SLIATE

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SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION
(Established in the ministry of Higher Education, vide in Act No. 29 of 1995)

Higher National Diploma in Engineering (Civil, Mechanical)
Higher National Diploma in Building Service Engineering
First Year, 1st Semester Examination – 2017
EE 1101 - BASIC ELECTRICITY AND ELECTRONICS

Instructions for candidates:

Answer Five Questions out of Six
All questions carry equal marks.
Calculators are allowed.

No of pages   : 04
No of questions: 06
Time: Three (03) hours

Q1.

(i)   Briefly explain why the atoms are electrically neutral.   (2 Marks)

(ii)   Calculate the quantity of electricity carried by 625×10^{18} electrons.   (2 Marks)

(iii)   Briefly explain the definition of conductor by referring the atomic structure of the conducting and insulating material.   (2 Marks)

(iv)   What sre Positive active material and negative active material and electrolyte in the Lead Acid Cell?   (3 Marks)

(v)   What is the purpose of vent cap in the Lead Acid Battery?   (2 Marks)

(vi)   What is the colour of the anode and the cathode in the Lead acid Battery, How do they change when charging?   (3 marks)

(vii)   Write down the two main differences between dry cell and wet cell.   (2 Marks)

(viii) Find the current through 6 V battery of the network given in figure below.   (4 Marks)
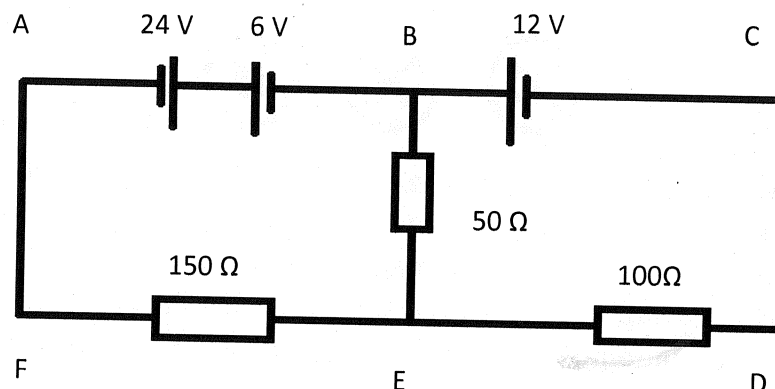
Q2.

(I) State 4 factors which affect to the resistance of any conducting material. (4 Marks)

(ii) Give one example for each of materials having positive and negative temperature co-efficient? (2 Marks)

(iii) Write down the relationship between temperature co-efficient at $0\ ^0C$ and $t\ ^0C$. (1 Marks)

(iv) The field coil at $20\ ^0C$ takes 10 A when a voltage of 230 V is applied across it. Calculate the temperature of the coil if the current reduces to 8 A for the same applied voltage. Assume the coil is made up of Cu conductor and temperature co-efficient of $0\ ^0C$ is equal to $0.00427/\ ^0C$. (5 Marks)

(v) Internal and external radii of length L metal cylinder are "a" and "b" respectively. Electrical resistivity of the cylinder material is ρ. Prove that the resistance between two ends of cylinder is $L\rho/\pi\ (b^2 - a^2)$. If the hole of the cylinder is filled by the material of electrical resistivity ρ_0, prove that the new resistance between two ends of cylinder is $L\rho\rho_0/\pi\ [b^2\ \rho_0 - a^2\ (\rho_0 - \rho)]$. (8 Marks)

Q3.

(i) Is it possible to generate the electricity in a conductor which is positioned stationary in a permanent magnet magnetic field? Justify your answer using Faraday's law of electromagnetic induction. (3 Marks)

(ii) Write down the four factors which affect the field strength of electromagnet. (4 Marks)

(iii) A, B, and C are, three thin long parallel conductors which are kept in perpendicular to the plane of paper. The direction of current flow of A and B conductors are into the plane of paper and that of C is away from the plane of paper. What is the force act on the wire B due to current flowing through the A and C conductors. Briefly explain the reason to force act on that direction. (4 Marks)
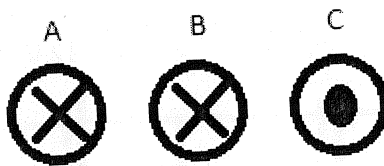
(iv) What is the amount of generated e.m.f. and the reasons to generate such an amount under the following conditions? (4 Marks)

a) Conductor moving parallel to the magnetic flux lines.

b) Conductor moving right angles to the magnetic flux lines.

(v) A coil is wound uniformly on a former having a width of 18mm and a length of 25mm. The former is pivoted about an axis passing through the middle of the two shorter sides and is placed in a uniform magnetic field of flux density 0.75 T, the axis being perpendicular to the magnetic field. If the coil carries the current of 120mA, determine the force exerted on each side of the coil. (5 Marks)

a) For a single turn coil.

b) For a coil wound with 400 turns.

Q4.

(i)   State the two conditions to be fulfilled for tight coupling of two coils.   (2 Marks)

(ii)   Two coils, "A" of 1000 turns and "B" of 500 turns lie near each other so that 60 % of the flux produced in one coil links the other. It is found that a current of 5 A in A produces a flux of 0.25 mWb while the same current in B produces a flux of 0.15 mWb. Determine the mutual inductances and co-efficient of coupling between two coils.
[Hints: $L = N \phi/I$, $M = N_2 (k\phi_1)/I_1$]
                                                                                        6 Marks)

(iii)   Write down the relationship between primary voltage, secondary voltage, primary current, secondary current and primary and secondary, turns ratio.   3 Marks)

(iv)   Is it possible to transform the DC electric power through a transformer?   (1 Marks)
Justify your answer.   (2 Marks)

(v)   A step down transformer having a turns ratio of 20:1 has a primary voltage of 4kV and a load of 10 kW. Neglecting losses, and assuming unity power factor, calculate the value of the secondary current.
                                                                                        (6 Marks)

Q5.

(i)   How many significant figures can be found on the following numerical values?
                                                                                        (3 Marks)

        a)   122.32
        b)   202.302
        c)   302.20

(iii)   What is the importance of average value on measurement which related to engineering field?
                                                                                        2 Marks)

(iv)   If the input of an amplifier is 10 mW and the power gain 20dB find the output power.
                                                                                        (2 Mark)

(v)   Write down the two prefixes (multiple and submultiple) for the following units.
                                                                                        (4 Marks)

        a)   Volts
        b)   Joules

(vi)   Determine the r.m.s. value of a semi-circular current wave which has a max value of 5 A. [Hints: equation of the semi-circular wave $x^2 + y^2 = a^2$]
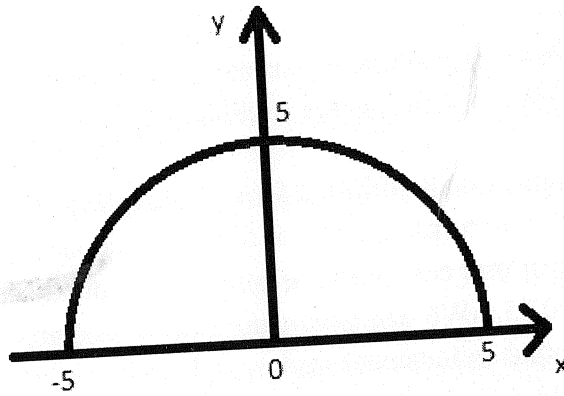   (5 Marks)

Figure 3

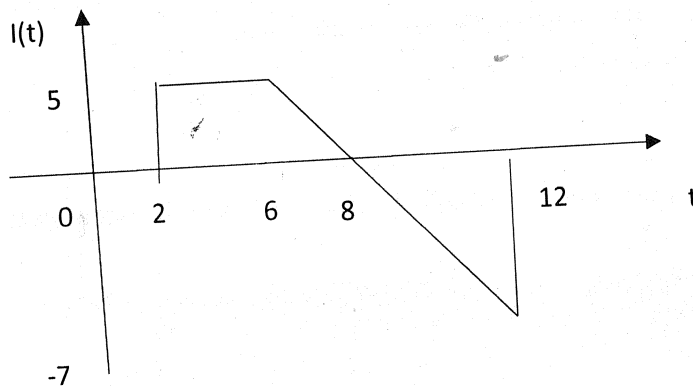(vii)   Find the average current value of the wave form given in figure 4.   (4 Marks)

Figure 4

Q6.

(i)   State the 3 basic categories of measurement.   (3 Marks)
(ii)   Select the following measurements into above 3 categories.   (4 Marks)
a.   Measuring of length of wire.
b.   Measuring the temperature of metal melting furnace.
c.   Measuring the human blood pressure.
d.   Measuring the value of unknown resistor with the help of Wheatstone bridge.
(iii)   State the 7 factors or characteristics of a measuring instrument on which the goodness
        of the measurements depend.   (7 Marks)
(iv)   Select the highly précised data set from the following and briefly explain the reason for
        the selection.   (4 Marks)

        Set 1 - 20.1 mm, 20.2 mm, 20.1 mm, 20.0 mm, 20.1 mm, 20.0 mm, 20.1 mm

        Set 2 - 19.9 mm, 20.3 mm, 20.0 mm, 20.5 mm, 20.2 mm, 19.8 mm, 20.3 mm

(v)   Explain the terms instrumental error and environmental error?   (2 Marks)