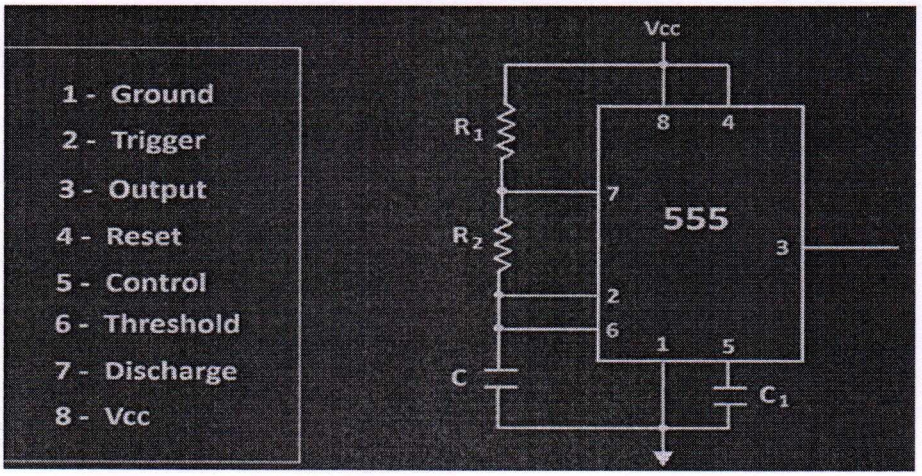
ENR107

Mid-Term

25 Marks

1. In a 555 timer, operating in astable mode, R1 = 20 kΩ, R2 = 15 kΩ and C1 = 0.001 μF. What is the value of the duty cycle for the generated waveform? **(2)**



a) 35% b) 70% c) 80% d) 50%

Answer - 70%

2. Consider the following two statements. **(1)**

Statement 1: An Astable Multivibrator can be used for generating a Square Wave.

Statement 2: A Bistable Multivibrator can be used for storing binary information.

Which of the following is true?

a) Only Statement 1 is correct. b) Only Statement 2 is correct.

c) Both Statements 1 and 2 are correct. d) Neither Statement 1 nor Statement 2 is correct.

Answer – Both Statement 1 and 2 are correct.

3. According to Moore's Law (updated), the number of transistors per square inch on an integrated circuit doubles approximately every: **(1)**

a) 6 months b) 12-14 months c) 18-24 months d) 36 months

Answer – c

4. To extract DC voltage from a PWM (Pulse Width Modulation) signal in Arduino, which of the following circuits is used? **(1)**

a) Resistor Circuit b) RC filter c) Priority encoder d) 7-seg display

Answer – b

5. What will the following Arduino Code print? **(2)**

```
// C++ code
//

int j = 1;

void setup()
{
  Serial.begin(9600);

}

void loop()
{
  for (j=1; j<4; j = j + 1)
  { Serial.print(j);
  }}
```

a) 123 b) jjj c) jjjjjj.....forever d) 123123123123.....forever

Answer - d

6. In a 5-bit weighted resistor D/A converter, the resistor value corresponding to the LSB is 40 kΩ, and the resistor value corresponding to the MSB will be **(1)**

a) 2.5 kΩ b) 2.8 kΩ c) 640 kΩ d) 80 kΩ

Answer - a

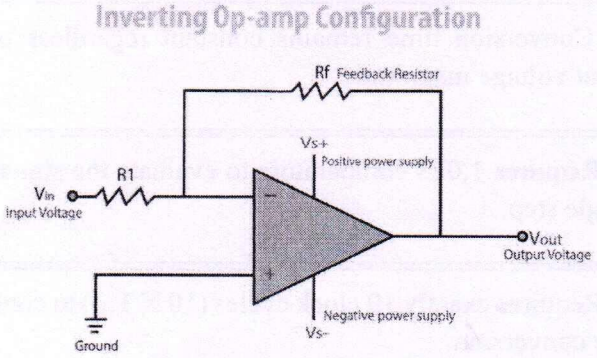
7. A manufacturing plant uses a digital temperature monitoring system to control a furnace. The system uses a 5-bit Successive Approximation (SAR) ADC (Analog to Digital Converter) with a reference voltage of 32V to convert the analog output of a temperature sensor into a digital value. During operation, the temperature sensor outputs 2.3 V. What will be the corresponding output (in binary) of the SAR ADC? (Write the answer in 5 bits without any spaces.) **(2)**

Answer - 00010

8. A 4-bit flash ADC is designed with a reference voltage of 8V. The input voltage applied is 5.2 V. How many comparators will have a HIGH output in this case?

a) 8 b) 9 c) 10 d) 11 **(1)**

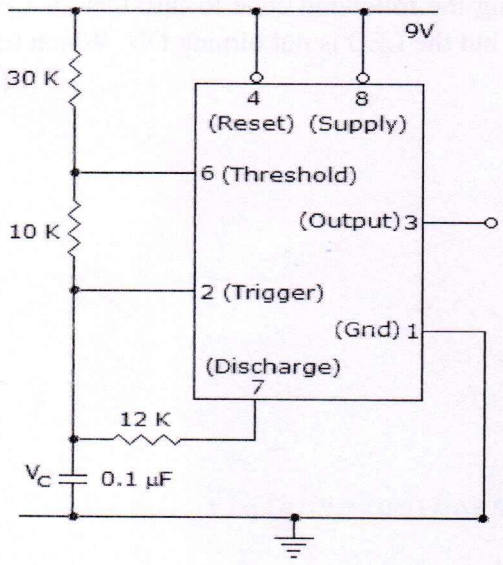
9. In the given inverting Op-Amp circuit: V_{in}= 5V, R_{in} = 20 kΩ, R_f = 10 kΩ. What will be the output voltage of the circuit? **(1)**



a) – 3V b) + 3 V c) -2.5V d) +2.5 V

Answer - c

10. An astable multivibrator circuit using IC 555 timer is shown below. Assume that the circuit is oscillating steadily **(1)**



The voltage V_C across the capacitor varies between

a) 3 V to 5 V b) 3 V to 6 V c) 3.6 V to 6 V d) 3.6 V to 5 V

Answer - b

11. Match the column **(2)**

Column A	Column B
1. 10-bit Flash ADC Architecture	A. Conversion time remains constant regardless of the input voltage magnitude.
2. 10-bit SAR ADC Architecture	B. Requires 1,023 comparators to evaluate the signal in a single step.
3. ADC Resolution Definition	C. Requires exactly 10 clock cycles (10 X T_{clk}) to complete one conversion.
4. ADC Conversion Time	D. The smallest magnitude change detectable by the system.

Answer - 1-b, 2-c, 3-d, 4-a

12. A student programmed an Arduino UNO using the following code to turn ON an LED when a push button connected to Pin 7 is pressed, but the LED is not turning ON. Which line in the code has a logical error? **(1)**

```
1  // C++ code
2  //
3
4  const int buttonpin = 7;
5  const int ledpin = 13;
6
7  void setup() {
8    pinMode(buttonpin, INPUT);
9    pinMode(ledpin, INPUT);
10 }
11
12 void loop() {
13   int buttonState = digitalRead(buttonpin);
14
15   if (buttonState == HIGH) {
16     digitalWrite(ledpin, HIGH);
17   }
18 }
```

a) Line 4 b) Line 8 c) Line 8 d) Line 16

Answer – Line 9

13. You are designing a control system for a chemical mixer. The mixer's motor (Output Y) should only be active under specific conditions involving a Pressure Sensor (A), a Flow Valve (B), and a Manual Override (C). **(2)**

Condition 1: The Pressure Sensor (A) must be within its limits (A=1).

Condition 2: The system must detect a state where the Flow Valve (B) and the Manual Override (C) are in opposite states (one is open/active, the other is closed/inactive).

Condition 3: For fail-safe purposes, the entire logic output must be inverted at the very last stage before reaching the motor.

Find the final Boolean expression for the motor output Y.

a) (A AND (B XOR C))'

b) (A' AND (B XOR C))'

c) A XOR B XOR C

d) A XOR B AND C

14. How can a NOT gate be implemented using a 2-input NOR gate? **(1)**

a) It is not possible to create a NOT gate using a NOR gate

b) By connecting two NOR gates in parallel

c) By connecting both inputs of the NOR gate to the same input signal

d) By connecting two NOR gates in series

Answer – c

15. The solutions to the quadratic equation $x^2 - 13x + 22 = 0$ are $x = 7$ and $x = 2$. What is the base of the number system used here? (Only write the numerical value). **(2)**

Answer – 6

16. Convert $(1947)_{10}$ to Hexadecimal. **(1)**

a) $(79B)_{16}$ b) $(97B)_{16}$ c) $(89B)_{16}$ d) $(B97)_{16}$

17. A function generator produces a function $\cos(y) = x^2 + k$ operating with multiple time period components ranging from 500 microseconds to 10 milliseconds. Which of the following would be an appropriate Nyquist sampling rate to avoid aliasing during interfacing. **(1)**

a) 4200 Hz b) 220 Hz c) 3600 Hz d) 833.33 Hz

18. Which number system is most widely used in computer memory addresses, color representation, and character encoding? **(1)**

a) Decimal b) Binary c) Octal d) Hexadecimal

Answer – d

19. A signal varies from 0 V to 16 V. It is quantized using a 4-bit uniform quantizer. Calculate the quantization step size. (Only write the numerical value and no units). **(1)**

Answer - 1