January 2022

FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING

Time Allowed: 1.5 Hours | Full Marks: 60

Answer to Question No.1 is compulsory and Answer any two questions from the rest.

1. Answer the following questions (any twenty): 20x2

i) Which component opposes any change in current?
a) Resistor
b) Capacitor
c) Inductor
d) Diode

ii) The duration of one cycle known as _____
a) waveform
b) peak value
c) instantaneous value
d) period

iii) In case of ideal current sources, they have _____
a) zero internal resistance
b) low value of voltage
c) large value of current
d) infinite internal resistance

iv) The unit of magnetomotive force is-
a) ampere-turn
b) weber
c) mho
d) Maxwell

v) The property of a material which opposes the creation of magnetic flux is called-
a) permeability
b) permittivity
c) reluctance
d) resistance

vi) The energy stored in a magnetic field is given by (L= self inductance, I= current)-
a) $\frac{1}{2}LI^2$
b) $\frac{1}{2}IL^2$
c) IL^2
d) LI^2

vii) Eddy current loss is directly proportional to (f= frequency , B_m = maximum flux density)-
(a) f^2 and B_m^2
(b) f and B_m
(c) f and B_m^2
(d) f^2 and B_m

viii) The direction of induced emf is such that it will oppose the cause to which it is created, is related to _____ law of electromagnetic induction.
(a) Faraday's
(b) Lenz's
(c) Ohm's
(d) Ampere's

ix) The unit of inductive reactance is–
(a) Henry
(b) Farad
(c) Ohm
(d) Joule

x) In an ac circuit '$VI \sin\theta$' represents-
a) Active power
b) Reactive power
c) Apparent power
d) True power

xi) When sinusoidal voltage is applied across a pure capacitor the current in the capacitor-
a) lags applied voltage by 90^0
b) leads applied voltage by 90^0
c) is in phase with applied voltage
d) is in phase opposition with applied voltage

xii) Peak factor for a sine wave is-
a) 1
b) 1.414
c) 1.11
d) 2

xiii) The maximum value of sine wave current is 100 A, the rms value of current in the circuit will be-
a) 70.7 A
b) 100 A
c) 50 A
d) 70.7 mA

xiv) Voltage per turn in both primary and secondary winding of a transformer is-
a) high in high voltage winding
b) low in low voltage winding
c) same
d) cannot determine

xv) A 10 KVA, 1100/400 V, 50 Hz single phase transformer has 100 turns in the secondary winding. The number of turns in primary winding is _____. (Fill in the blank)

xvi) Direction of rotation of the motor armature/rotor can be determined by applying Fleming's left hand rule .(True/False)

xvii) A diode is a/an-
a. bidirectional device
b. unidirectional device
c. both (a) and (b)
d. none of the above

xviii) Free electrons in p type material -
a. are majority carrier
b. are minority carriers
c. both (a) and (b)
d. none of the above

xix) At absolute temperature an intrinsic semiconductor has-
   a) few free electrons
   b) few holes
   c) many holes and free electrons
   d) no holes and free electrons

xx) An ideal OP-AMP has the following characteristics- (R_{in} =input resistance, A= open loop gain, R_{out}= output resistance)
   a) $R_{in}= \infty$, $A= \infty$ and $R_{out} = 0$
   b) $R_{in}= 0$, $A= \infty$ and $R_{out} = 0$
   c) $R_{in}= \infty$, $A= 0$ and $R_{out} = \infty$
   d) $R_{in}= 0$, $A= \infty$ and $R_{out} = \infty$

xxi) The expression of voltage gain in an inverting amplifier using ideal OP-AMP is (R_f =feedback resistance, R_i= input resistance)-
   a. $-R_f/R_i$
   b. R_f/R_i
   c. $1+ R_f/R_i$
   d. $-(1+R_f/R_i)$

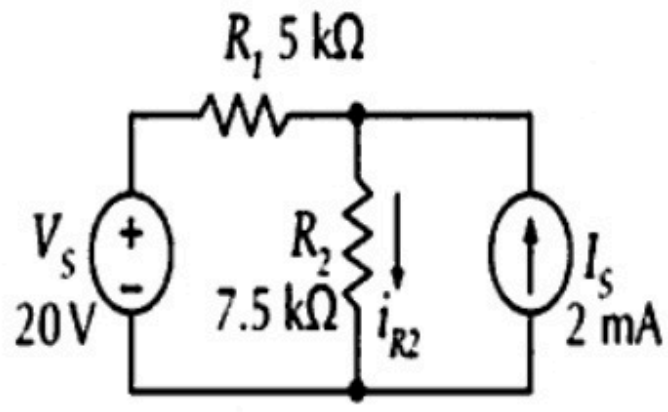
xxii) The expression of voltage gain in a non- inverting amplifier using ideal OP-AMP is (R_f =feedback resistance, R_i= input resistance)-
   a. $-R_f/R_i$
   b. R_f/R_i
   c. $1+ R_f/R_i$
   d. $-(1+R_f/R_i)$

xxiii) Which of these sets of logic gates are known as universal gates?
   a. XOR, NAND, OR
   b. OR, NOT, XOR
   c. NOR, NAND, XNOR
   d. NOR, NAND

xxiv) A digital circuit that can store only 1 bit information-
   a. NOR gate
   b. XOR gate
   c. Flip flop
   d. AND gate

xxv) The logical sum of two or more than two logical products is termed as
   a. OR operation
   b. POS
   c. SOP
   d. NAND operation

2. a) Define periodic & non-Periodic waveform with one example of each.
b) Using Source transformation principle find out the current through resistance R2.



4+6

3. a) Calculate the RMS and average values of a purely sinusoidal current having peak value 15A.
b) Draw STAR & DELTA connections. Also write voltage and current relations for both types. 4+6

4. a) Define self & mutual inductance.
b) State Faradays law of electromagnetic Induction. 5+5

5. a) Define true & reactive power.
b) Show that in a pure capacitive circuit the current leads the applied voltage by 90 degree. Also show the phasor diagram for the same. 4+6

6. a) Define a Transformer.
b) A single phase 50Hz transformer has 80 turns on the primary winding & 400 turns on the secondary winding. If the primary winding is connected to a 240 volt, 50 Hz supply, determine the e.m.f induced in the secondary winding. 4+6

7. a) Differentiate between Intrinsic & Extrinsic semiconductor.
b) Define the term Doping. Give examples of material for creation of p & n-type material. 5+5

8. a) Why is transistor termed as current controlled device?
b) Explain with diagram the principle of operation of an NPN transistor. 4+6

9. a) Draw the circuit diagram of a non inverting amplifier with feedback using op-amp & derive the expression of gain.
b) Define Flip-Flop. 7+3

10. Draw the pin diagram of IC 741 OP AMP & describe the function of each pin. 10

11. a) State De Morgan's Theorem.
b) Draw the NOR gate & write down its truth table. 6+4