

**M.Sc. 1st Semester Examination, 2013**

**PHYSICS**

**PAPER —PHS-104 (A + B)**

*Full Marks : 40*

*Time : 2 hours*

*The figures in the right-hand margin indicate marks*

**GROUP — A**

**[ Marks : 20 ]**

**Attempt Q. No. 1 and any one from the rest**

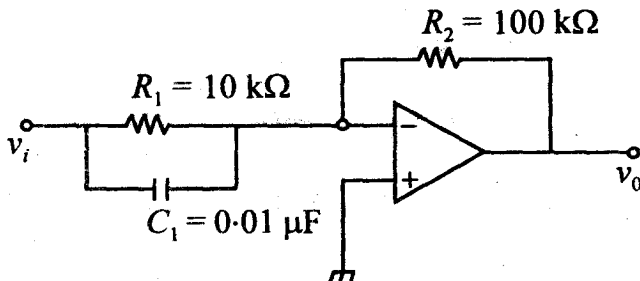
**1. Answer any five bits : 2 × 5**

(a) A 2.0 kW carrier signal is amplitude modulated (DSB-TC) by a single frequency same wave signal. If the modulation index is 50%, determine the total power of the modulated wave.

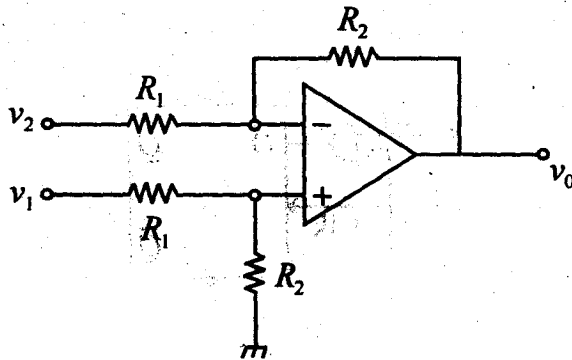
(b) Explain the operation of a Duplexer.

( Turn Over )

- (c) What is CMRR of an operational amplifier ?  
Write the value of CMRR of an operational amplifier when it is an ideal one.
- (d) Write one advantage of MOSFET over FET and one advantage of MOSFET over BJT.
- (e) Draw the schematic diagram of any discriminator circuit for FM detection.
- (f) State Carson's rule of thumb for the bandwidth of FM and hence find out the bandwidth of an FM signal whose modulation index is 5 and maximum modulating frequency is 12 kHz.
- (g) Find out the low frequency input impedance of the following circuit :



2. (a) Explain how a constant current source can be realised inside an Op-Amp using low- $\beta$  transistors, with necessary theory and circuit diagram. 3
- (b) Draw the circuit diagram of the input stage of an Op-Amp and derive the expression for its CMRR. 1 + 3
- (c) Derive the expression for the output voltage of the following Op-Amp circuit. 3



3. (a) What do you mean by VSB modulation? Draw the spectrum of a VSB modulated signal, hence discuss the advantage of VSB modulation in broadcasting. Obtain also the expression of a VSB modulated signal. 1 + 1 + 1 + 3

( 4 )

(b) Explain the principle of FM Stereo broadcasting.

4

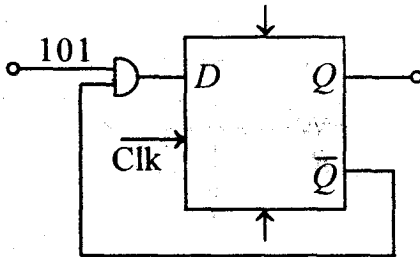
GROUP – B

[ Marks : 20 ]

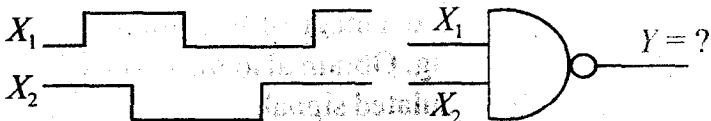
Answer Q. No. 1 and any **one** from the rest

1. Answer any *five* questions : 2 × 5

(a) What will be the output of the following circuit in three consecutive pulses ?



(b) Draw the output waveform for the following circuit.



( 5 )

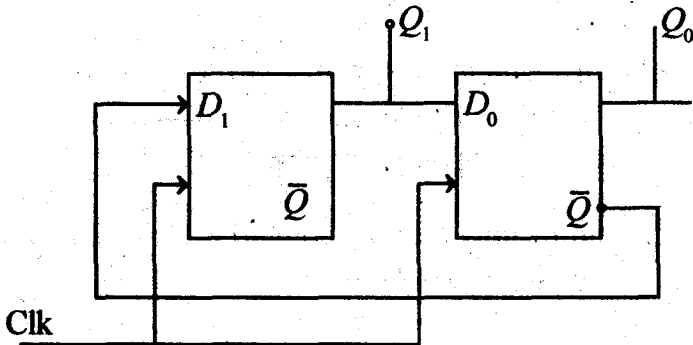
(c) Design the following circuit with NOR gate.

$$Y = A \cdot B + \bar{C}$$

(d) In a 3-input digital system the output is high only when the MSB and LSB are in opposite phase. Write down the output expression in SOP form.

(e) Give the circuit diagram of a square wave generator using 555 Timer IC.

(f) What will be the different output states for the following circuit assuming the initial condition is 10.



(g) Give the idea of 7 segment display system for octal number.

( 6 )

2. (a) Design a 2 bit up/down counter which can act synchronously with the facility of mode control selector. Explain briefly. 4
- (b) Solve the following digital equation using Karnaugh mapping.  
$$\gamma = \Pi M (1, 2, 5, 7, 9) \cdot d (12 - 15)$$
 3
- (c) You have 3 kHz signal. Design a circuit to produce 1 kHz signal at output. 3
3. (a) Design a 2-bit bi-directional SISO register and explain briefly. 4
- (b) In a 3-bit input system give the truth table for "Odd" parity generator. Write down the output expression using K' map. 3
- (c) Show how can you convert 4-bit serial data into 4 bit parallel data. 3