

2021

ELECTRONICS — GENERAL

Second Paper

Full Marks : 100

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

Group - A

Answer **question no. 1** and **any four** questions, taking **two** from each of **Unit-I** and **Unit-II**.1. Answer **any five** questions :

2×5

- (a) What are positive and negative logic systems?
- (b) What is the binary equivalent of $(135.15)_8$?
- (c) Verify the Boolean identity: $A(A+B) = A$
- (d) What is the meaning of the term 'Fan-out' with reference to IC gates?
- (e) How can you convert a voltmeter to an ammeter?
- (f) Name two AC Bridges used to measure capacitance.
- (g) What is dual beam CRO?
- (h) What type of DVM has the fastest conversion time?

Unit - I

2. (a) Find the dual of the function $F = (A'B + AB')$

(b) Why EX-OR gate is called controlled inverter?

(c) Prove that NAND and NOR gates are universal gates.

2+2+(3+3)

3. (a) Design a full adder circuit using NAND gates only.

(b) Design a (2×4) decoder using basic gates only.(c) Design a (4×16) decoder using two (3×8) decoders.

3+3+4

4. (a) Distinguish decoder and demultiplexer.

(b) Design a 8 : 1 multiplexer circuit using two 4 : 1 multiplexer and one 2 : 1 multiplexer.

(c) What are the advantages of JK flip flop over SR flip flop?

(d) Draw the circuit diagram of a MOD-8 ripple counter.

2+3+2+3

Please Turn Over

5. (a) Design an AND gate using discrete circuit components and explain its working principle.
(b) Define propagation delay of a logic gate.
(c) What are the advantages of CMOS over TTL?
(d) What is the minimum number of flip flops required to design a MOD-128 ripple counter?
4+2+2+2

Unit - II

6. (a) Draw the block diagram of a general purpose CRO and indicate its basic components.
(b) How frequency of an AC signal can be measured using CRO?
(c) What is the need for applying a saw-tooth voltage in a CRO?
4+3+3
7. (a) What is meant by regulated power supply?
(b) Draw the circuit diagram of a fixed +5V regulated power supply using a suitable IC regulator.
(c) Explain the operation of a basic DC ammeter.
2+3+5
8. (a) Explain with a diagram the operation of a dual-slope digital voltmeter.
(b) Draw the circuit and explain the operation of a square wave generator.
5+5

Group-B

Answer *question no. 9* and *any four* questions, taking *two* from each of **Unit-I** and **Unit-II**.

9. Answer *any five* questions :
2×5
- (a) What is dielectric polarization?
(b) Write down the relation between electric field and electric potential.
(c) What is noise figure?
(d) What is signal to noise ratio (SNR)?
(e) What is modulation index in FM?
(f) What is reflection coefficient of a transmission line?
(g) What is PWM?
(h) What is Nyquist rate in pulse communication?

Unit - I

10. (a) What is current density?
(b) Write down integral and differential forms of Gauss's law in electrostatics.
(c) What is equipotential surface? Show by drawing, the nature of the lines of force and equipotential surfaces around a charged spherical ball.
2+(2+2)+(2+2)

11. (a) State Faraday's laws of electromagnetic induction.
(b) What is Lorentz force?
(c) Compare ferromagnetic, paramagnetic and diamagnetic materials.
(d) Calculate the flux density at a distance of 1 cm from a long straight wire carrying a current of 25A and placed in air. 2+2+3+3
12. (a) What is meant by 'characteristic impedance' of a transmission line?
(b) Derive transmission line equations in terms of voltage and current.
(c) What is a coaxial cable? 2+6+2
13. (a) What are the different types of transmission line used?
(b) Derive the relation between line impedance and reflection coefficient of a loss-less transmission line.
(c) Explain the primary and secondary constants of a transmission line. 2+5+3

Unit-II

14. (a) What is meant by TE and TM modes in a waveguide?
(b) What is the cut off wavelength of a waveguide?
(c) Write the relation between the guide-wavelength, cut-off wavelength and the free-space wavelength in a waveguide.
(d) Define phase velocity and group velocity in a waveguide.
(e) What is the difference between a transmission line and a waveguide? 2+2+2+2+2
15. (a) Why is modulation needed?
(b) Obtain an expression for an AM wave with sinusoidal modulation. Draw the message signal, carrier signal and AM waveforms.
(c) What is depth of modulation? 2+(3+3)+2
16. (a) Compare AM and FM.
(b) Derive the relation between total power and carrier power of a 100% modulated AM wave.
(c) Why is sky wave reception better during night time?
(d) What is skip distance? 2+4+2+2
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