

B.Sc. T.Y. (CBCS Pattern) Sem-VI
USDSEPHT14 - Physics (Paper-II) : Digital & Analog Circuits and Instrumentation

P. Pages : 2

Time : Three Hours



GUG/W/22/13366

Max. Marks : 50

- Notes : 1. All questions are compulsory.
2. Draw well labelled diagram wherever necessary.

Either :

1. a) i) Explain Decimal to Binary conversion and convert (a) $(13)_{10}$ (b) $(29)_{10}$ to Binary. 5
ii) Perform the following subtraction by using 2's complement. 5
a) $(11000)_2 - (100)_2$ c) $(1111)_2 - (0101)_2$
b) $(101011)_2 - (10010)_2$

OR

- b) 1) What is Ex-OR gate? Draw its symbol. Write Boolean expression for two input Ex-OR gate & give its Truth Table. 2½
2) Convert as directed 2½
a) $(FCB)_{16} = (?)_{10}$ b) $(11001)_2 = (?)_{10}$ c) $(6AE)_{16} = (?)_2$
3) Reduce the logical expression $Y = (A + B)(A + \bar{B})(\bar{A} + B)$ and Draw logic circuit. 2½
4) Construct basic Gates by using NAND gate. 2½

Either:

2. a) i) What is rectifier? Draw the circuit diagram of full wave rectifier and explain its working. 5
ii) Derive an expression for efficiency of full wave rectifier. 3
iii) In centre tapped full wave rectifier the peak value of current is 0.1041 Amp, Calculate ripple factor. 2

OR

- b) 1) Explain the working of PN Junction diode in forward bias and draw its characteristics. 2½
2) Show that maximum rectifier efficiency for Half wave rectifier is 40.6%. 2½
3) Explain working of zenor diode as a voltage regulator. 2½
4) What is photo cell? State its any two applications. 2½

Either:

3. a) i) What is transistor? Explain the working of NPN transistor. 3
ii) Explain the input and output characteristic of NPN transistor. in CE mode with necessary circuit diagram. 4
iii) The current gain α of an transistor is 0.98 it is connected in CB mode. If the base current, changed by 0.2mA. Calculate change in collector current, current gain β and emitter current. 3

OR

- b) 1) In CE Amplifier, the load resistance in the collector circuit is $4k\Omega$ and $V_{CC} = 12V$. Find the co-ordinates of the operating point, if zero signal base current is $20\mu A$ and $\beta = 100$. 2½
- 2) Explain class A and class B Amplifier. 2½
- 3) Explain the working of two stage RC coupled Amplifier. 2½
- 4) Explain why the gain of an amplifier is low at low & high frequency region. 2½

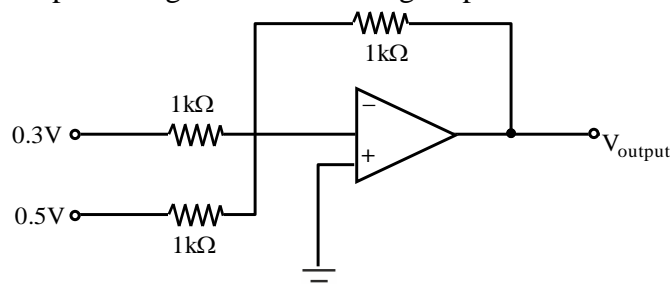
Either:

4. a) i) What is an op-Amp? Draw the block diagram of an op-Amp and explain the function of each stage. 4
- ii) State and explain any four characteristics of an ideal op-Amp. 4
- iii) A differential amplifier has difference mode gain is 100 and CMRR = 100, Calculate output voltage if the inputs are $V_1 = 1mV$ and $V_2 = 0.9mV$. 2

OR

- b) 1) Explain concept of virtual ground in operational Amplifier. 2½
- 2) Draw the circuit diagram of op-Amp as an inverting amplifier & obtain an expression for its closed loop voltage gain. 2½
- 3) Explain an op-Amp as a subtractor. 2½
- 4) The input to the op-Amp as a differentiator circuit is $V_i = 5 \sin(2\pi \times 1000t)$. Find the output if $R = 100k\Omega$ and $C = 1\mu F$. 2½

5. Solve **any ten** of following.
- a) What is Boolean expression? 1
- b) Write truth table of Exclusive NOR gate. 1
- c) Simplify $Y = \overline{\overline{A} + \beta}$ 1
- d) What is depletion region? 1
- e) State any two application of LED. 1
- f) State the filter circuit in a power supply. 1
- g) Draw symbol of NPN and PNP Transistor 1
- h) What is amplifier? 1
- i) What is the relation between α and β 1
- j) Draw the pin configuration of op-Amp IC 741. 1
- k) Determine the output voltage for the summing amplifier. 1



- l) Define slew rate. 1
