

SECTION A**MULTIPLE CHOICE****[10 MARKS]**

Choose the appropriate answer from each question by writing the alphabet beside the question number:

- 1) What are the four primary constants of a transmission line?
 - A) R, L, C and Y
 - B) R, L, C and F
 - C) R, L, C and G
 - D) R, L, C and Z_0

- 2) In a series resonance circuit the impedance at resonance is
 - A) Infinite
 - B) Zero
 - C) Minimum
 - D) Maximum

- 3) The brushes in modern motors are mainly made of
 - A) Copper
 - B) Zinc
 - C) Iron
 - D) Carbon

- 4) If the input power to a transformer is 650watts and the output power is 610watts, what is the efficiency?
 - A) 0%
 - B) 50%
 - C) 93.8%
 - D) 100%

- 5) What is the range of a resistor having the following colors:
Blue, Red, Black, Silver
 - A) 72Ω to 82Ω
 - B) 55.8Ω to 68.2Ω
 - C) 55Ω to 68Ω
 - D) 70Ω to 80Ω

6. Good electrical conductors, such as copper have aresistance.
- A. low
 - B. high
 - C. very high
 - D. average
7. Which of the following magnetic poles will repel each other?
- A. North and South
 - B. North and North
 - C. East and West
 - D. Positive and Negative
8. Which of the following best describes the *Kirchhoff's Voltage Law*?
- A. $\sum I = 0$
 - B. $\sum I = \sum V$
 - C. $\sum V = 0$
 - D. $\sum I = 2$
9. In Ohm's Law the current flowing in a conductor is proportional to the
- A. voltage
 - B. resistance
 - C. capacitance
 - D. charge
10. The unit of mutual inductance is
- A. capacitance
 - B. resistance
 - C. henry
 - D. voltage

SECTION B**FILL IN THE BLANKS****[10 MARKS]**

Write down the words that best complete the sentence.

1. _____ is the reciprocal of impedance.
2. The gain in decibel at cutoff frequency is _____ dB.
3. _____ is from negative to positive.
4. The S.I. unit for the light intensity is _____.
5. The _____ is used to store electric charge in any capacitor.
6. _____ electrons are located at the outer most shell of an atom.
7. _____ are those materials that have very few electrons.
8. Kirchhoff's law states that algebraic _____ of voltage around one complete loop of a circuit is equal to zero.
9. The magnetic field penetrates a piece of glass because glass is a _____ material.
10. Resonance occurs when X_L equals _____.

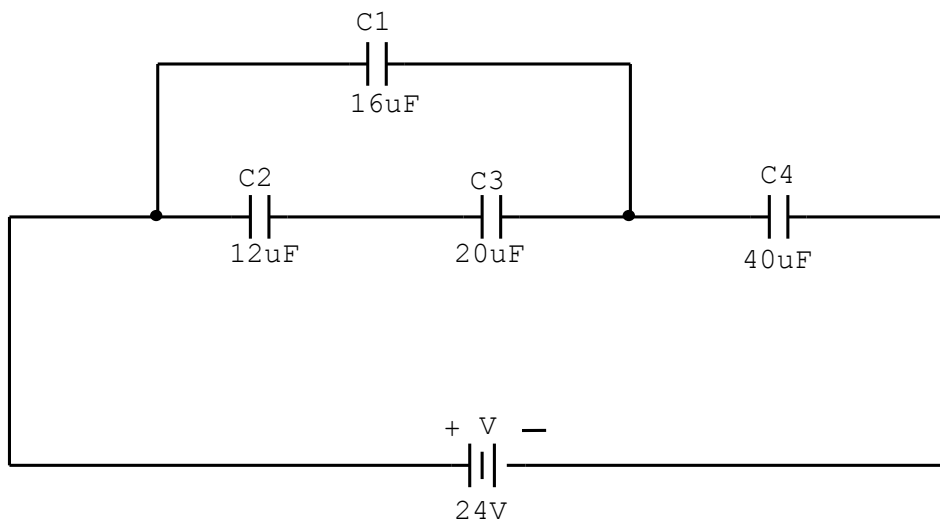
SECTION C

[80 MARKS]

1. The armature of a d.c. machine has a resistance of 0.1Ω and is connected to a 230V supply. Calculate the generated e.m.f. when it is running as a motor taking 60A. **[2 marks]**

2. Life is sustained by two body functions. What are these two body functions? **[2 marks]**

3.



For the circuit shown above, calculate the following:

- a) total capacitance of the circuit **[3 marks]**
- b) the total charge of the circuit **[2 marks]**
- c) voltage across C_4 **[2 marks]**

4. Determine the values and tolerance range of given resistors:

- i) brown, red, yellow, gold **[1 mark]**
- ii) brown, red, black, brown, red **[1 mark]**

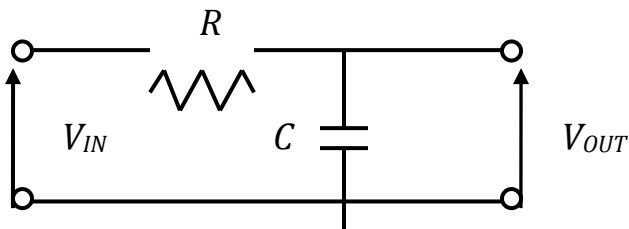
5. Define the following terms:

i) High Pass Filter

ii) Cut – off frequency

[2 marks]

6. An RC circuit is given below:



i) Derive the expression for

a) Cut-off frequency, f_c

[2 marks]

b) Output voltage, V_{out}

[2 marks]

ii) Construct the complete phasor diagram.

[2 marks]

iii) What is the effect of V_{out} , when the frequency is:

a) Increased

b) Decreased

[2 marks]

7. Find the total inductance in a circuit connected in series with three inductors, L_1 , L_2 , L_3 which have values of 3H, 5H and 2H respectively?

[2 marks]

8. What are the three things that determine the value of capacitor?

[3 marks]

9. List the four factors that affect the resistance of a conductor.

[2 marks]

10. What's the capacitance of a polycarbonate capacitor with foil plates measuring 10mm by 2m, separated with a 0.1mm thick dielectric?

[2 marks]

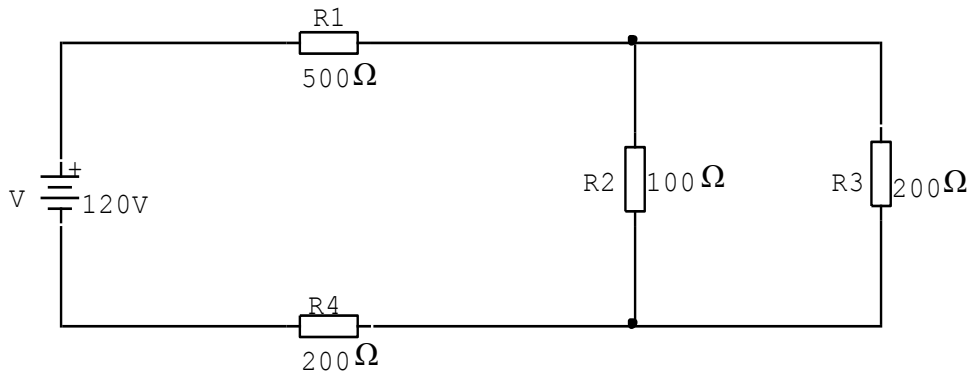
11. Find the force that should be exerted on a 4m length of a conductor, carrying a current of 600mA situated at right angles in a magnetic field with a flux of 8 Tesla.

[2 marks]

12. What are the four things that the value of the voltage induced in a conductor depends on? **[4 marks]**

13. A coil of 2000 turns wound on an iron core that's 85mm long has a current of 0.3A passing through the coil. What's the magnetizing force in the core? **[2 marks]**

14.



Calculate the following for the circuit shown above:

- a). total resistance of the circuit, R_T **[3 marks]**
- b). total current of the circuit, I_T **[2 marks]**
- c). voltage across R_2 and R_3 **[2 marks]**
- d). current through R_2 and R_3 **[3 marks]**
- e). voltage across R_4 **[2 marks]**

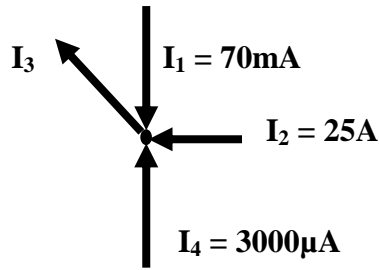
15 i) An ideal step-down transformer has 8000 turns on the primary and 200 turns on the secondary. The cross section of the magnetic core measures 20mm x 20mm. If the voltage V_1 applied to the input is 240V at 50Hz, and an indicator lamp of 20Ω resistance is connected to the output. Calculate:

- a) Primary and secondary voltages. **[2 marks]**
- b) Primary and secondary currents. **[2 marks]**

ii) An ideal transformer is used for matching a source impedance of 150Ω to a load impedance of 600Ω. Calculate the turn's ratio. **[2 marks]**

16. What are the two things that the voltage induced in a coil depends on? **[2 marks]**

17. Determine the missing current using Kirchhoff's Current Law.



[3 marks]

18. State the primary function of transmission line.

[1 mark]

19. a) Sketch the frequency of impedance for a series resonant circuit.

[2 marks]

b) A coil of inductance 100mH is connected in series with a $0.2\mu\text{F}$ capacitor. Calculate the frequency at which resonance occurs?

[1 mark]

c) A circuit having a resistance of 10Ω , an inductance of 0.5H and a variable capacitance in series. The circuit is connected to a 100V , 50Hz supply. Calculate:

i) The capacitance to give resonance.

[2 marks]

ii) The voltage across the inductance and capacitance.

[3 marks]

iii) The Q factor of the circuit.

[2 marks]

20. Determine the force on a 40cm long conductor which is carrying a current of 20A and is situated at right angles to the magnetic field with a flux density of 0.7T . If the force on a conductor is to be increased to 28N , determine the new current level required. [2 marks]

21. Explain the principle of self inductance.

[2 marks]

22. Determine the wavelengths for electromagnetic waves in free space with the following frequencies:

a) 5kHz

b) 10kHz

[2 marks]

.....End of Examination Paper.....