

2019

M.Sc.

1st Semester Examination

PHYSICS

PAPER – PHS-104 (Gr. – 104.1 + 104.2)

Full Marks : 50

Time : 2 Hours

Use separate answer scripts for Group 104.1 and Group 104.2

(Analog Electronics-I – PHS 104.1)

Answer Q1, Q2 and any one from Q3 and Q4

1. Answer any two bits: 2X2 = 4
- (a) What do you mean by slew rate of an OP-AMP? What should be its ideal and practical value?
- (b) An amplitude modulated broadcast radio transmitter radiates at 20KW at modulated index 75%. How much is the carrier power?
- (c) Calculate the length of a quarter-wave antenna if audio signal (1000Hz) is used without modulation.
- (d) Why MOSFET is commercially more important than BJT?
2. Answer any two bits: 2X4 = 8
- (a) (i) Explain why the FET is voltage controlled device whereas BJT is current controlled device.
- (ii) Sketch Block diagram of FM transmitter with automatic frequency control. (2+2)

(Turn Over)

(b) Show that for radio-wave propagation through ionosphere $\epsilon = \epsilon_0 \left(1 - \frac{81N}{f^2}\right)$, where ϵ is the effective permittivity of ionized region and f is the frequency of the radio-wave.

(c) (i) Define skip distance and maximum usable frequency (MUF) in radio-wave communication.

(ii) What is Secant law in radio wave communication? (2+2)

(d) (i) An n-channel enhancement mode MOSFET shows saturation drain current of 5 mA for a gate-source voltage of 8V. If the threshold voltage is 4V, what is the saturation drain current for a gate-source voltage of 10V?

(ii) What do you mean by frequency modulation? (3+1)

3. (a) Write down the expression for FM wave modulated by a sinusoidal signal and find out its spectral components.

(b) Describe the method of generation of DSB-SC signal by using balanced modulator. Draw the corresponding waveforms. (3+5)

4. (a) Derive radar range equation in free space.

(b) Draw the basic block diagram of an amplitude-modulated radio-telephone transmitter.

(c) The peak to peak value of an AM voltage has maximum value of 8V and a minimum value of 2V. What is the percentage modulation and amplitude of the unmodulated carrier? (3+2+3)

(Continued)

(Digital Electronics I– PHS 104.2)

Answer Q1, Q2 and any one from Q3 and Q4

1. Answer any two bits: 2X2 = 4

(a) Discuss the function of a bidirectional universal shift register.

(b) Simplify the following expression using K –map:

$$f(A, B, C, D) = \sum m (0, 5, 10, 11, 13) + d(4,14, 15)$$

(c) What is race around condition in J-K flip-flop?

(d) Draw the circuit of 2-bit twisted ring counter.

2. Answer any two bits: 2X4 = 8

(a) What are synchronous counters? What are their advantages?

(b) Design and explain the operation of mod-6 counter.

(c) Convert an R-S flip-flop into D and T flip-flop explaining the operation of each one.

(d) What do you mean by monostable multivibrator? Give a circuit of it. State the use of multivibrator.

3. (a) Write the excitation table for a JK Flipflop where NOT Gate is connected with the normal K input.

(b) Draw the circuit diagram of a seven segment display based system to display decimal numbers

(c) Write down the truth table of a 4-bit odd parity generator circuit. (3+4+1)

4. (a) Design a 4-bit synchronous up counter and explain its operation?

(b) Discuss the monostable multivibrator using IC-555 timer. (4+4)

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