

# PRABHAT KUMAR COLLEGE, CONTAI

M. Sc. 1<sup>st</sup> Semester Examination-2021

Subject: Physics Paper: **PHS 104** Full Marks: 50 Time: 2 hr

## 104.1: Analog Electronics-I

Answer any TWO questions

1. An audio signal given as  $15\sin 2\pi (1500t)$  amplitude modulates a carrier given as  $60\sin 2\pi (100,000t)$ . Determine the following : (a) Sketch the audio signal. (b) Sketch the carrier signal. (c) Construct the modulated wave. (d) Determine the modulation index and percent modulation. (e) What are the frequencies of the audio signal and the carrier? 2×5
2. (a) Write down the working operation of balanced frequency detector with figure. (b) A carrier wave of frequency 100MHz is frequency modulated by a sinusoidal wave of amplitude 20 V and frequency 100 kHz. The frequency sensitivity of the modulator is 25 kHz per volt. Determine approximate bandwidth of FM signal. 5+5
3. (a) Explain the operation of CMOS NAND gate with figure. (b) An n-channel JFET has  $I_{DSS} = 10$  mA and pinch-off voltage  $V_P = -4$ V. Find the drain current for  $V_{GS} = -2$ V. If the transconductance of the JFET with the same  $I_{DSS}$  at  $V_{GS} = 0$  is 4 millimho, find the pinch-off voltage. (c) The CMRR of an Op-amp is 60 dB and  $A_d = 200$ . Find  $A_c$ . 5+3+2
4. (a) Write down the block diagram of the frequency modulated transmitter. (b) Discuss the ionospheric influence on radio waves. 6+4

*Internal Assesment-05*

## 104.2: Digital Electronics-I

Answer any TWO questions

2X10=20

1. Minimize the following Boolean expression using K-map:  $f = \sum(1,2,5,6,7,9,10,12,13,16,17,18)$ .
2. Design a mod-10 counter. Draw its state diagram and explain the counting operation.
3. Design a 4-bit right shift register and explain how a data 1101 can be registered.
4. What is race-around condition in J-K flip-flop? How it was eliminated in MS-JK flip-flop?

*Internal Assesment-05*