M.Sc. 1st Semester Examination, 2012

PHYSICS

PAPER – PHS- 104(A + B)

Full Marks : 40

Time : 2 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

Write the answers to questions of each Group in separate books

GROUP – A

[*Marks* : 20]

Time : 1 hour

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

1. Attempt any *five* bits : 2 × 5

(*a*) What is fading in radio wave communication ?

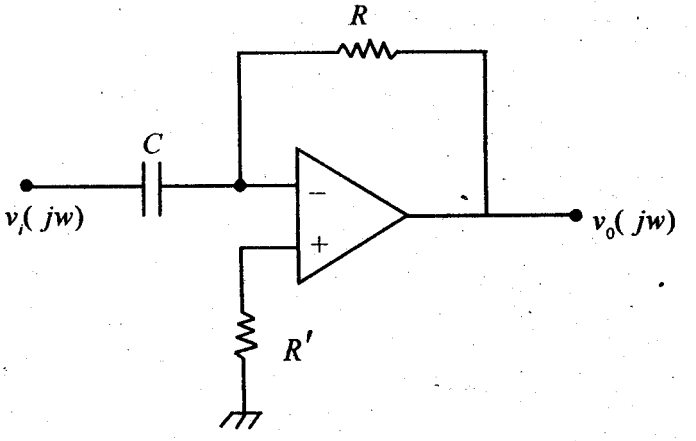
(*b*) What do you mean by slew rate of an Op-Amp ? What should be its ideal and practical value ?

(*c*) Compute the length of a $\lambda/2$ antenna required to transmit an FM signal at a frequency of 100 MHz.

(*d*) Explain the terms Ground wave and sky wave in case of radio wave propagation.

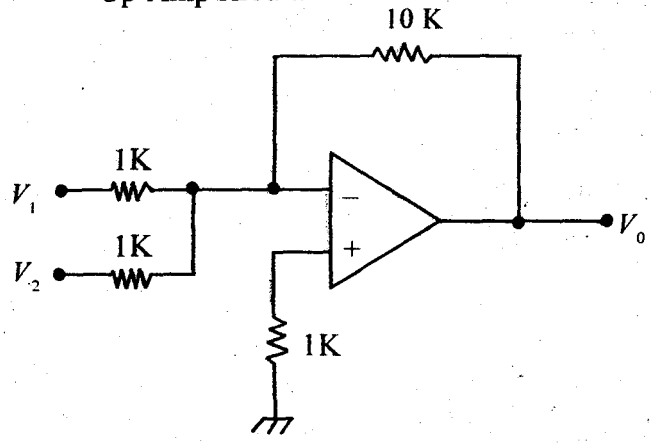
(*e*) Write down the expression for the refractive index of ionosphere, with explanations of the different terms used.

(*f*) Find $v_0(jw)$ in terms of $v_i(jw)$ for the following Op-Amp circuit



(*Continued*)

(*g*) Find the value of the O/P voltage of the following Op-Amp circuit.



$V_1 = 0.2V$, $V_2 = 0.5V$

2. (*a*) What do you mean by frequency modulation? Write down the expression for the FM wave modulated by a sinusoidal signal and find out its spectral components. Hence find out the theoretical bandwidth of FM. 1 + 1 + 3 + 1

(*b*) Draw the circuit diagram of any type of FM modulator and derive the necessary theory of operation. 1 + 3

3. (*a*) Derive RADAR range equation in free space. Hence explain how RADAR range can be increased ? 5 + 1

(*b*) Explain the working principle of Doppler RADAR. 3

(*c*) What is the difference between CW radar and pulsed radar ? 1

GROUP – B

[*Marks* : 20]

Time : 1 hour

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

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

(*a*) Represent the following function of A, B, C by Karnaugh map :

$$F(A, B, C) = AB + C$$

(*b*) Draw the Karnaugh map of

$$F(A, B, C, D) = \Sigma m\,(2, 3, 6, 7, 10, 11, 14, 15)$$

(*c*) What is a decade counter ? How can it be designed ?

(*d*) A clock pulse of 8 kHz is applied in the clock input of a 3-bit asynchronous counter. Find the frequency of the outputs of its different flip-flops.

(*e*) What is a seven segment display ? What are the different kinds of seven-segment display are there ?

(*f*) Write the advantage of serial-in parallel-out shift register over serial-in serial-out one.

(*g*) Draw the block diagram of 555 tiwer.

2. (*a*) What is an astable multivibrator ? Discuss the principle of operation of the astable multivibrator using transister. Discuss, why it is called a self triggering circuit.

(*b*) Obtain the expression of frequency of oscillation of the multivibrator. 1 +4 + 2 + 3

3. (*a*) Draw the circuit diagram of a JK-flip-flop using NAND gates only and explain its operation. $2\frac{1}{2} + 2\frac{1}{2}$

(*b*) What is race-around condition ? How this condition is eliminated ? 2 + 3