



WEST BENGAL STATE UNIVERSITY

B.Sc. Honours Part-III Examination, 2019

PHYSICS

PAPER-PHSA-VII-A

Time Allotted: 2 Hours

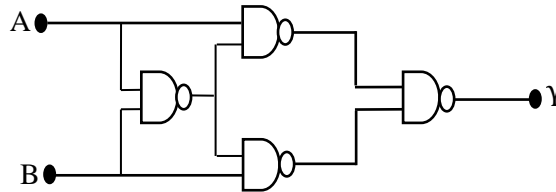
Full Marks: 50

The figures in the margin indicate full marks.

Candidates should answer in their own words and adhere to the word limit as practicable.

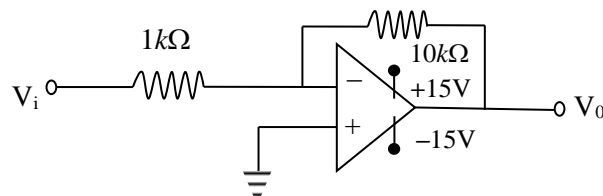
Answer question No. 1 and any four questions from the rest

1. Answer any *five* questions from the following: 2×5 = 10
- (a) Give a comparison of JFET and MOSFET.
 - (b) What are the characteristics of (i) an ideal voltage amplifier (ii) an ideal current amplifier?
 - (c) What type of feedback is used in an OPAMP adder? Justify your answer.
 - (d) Draw the output waveform of a modulo four ripple counter.
 - (e) What will be the output of the circuit given below:



- (f) What are the needs for modulating a signal?
 - (g) The CMRR of an OPAMP is 60 dB and $A_d = 200$. Find A_c .
 - (h) Why CRO is superior to other measuring instruments?
2. (a) What is the difference between the depletion and enhancement type MOSFETs? 2
- (b) Sketch the basic structure of n channel depletion MOSFET. Draw the drain characteristics of this MOSFET. 3+2
- (c) An n channel FET has $I_{DSS} = 8$ mA, $V_p = -4$ volt. Find V_{GS} that will result in a drain current of 4.5 mA. 3
3. (a) What are the advantages and disadvantages of cascading amplifier stages? 2+2+2+4
- (b) Draw a labeled circuit diagram of a two stage R-C coupled amplifier and draw its labeled Bode plot.
- (c) Explain why gain of R-C coupled amplifiers falls at high frequencies.

- (d) The r.m.s. output voltage in the mid-band region of an amplifier is 2 V and the power gain is 42 dB. Its power output at lower cutoff frequency (100 Hz) is 0.4 W. Find the output power in the mid band region and r.m.s. input voltage if input resistance is $1k\Omega$.
4. (a) Draw the circuit diagram of an astable multivibrator and explain its principle of action, showing the collector voltage waveform. 2+2+1
- (b) Why is the frequency stability of an oscillator high when a piezoelectric crystal is used? 2
- (c) A certain Colpitts oscillator uses a tank circuit with $L = 20 \text{ mH}$, $C_1 = 20 \text{ PF}$ and $C_2 = 300 \text{ PF}$. What is the frequency of oscillation? 3
5. (a) Write down the characteristics of an ideal OP-AMP. 2
- (b) What do you mean by virtual ground point? Is there any virtual ground point in the non-inverting amplifier? 1+1
- (c) Explain the operation of a Non inverting amplifier using OP-AMP. 3
- (d) Find the output of the circuit for an input 2+1
- (i) $V_i = 1\text{V}$ and (ii) $V_i = 2\text{V}$, assuming ideal OP-AMP.



6. (a) Draw the circuit diagram of a JK master slave flip flop using universal gates. Hence explain the operation of the flip flop and write down the truth table. How is race around condition avoided here? 1+2+1+1
- (b) What is the operation of an encoder? 2
- (c) Design a 1 bit comparator that has two inputs A and B and three outputs, one each for equality, $A = B$, greater than, $A > B$ and less than $A < B$. 3
7. (a) What are the practical difficulties in AM broadcast? How are they removed in FM? 2+2
- (b) Define the modulation index of an FM wave. Obtain an expression for the frequency modulation index for sinusoidal oscillation. 1+3
- (c) Draw the circuit diagram of an AM detector. 2

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