

**FIJI NATIONAL UNIVERSITY****COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY****SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING****CERTIFICATE IV IN ELECTRONICS ENGINEERING-STAGE 3****EEC401- ELECTRICAL PRINCIPLES III****FINAL EXAMINATION****Quarter III, 2019****DURATION: 2 Hrs****Date: TBA****Venue: TBA****TIME: TBA****INSTRUCTIONS TO STUDENTS**

1. *You are allowed 10 minutes Extra reading time during which you are NOT to write.*
2. *Begin each answer on a fresh page and use both sides of the sheet.*
3. *Write your candidate-number at the top of each attached sheet*
4. *Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string*
5. *For all sheets of paper on which rough/draft work has been done, cross each one through and ATTACH these to your answer scripts.*
6. *Write clearly the number(s) of the question(s) attempted on the top of each sheet.*
7. **ANSWER ALL QUESTIONS.**
8. *Show all workings where necessary.*
9. *Do not use programmable calculators, especially the ones that does the conversions of number systems.*
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!**

Section A**Matching****10 Marks**

From the list in the left column, select the matching definition from that in the column on the right. Write down in your answer sheet only the number with the corresponding alphabet from the right.

| # | Left Column | # | Right Column |
|----|--------------------|---|--|
| 1 | N-type connectors | A | Frequency response curve |
| 2 | -3dB | B | Type of coaxial cable. |
| 3 | Balun | C | Is used in equipment with VHF frequencies. |
| 4 | VSWR | D | Connects a stationary conductor to a rotating conductor. |
| 5 | Primary winding | E | Half-power point |
| 6 | Bode plot | F | Wavelength in meters |
| 7 | Carbon brushes | G | Patch antenna |
| 8 | $X_L = X_C$ | H | Impedance matching in antennas |
| 9 | Centrifugal switch | I | is connected to a source of ac power. |
| 10 | RG213 | J | E_{max}/E_{min} |
| | | K | Is in a single phase motor |
| | | L | Resonance frequency is reached. |

Section B**Multiple Choice****[30 marks]**

Write the ***Alphabet*** of the ***best choice*** in your Answer Sheet.

- 1) The most probable spot where a fault in a transmission line could be located is at:
 - A) half-lambda from the output
 - B) the connection point
 - C) quarter lambda from the output
 - D) half-lambda from the input

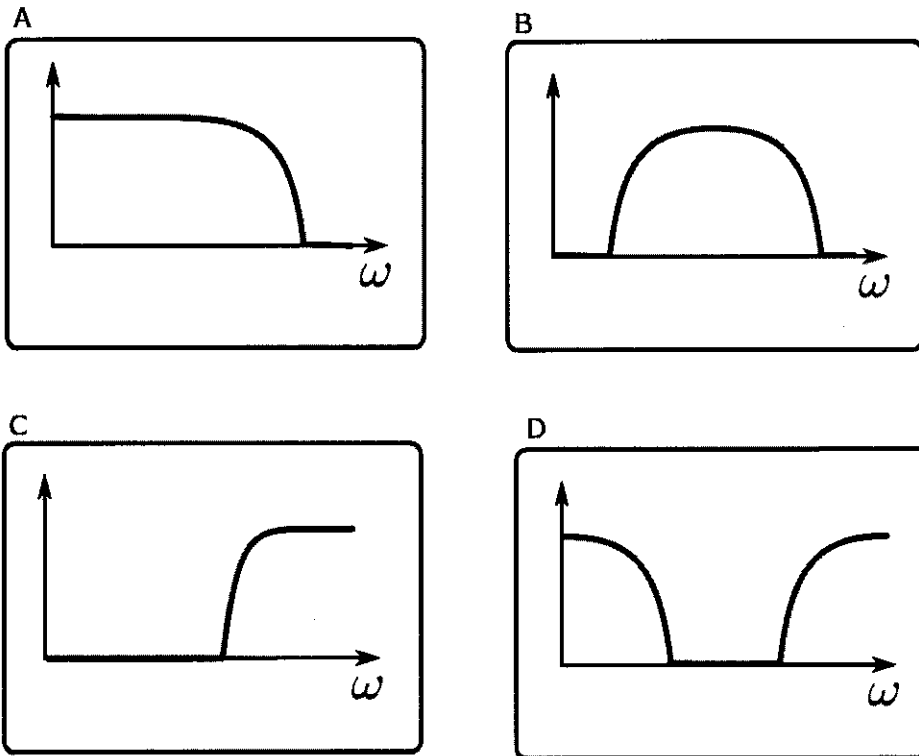
- 2) In a series resonance circuit the impedance at resonance is
 - A) Infinite
 - B) Zero
 - C) Minimum
 - D) Maximum

- 3) The brushes in electrical 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 wavelength of a 150MHz sine wave?
 - A) 0.5m
 - B) 1m
 - C) 1.5m
 - D) 2m

6) Identify the frequency response curve for a band-pass filter.



7) Which of these is correct about a step down transformer:

- A) $V_p < V_s$
- B) $N_p < N_s$
- C) $I_p < I_s$
- D) $I_p > I_s$

8) The two sets of windings in a single phase motor are:

- A) Primary and secondary windings
- B) Outer and inner windings
- C) Start and stop windings
- D) Start and run windings

9) The unit for flux density, B is

- A) fluxicity
- B) tesla
- C) neumans
- D) rho

- 10) The total impedance at resonant frequency in a series resonance circuit is:
- A) 0Ω
 - B) X_L
 - C) X_C
 - D) The same as the value of R in the circuit.
- 11) A machine that converts electrical energy into mechanical energy is called:
- A) Regulator
 - B) Motor
 - C) Engine
 - D) Generator
- 12) A cavity filter used in RF transmission systems performs in this manner:
- A) Pass the desired, reject the undesired
 - B) Reject the side bands only
 - C) Passes the fundamentals only
 - D) Rejects the fundamentals and passes side bands.
- 13) In a parallel RLC circuit, which value may always be used as a vector reference?
- A) current
 - B) reactance
 - C) resistance
 - D) voltage
- 14) The amount of voltage induced in the transformer secondary depends on:
- A) Self-Inductance
 - B) Length of Core
 - C) Input Voltage
 - D) Mutual Inductance
- 15) What is the mathematical relationship between the power in the primary (P_P) and power in the secondary (P_S) of a transformer?
- A) $P_S = P_P + P_L$
 - B) $P_S = P_P / P_L$
 - C) $P_S = P_P \times P_L$
 - D) $P_S = P_P - P_L$

- 16) The gain in decibel at cutoff frequency is
- A) 0 dB
 - B) 1 dB
 - C) 3 dB
 - D) -3 dB
- 17) The most prominent feature of the frequency response of a resonant circuit is:
- A) Bell-shaped frequency response
 - B) a sharp resonant peak in its amplitude characteristics.
 - C) Unity power factor and minimum impedance
 - D) Zero VSWR
- 18) What would be the current ratio of a transformer with a turn's ratio of **1:3**?
- A) 3:1
 - B) 1:1
 - C) 1:3
 - D) $\sqrt{2} = 1$
- 19) Resonance occurs when
- A) $X_L = R$
 - B) $X_L = X_C$
 - C) $L = C$
 - D) $F_r = f_c$
- 20) Resonant tuned circuits are used in
- A) Logic circuits
 - B) Radio receivers
 - C) Power distribution control
 - D) Motor speed regulation
- 21) Which of the following causes opposition to the flow of alternating current in an inductor?
- A) Conductance
 - B) Reluctance
 - C) Admittance
 - D) Reactance

22. How does an inductor react to AC?

- A) As the frequency of the applied AC increases, the reactance decreases.
- B) As the amplitude of the applied AC increases, the reactance increases.
- C) As the amplitude of the applied AC increases, the reactance decreases.
- D) As the frequency of the applied AC increases, the reactance increases.

23. Why is impedance matching important?

- A) So the source can deliver maximum power to the load.
- B) So the load will draw minimum power from the source.
- C) To ensure that there is less resistance than reactance in the circuit.
- D) To ensure that the resistance and reactance in the circuit are equal.

24. Which of the following describes one method of impedance matching between two AC circuits?

- A) Insert an LC network between the two circuits.
- B) Reduce the power output of the first circuit.
- C) Increase the power output of the first circuit.
- D) Insert a circulator between the two circuits.

25. State one reason for the use of an impedance matching transformer?

- A) To minimize transmitter power output.
- B) To reduce distortion and attenuation
- C) To reduce power supply ripple.
- D) To minimize radiation resistance.

26. Which of the following devices can be used for impedance matching at radio frequencies?

- A) A transformer
- B) A Pi-network
- C) A length of transmission line
- D) All of the above

27. A two-times increase or decrease in power results in a change of how many dB?

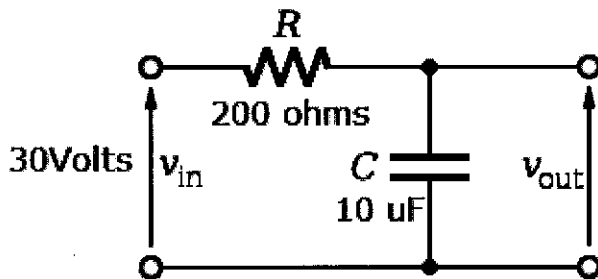
- A. Approximately 2 dB
- B. Approximately 3 dB
- C. Approximately 6 dB
- D. Approximately 12 dB

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28. What are the typical characteristic impedances of coaxial cables used for antenna feed lines at HF radio stations?
- A) 25 and 30 ohms
 - B) 50 and 75 ohms
 - C) 80 and 100 ohms
 - D) 500 and 750 ohms
29. Which of the following factors determine the characteristic impedance of a parallel conductor antenna feed line?
- A. The distance between the centres of the conductors and the radius of the conductors.
 - B. The distance between the centers of the conductors and the length of the line
 - C. The radius of the conductors and the frequency of the signal.
 - D. The impedance of the RF connectors.
30. The characteristics impedance of a flat ribbon type TV antenna cable is 300 ohms. How do you match its impedance to the TV antenna?
- A) Use a band-pass filter.
 - B) Use a balun transformer.
 - C) Use an LC circuit.
 - D) Connect them directly.

SECTION C**FUNDAMENTALS****[30 MARKS]**

1. Using diagrams, explain the following terms and state one application of each:
- Balanced circuits
 - Unbalanced circuits
 - Frequency response
- [2 marks each]**

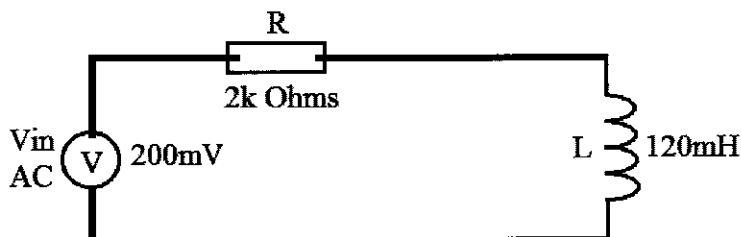
2. An RC circuit is given below:



- Calculate the following:
 - Cut-off frequency, f_c
 - Output voltage, V_{out}

[2 marks each]
 - What is the effect of V_{out} , in the RC circuit above when the frequency is:
 - Increased
 - Decreased

[2 marks each]
3. An RL High Pass Filter circuit is shown below:



Calculate the following:

- Cut-off frequency, f_c **(3 marks)**
- V_{out} at cut-off frequency **(3 marks)**
- Phase angle, Φ at 1KHz **(2 marks)**

SECTION C**[CONTINUED]**

4. A circuit having a resistance of 50Ω , an inductance of 150mH and a variable capacitance in series, is connected across a 240V , 50Hz supply.

Calculate:

- a) The capacitance to produce resonance. **(2.5 marks)**
- b) The voltage across the inductance and capacitance. **(3 marks)**
- c) The Q factor of the circuit. **(2.5 marks)**

SECTION D. TRANSMISSION LINES AND ELECTRICAL MACHINES. [30 MARKS]**QUESTION 1.**

- A. With the use of appropriate diagrams, explain what the characteristic impedance of a transmission line is. **(3 marks)**
- B. The coaxial cable is used widely in the industry.
- a) Sketch the basic construction of a coaxial cable. **(2 marks)**
 - b) Give one precaution that needs to be taken when working with such cables. **(1 mark)**
- C. i A 75Ω transmission line is terminated with a load resistance Z_L of $= 150\Omega$. Determine the following:
- a) *The theoretical Standing Wave Ratio (SWR)* that will result from this mismatch. **(3 marks)**
 - b) When the line was connected to a transmitter and the power measurements done, it was found that forward power was 5watts and reflected power 4watts. What is the SWR? **(4 marks)**

QUESTION 2.

A radio communication relay station goes off air. When the technicians attended to the fault at the station, they found that the transmitter was on shutdown mode and would not reset. What would the expected fault be? State the immediate action that has to be taken and explain the procedures they will follow to eliminate the fault from the system in the future. **(10 marks)**

QUESTION 3

A single phase motor is used to drive a fan. The fan is faulty – when switched on, it doesn't run until someone physically spins the blades. Draw the schematic diagram of this motor and explain its operation based on motor principles, stating the suspected faulty component and the remedy you will carry out to rectify the fault.

(7 marks)

The End
