PG/IIS/PHS-204/14

M.Sc. 2nd Semester Examination 2014

PHYSICS

PAPER – PHS-204(Gr.-A + Gr.-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

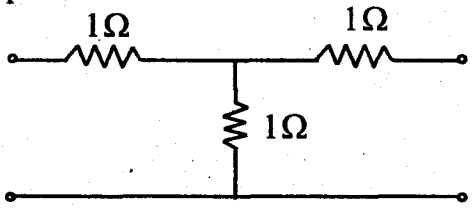
GROUP–A

[*Marks* : 20]

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

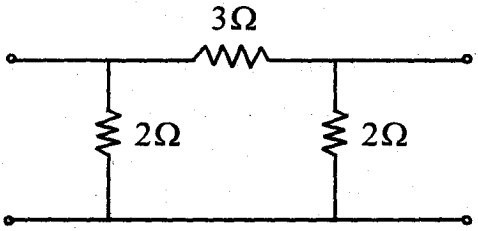
1. Attempt any *five* of the following : 2 × 5

(*a*) Convert the following *T* network into its equivalent π-network



(*b*) Define the terms reflection coefficient and voltage standing wave ratio in case of a transmission line.

(*c*) Find the characteristic impedance of the following π-network.



(*d*) Explain the origin of distortion in a transmission line.

(*e*) Draw the equivalent circuit of a transmission line using primary line constants.

(*f*) Design a constant k low pass filter having the following specifications–

Nominal resistance = 500 Ω
Cut-off frequency = $1000/\pi$ Hz.

(*g*) Explain in short the basic principle of operation of a phototransistor.

(*h*) Why a photodiode is never used in forward bias mode ?

2. (*a*) Sketch the frequency response characteristics of an ideal band-pass filter. 1

(*b*) Draw the circuit diagram of a constant-*k*-band -pass filter and derive the expressions for its cut-off frequencies. Derive the expressions for attenuation constant and phase constant in the pass band and attenuation band. Also represent graphically their variations as a function of frequency in the pass band and attenuation band.
1 + 3 + 4 + 1

3. (*a*) State and explain the two corrollaries of Foster's reactance theorem. 4

(*b*) Draw the cross-sectional diagram of a silicon controlled rectifier and its two transistor equivalent circuit. Is it possible to fabricate similar type of device using germanium ? 1 + 1 + 2

(*c*) Draw the *I* - *V* characteristic of a Triac, with proper labelling of the different voltages and currents. 2

GROUP–B

[*Marks* : 20]

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

1. Answer any *five* bits : 2 × 5

(*a*) What do you mean TDM-PAM ?

(*b*) An analog signal is represented by the equation

$x(t) = 3\cos(50\pi t) + 10\sin(300\pi t) - \cos(100\pi t)$.

Calculate the Nyquist rate for this signal.

(*c*) What is EEPROM ?

(*d*) Draw the basic memory cell for ROMs using diodes.

(*e*) Multiply $(110101)_2$ by $(1101)_2$.

(*f*) What is floating-point binary representation ? Explain with an example.

(*g*) Write the meaning of the following instructions for a 8085 μp – LHLD addr. ; STAX B ; DAD ; XCHG.

(*h*) Write a programme which substracts two numbers $5A_H$ and FF_H through immediate addressing.

2. (*a*) Design a 1-bit comparator circuit having three outputs $(A > B)$, $(A = B)$ and $(A < B)$ using only 2-input NAND-gates. 3

(*b*) Write the function of stack-pointer, temporary-register and Instruction-register in connection with a 8085 μp. 3

(*c*) What are the important properties that characterize the memory used in digital computer ? What are the differences between SRAM and DRAM ? 4

3. (*a*) What is a multiplexer ? Design a 4 : 1 multiplexer using basic-gates. 1 + 3

(*b*) What do you mean by Pulse-width-modulation (PWM) and pulse-position-modulation (PPM) method ? 3

(*c*) What do you mean by quantization error in PCM method ? How do you improve the error ? 3
