



WEST BENGAL STATE UNIVERSITY
B.Sc. Honours Part-III Examination, 2022

PHYSICS

PAPER: PHSA-VII-A

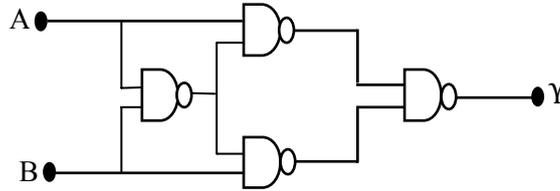
Time Allotted: 2 Hours

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.
All symbols are of usual significance.*

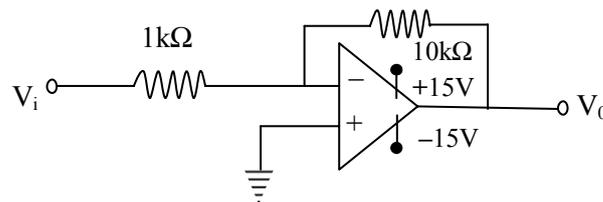
Answer question no. 1 and any *four* questions from the rest

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) How does the transconductance vary with drain current of an n-channel JFET? 2
- (b) Establish the relation $\mu = r_d \times g_m$ for JFET, where symbol have their usual meaning. 2
- (c) What is CMOS? Describe its use as a logic inverter. 1+2
- (d) Find the Pinch-off voltage of a p-Channel FET. Given: Drain to source saturation current is -45 mA, Drain to source voltage is such that the FET is operating in saturation region. Drain current is -15 mA and Gate to source voltage is -2 V. 3
3. (a) What are the advantages and disadvantages of cascading amplifier stages? 2

- (b) Draw a labeled circuit diagram of a two stage R-C coupled amplifier and draw its labeled Bode plot. 2
- (c) Explain why gain of R-C coupled amplifiers falls at high frequencies. 2
- (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 1 k Ω . 4
4. (a) What are the fundamental differences between Class A and Class C amplifiers? 2
- (b) Explain with a circuit diagram the operation of a Push-Pull power amplifier. Obtain an expression for the maximum efficiency of the circuit. 2+3
- (c) A two stage RC coupled amplifier uses transistors having h-parameters $h_{ie} = 1100 \Omega$ and $h_{fe} = 250$. If the load resistance is 10 k Ω , find the value of the coupling capacitor for having a lower cut-off frequency of 10 Hz. 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) $V_i = 1$ V and (ii) $V_i = 2$ V, assuming ideal OP-AMP.



6. (a) What is a flip-flop? What is its importance in a digital system? Draw the logic circuit of an RS flip-flop using NOR gates. 1+1+2
- (b) Show how an RS flip-flop can be converted into a JK flip-flop. 2
- (c) What is a D/A converter? Give the circuit diagram of a 4-bit R-2R ladder D/A converter that uses one Op-Amp. Write down the expression for the output voltage. 1+2+1
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

N.B. : Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.

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