

**Fiji National University**  
College of Engineering, Science & Technology

**SCHOOL OF ELECTRICAL & ELECTRONIC**  
**ENGINEERING.**

**ELECTRICAL TRADE CERTIFICATE STAGE 3**

**EEE411 –ELECTRICAL PRINCIPLES 1C.**

**FINAL EXAMINATION – 1<sup>ST</sup> HALF - PENSTER 1 - 2014**

**DAY/DATE: as per timetable      TIME: as per timetable      ROOM: as per timetable.**

**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 it through and you MUST ATTACH 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!**

1. What is the wavelength of a 400MHz sine wave?
  - A) 0.5m
  - B) 0.75m
  - C) 3m
  - D) 1.2m
  
2. What is the characteristic impedance of RG58U coaxial line if it has a capacitance of 20pF/m and an inductance of 85nH/m?
  - A) 50  $\Omega$
  - B) 65
  - C) 65  $\Omega$
  - D) 75  $\Omega$
  
3. The input power to a transformer is 500watts and the output power is 450watts. What will be its efficiency?
  - A) 90%
  - B) 80%
  - C) 57%
  - D) 90
  
4. The unit for flux density, B is
  - A) Weber
  - B) No unit
  - C) Turns
  - D) Tesla
  
5. When resonance occurs in a parallel resonant circuit the impedance is :
  - A. Maximum
  - B. Infinite
  - C. Zero
  - D. Zero
  
6. Resonant tuned circuit are used in
  - A) Water pumps
  - B) Electric Motors
  - C) Radio receivers
  - D) Motor speed regulation
  
7. A transformer has 100 turns on the primary and 10 turns on the secondary. If 500 volts AC is applied to the primary what will be the secondary voltage?
  - A) 25V
  - B) 60V
  - C) 76V
  - D) 50V

8. A filter that passes low-frequency signals and attenuates signals with frequencies higher than the cutoff frequency.
- A) Band Stop Filter
  - B) High Pass Filter
  - C) Low Pass Filter
  - D) Saw Filter
9. What is your understanding a high selectivity circuit?
- A) Wide bandwidth circuit
  - B) Low Q circuit
  - C) High Q circuit
  - D) Low Q circuit
10. The voltage standing wave ratio (VSWR) is defined as:
- A) ratio of the maximum radio-frequency (RF) voltage to the minimum RF voltage along the line
  - B) function of the capacitance and inductance distributed along the line's length
  - C) high R & C components
  - D) a fractional value relating a transmission line's propagation speed to the speed of light in a vacuum
11. The condition for resonance is:
- A)  $X_L = R$
  - B)  $X_L = X_C$
  - C)  $L = C$
  - D)  $f_r = f_c$
12. If a transformer has 300 turns on the primary and 900 turns on the secondary then the turns ratio is:
- A) 2:7
  - B) 1:1
  - C) 1:3
  - D) 3:1
13. A machine that converts electrical energy into mechanical energy is called:
- A) Generator
  - B) Engine
  - C) Turbine
  - D) Electrical Motor
14. The brushes in modern motors are mainly made of
- A) Copper
  - B) Zinc
  - C) Iron
  - D) Carbon

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 amount of voltage induced in the transformer secondary depends on:
- A) Self-inductance
  - B) Mutual Inductance
  - C) Length of Core
  - D) Input Voltage
17. 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  $Z_o$
18. A transformer has an efficiency of 80% with an output power of 120W. What is the input power?
- A) 150W
  - B) 100W
  - C) 260W
  - D) 60W
19. Torque in a motor is made from
- A)  $I_f$  and  $\Phi$
  - B)  $V_g$  and  $I_a$
  - C)  $I_a$  and  $\Phi$
  - D)  $R_a$  and  $\Phi$
20. The gain in decibel at cutoff frequency is
- A) 0 dB
  - B) -3 dB
  - C) 3 dB
  - D) -3

**SECTION B**  
**QUESTION 1**

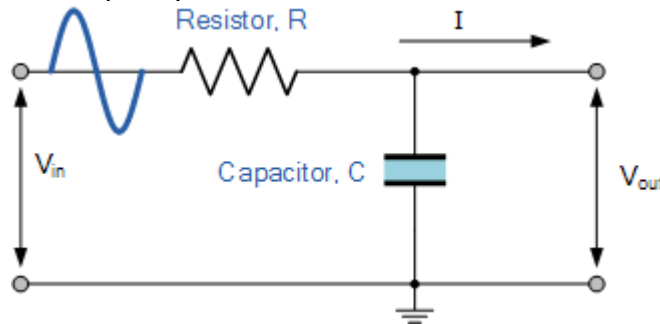
**FREQUENCY RESPONSE**

[16 MARKS]

- A. Define the following terms:
- Frequency response
  - Bandwidth
  - High pass filter
  - Cut-off frequency

(4 marks)

- B. Sketch the typical frequency response curve for the filter circuit is shown below. Clearly indicate the cut-off frequency and its bandwidth. (4 marks)



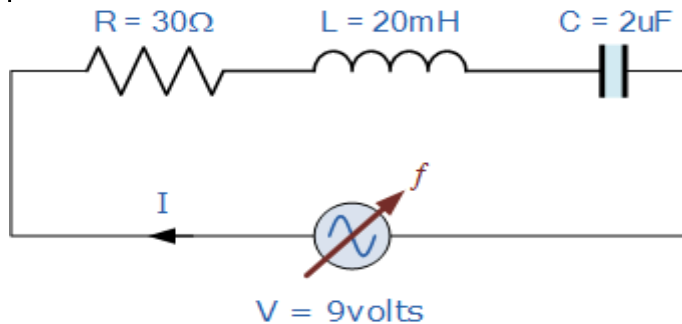
- C. With the aid of a diagram, clearly explain how you would perform a frequency response measurement of an audio amplifier. (8 marks)

**QUESTION 2**

**RESONANCE**

[16 MARKS]

- A.
- A series resonance network consisting of a resistor of  $30\Omega$ , a capacitor of  $2\mu\text{F}$  and an inductor of  $20\text{mH}$  is connected across a sinusoidal supply voltage which has a constant output of 9 volts at all frequencies. Calculate the following:
    - resonant frequency (2 marks)
    - current at resonance (2 marks)
    - voltage across the inductor and capacitor at resonance (4 marks)
    - the quality factor (2 marks)
    - Bandwidth of the circuit. (3 marks)
    - sketch the corresponding current waveform for all frequencies. (3 marks)



**QUESTION 3****TRANSMISSION LINES****[16 MARKS]****A.**

- i. Determine the wavelengths for electromagnetic waves in free space with the following frequencies:  
a) 80 MHz  
b) 45 MHz **(3 marks)**
- ii. State the primary function of transmission line. **(1 mark)**

**B.**

- i. Define the following terms:  
a) Velocity of propagation **(1 mark)**  
b) Characteristic Impedance **(1 mark)**
- ii. The coaxial line is a very popular transmission line.  
a) Sketch the basic construction. **(3 marks)**  
b) Give one advantage of it. **(1 mark)**

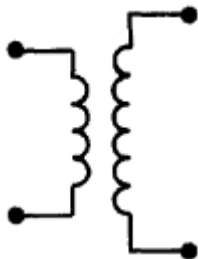
**C.**

- i. The characteristic impedance of RG58U coaxial line is  $50\Omega$ . If it has a capacitance of  $20\mu\text{F}/\text{m}$ , what will be its inductance per meter? **(2 marks)**
- ii. A  $50\Omega$  transmission line is terminated in a load resistance  $Z_L = 40\Omega$ . Determine the following:  
a) Standing Wave Ratio (SWR) resulting from this mismatch. **(2 marks)**  
b) Reflection Coefficient,  $K_r$ . **(2 marks)**

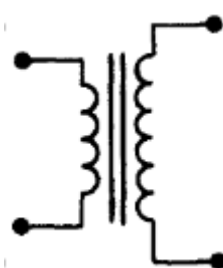
**QUESTION 4:****TRANSFORMERS****[16 MARKS]****A.**

- i. Name 3 types of transformers and briefly explain their functions. **(6 mark)**
- ii. Identify the schematic symbols of the transformers shown below. **(3 marks)**

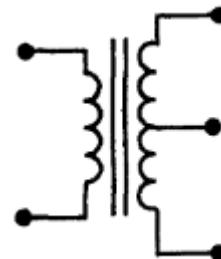
a



b



c



- iii. What causes a voltage to be developed across the secondary winding of a transformer? **(1 mark)**

**B.**

- i. There are 400 turns of wire in an-core coil. If this coil is to be used as the primary of the transformer, how many turns must be wound on the coil to form the secondary winding of the transformer so that the secondary voltage is 1 volt and the primary voltage is 5 volts? **(2marks)**
- ii. An ideal step-down transformer has 6000 turns on the primary and 400 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  $20\Omega$  resistance is connected to the output.

Calculate the:

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

**QUESTION 5:**

**DC MACHINES**

**[16 marks]**

- A. i. Briefly describe the principle of operation of DC motor. State any relevant formula or rule used. **(4 marks)**  
ii. Briefly comment on the four essentials parts of a dc motor. **(4 marks)**  
iii. List two causes of losses in a DC motor. **(2 marks)**
- B. i. A motor operating at full speed draws a current of 4.0 A when connected to a 110 V source. If the motor has an armature resistance of  $3.5\Omega$ , what is the back EMF at full speed?
- ii. A 120 V dc motor has an armature resistance of  $5\Omega$  and draws 6.0A when it is operating normally.  
a) What is the starting current of the motor just before the armature begins to turn?  
b) What is the back EMF when it is operating properly?