AMALTHEA '18

Electronica

Round 1

Time - 45 minutes.

Team Name…….

Member 1:..... Mobile :.....

Member 2:..... Mobile :.....

- The star marked questions will be used in case of any tie.
- If a participant solves **all four** of the special questions given at the end of the paper correctly, they will be awarded 5 extra marks.
- Use of communication gadgets like mobile phones is not allowed. If you are found using them, you will be disqualified without warning. You can use scientific calculators if necessary.
- Rough sheets will be provided. No personal notes/ sheets are allowed.
- **We will call the top six teams if they get selected for the second round. Therefore write your name and number properly. Please do not call us to know the result.**
- The multiple choice questions have single correct options.
- Correct answers receive marks written alongside the questions. Wrong answers, multiple cancellations of options, untidy work receive 0 mark. There is no negative marking.
- Corrected papers will not be shown to you.
- The decisions by the organisers are final.

Q1 ..[1]

A signal source has an open-circuit voltage of 10 mV and a short-circuit current of 10 μA. The source resistance is_____

Q2*

The maximum power efficiency of an AM modulator is ..[1]

(a) 25%
(b) 50%
(c) 33%
(d) 100%

Q3 [1]

In an instrumentation amplifier, the output voltage is based on the _____ times a scale factor.

(a) summation of the two inputs
(b) product of the two inputs
(c) difference between the two inputs
(d) None of the above

Q4 [1]

In a millivoltmeter, the diodes and the capacitor are used in _____ parts of the circuit.

(a) the dc
(b) the ac
(c) both the dc and ac
(d) neither the dc nor ac

Q5 [1]

A low-pass filter _____.

(a) provides a constant output up to the cutoff frequency
(b) passes frequencies from zero up to the cutoff frequency
(c) rejects all frequencies above the cutoff frequency
(d) All of the above

Q6 [2]

The open-loop DC gain of a unity negative feedback system with closed-loop transfer

Function S+4S2+7S+13 is

(a) 4/13
(b) 4/9
(c) 4
(d) 13

Q7* [1]

In commercial TV transmission in India, picture and speech signals are modulated respectively

(a) VSB and VSB
(b) VSB and SSB
(c) VSB and FM
(d) FM and VSB

Q8 [2]

If the Fourier Transform of a deterministic signal g(t) is G(f), then
Match the items in column 1 with appropriate items in column 2.

Column 1	Column 2
(1) The Fourier Transform of $g(t-2)$ is	(A) $G(f)e-j\ (4\pi f)$
(2) The Fourier Transform of $g(t/2)$ is	(B) G(2f)
	(C) 2G(2f)
	(D) G(f - 2)

(1) _____
(2) _____

Q9 [1]

If a series circuit contains resistor and capacitor, the expression for quality factor is?

(a) C
(b) ωRC
(c) ωC
(d) 1/ωRC

Q10* [1]

The transfer function of a linear system is the
(a) ratio of the output, V0(t) and input Vi(t).
(b) ratio of the derivatives of the output and the input.
(c) ratio of the Laplace transform of the output and that of the input with all initial conditions zeros.
(d) none of these

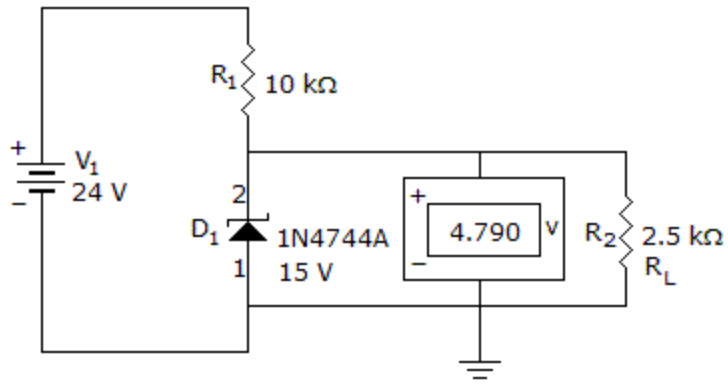
Q11 [1]

Which type of transformer is required to create a 180-degree input to a rectifier?

(a) center-tapped secondary
(b) step-down secondary
(c) stepped-up secondary
(d) split winding primary

Q12

What is wrong with this circuit? [2]



(a) The zener is open.
(b) The zener is shorted
(c) nothing
(d) not enough data

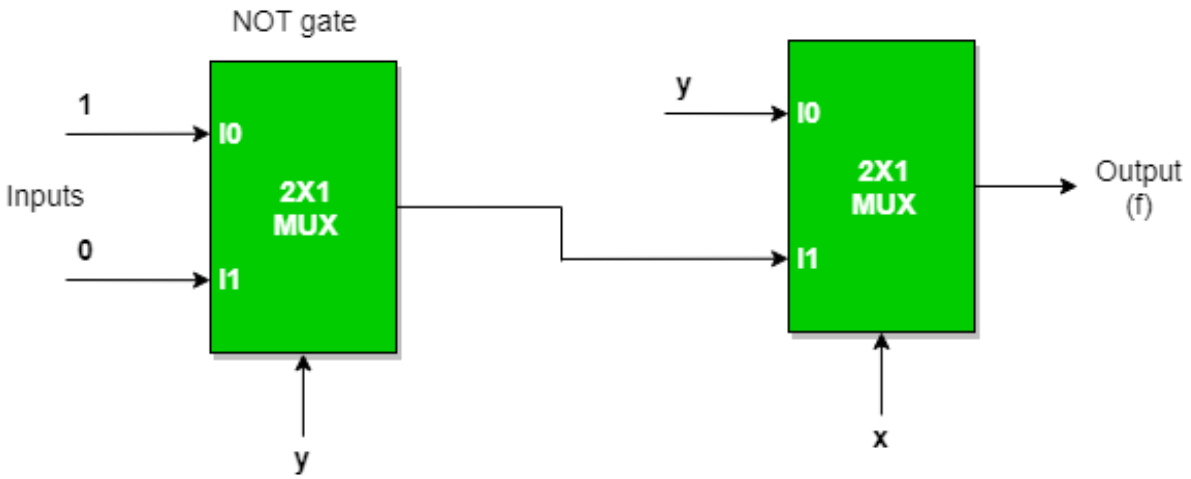
Q13* [1]

Which of the following circuits would require the least amount of filtering?
(a) A half-wave rectifier
(b) A full-wave rectifier
(c) A bridge rectifier
(d) A full-wave rectifier and a bridge rectifier

Q14 [2]

A single-machine system has M = 1 x10-3 p.u. is subject to a fault that causes an accelerating power ΔP = Pa = 0.8 p.u. then the rotor acceleration of the machine will be:
(a) 400 degree/sec^2 .
(b) 800 degree/sec^2 .
(c) 500 degree/sec^2 .
(d) 600 degree/sec^2

Q15 [1]



Which of the following gate is implemented in above figure?
Ans_____

Q16 [1]

The leakage current in CE arrangement is ……. that in CB arrangement
(a) more than
(b) less than
(c) the same as
(d) none of the above

Q17 [1]

The phase difference between the input and output voltages of a transistor connected in common collector arrangement is_____

Q18* [1]

An SCR is made of silicon and not germanium because silicon_____
(a) Is inexpensive
(b) Is mechanically strong
(c) Has small leakage current
(d) Is tetravalent

Q19 [2]

Determine the Time period of: x(t)=3 cos(20t+5)+sin(8t-3).
a) 1/10 sec
b) 1/20 sec
c) 2/5 sec
d 2/4 sec

Q20 [1]

When the temperature increases, the intrinsic stand off ratio_____
a) Increases
b) decreases
c) essentially remains the same
d) None of the above

Q21 [1]

The most popular form of IC package is
a) DIL
b) Flatpack
c) TO-5
d) None of the above

Q22 [1]

What is the minimum number of terminals required in an IC package containing four operational amplifiers (quad op amps)?
a) 12
b) 13
c) 14
d) 15

Q23 [3]

For an ideal operational amplifier (except for the fact that it has finite gain) one set of the value for the input voltages (V2 is the positive terminal V1 is the negative terminal) and output voltage (Vo) as determined experimentally is V1= 2.01V, V2=2.00V and Vo= -0.99V. Experiment was carried with different values of input and output voltages. Which of the

following is not possible considering experimental error?

a) v1= 1.99V, v2= 2.00V, v0 = 1.00V
b) v1= 1.00V, v2= 1.00V, v0 = 0V
c) v1= 1.00V, v2= 1.10V, v0 = 10.1V
d) v1= 0.99V, v2= 2.00V, v0 = 1.00V

Q24 [1]
In an instrumentation amplifier using transducer bridge, which device measure the change in physical energy

a) Resistive transducer
b) Indicating meter
c) Capacitive transducer
d) Inductor circuit

Q25 [1]
A ripple counter's speed is limited by the propagation delay of_____

a) Each flip-flop
b) All flip-flops and gates
c) The flip-flops only with gates
d) Only circuit gates

Q26* [1]
In an interconnected power system, the frequency of electro-mechanical modes of oscillation lies in the range_____

(a) 0.5-2.5 Hz
(b) 1-10 Hz
(c) 10-20 Hz
(d) 30-60 Hz

Q27 [2]
An AM signal is detected using an envelope detector. The carrier frequency and modulation signal frequency are 2 MHz and 2 KHz respectively. An appropriate value for the time constant of the envelope detector is

(a) 500 μsec
(b) 0.6 msec
(c) 0.6 μsec
(d) 0.2 μsec

Q28 [2]
The speed of a 125 hp, 600 V, 1800 rpm, separately excited d.c. motor is controlled by a three-phase fully controlled full- converter (6-pulse converter). The converter is operating from a 3 – phase 480, 60 Hz supply. The rated armature current of the motor is 165 A. The motor parameters are as follows:

Ra = 0.0874Ω La = 6.5 mH , Ke Φ = 0.33 V/rpm

The firing angle to obtain the rated speed of 1800 rpm at rated motor current is _____

Special Questions:

[If a participant solves **all four** of the special questions given at the end of the paper correctly, they will be awarded 5 extra marks]

Q1 [1]

Two bulbs of 40W and 60W are connected in series with an AC power supply of 100V. Which bulb will glow brighter?

Ans _____

Q2 [1]

Two bulbs of 40W and 60W are connected in parallel with an AC power supply of 100V. Which bulb will glow brighter?

Ans _____

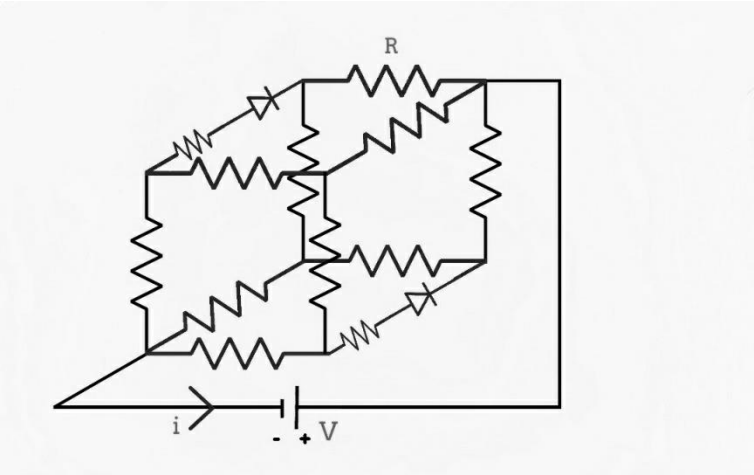
Q3 [1]

A lucknow number is a positive integer such that it is equal to the sum and the product of all its digits. Find the sum of all lucknow numbers

Ans_____

Q4 [1]

Find the value of i:
All the resistors have resistance R
Battery has negligible internal resistance and potential difference V across its terminals.



Ans_____