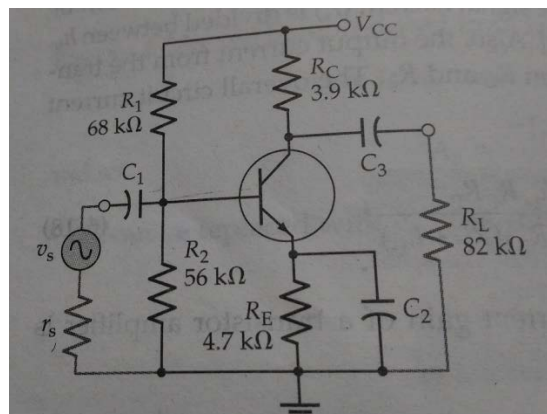   (iii) Voltage gain   **(6)**

Fig. 1   Common Emitter (CE) circuit

Q.4 a. Draw and explain the operation of N-channel Depletion – Enhancement mode of MOSFET. Sketch drain and transfer characteristics for an n-channel DE-MOSFET. **(8)**

b. Define the following FET parameters: **(4)**
(i) Transconductance (g_m)
(ii) Output Admittance

c. Draw the symbols of N & P - channel JFET, N & P - channel EMOSFET, N-channel DE-MOSFET and N-channel VMOSFETs. **(4)**

Q.5 a. With the help of a neat circuit diagram, explain the working of a Class-B transformer-coupled power amplifier and derive an expression for its collector efficiency. **(10)**

b. Calculate the total power supplied to a 3 ½ digit LED display when it indicates 1888. A 5V supply is used, and each LED has a 10 mA current. **(6)**

Q.6 a. Draw the circuit of inverting and non-inverting amplifiers using OP-AMP when feedback resistor is connected between input and output. Derive the closed loop gain of (i) inverting amplifier and (ii) non- inverting amplifier. **(12)**

b. Define Slew Rate. What causes the slew rate? **(4)**

Q.7 a. Explain the working of the following circuits using OP-AMP with circuit diagrams: **(10)**
(i) Half-Wave Rectifier   (ii) Peak Detector

b. Draw the circuit diagram of Inverting Summing Amplifier and derive an expression for its output voltage. **(6)**

Q.8 a. Draw the circuit diagram of RC Phase Shift Oscillator and derive the expression for frequency of oscillation. **(8)**

b. A 555 timer is configured to run in Astable mode with R_A = 6.8 KΩ, R_B = 3.3KΩ and C = 0.1μF. Calculate **(8)**
(i) T_{High} (ii) T_{Low}
(iii) Free running frequency   (iv) Duty cycle D

Q.9 **(For Current Scheme students i.e. DE56)**
a. List and explain the characteristics of three terminal IC voltage regulators. **(4)**

b. Draw the circuit of successive approximation type Analog to Digital Converters and explain its operation. **(8)**

c. Write the important features of LM380 monolithic audio Power amplifier. **(4)**

Q.9 **(For New Scheme students i.e. DE106)**
a. Draw the Circuit of Series-Parallel arrangement of solar cells and explain its operation with the help of solar cell characteristics. **(8)**

b. Explain in detail, the working of R-2R Ladder Digital to Analog Converter with the help of neat circuit diagrams. **(8)**