TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN INFORMATION TECHNOLOGY

APS 2103: FUNDAMENTALS OF PHYSICS.

SPECIAL/ SUPPLIMENTARY EXAMINATIONS

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

DATE: Sep 2018

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt question ONE (compulsory) and any other TWO questions.

Do not write on the question paper.

Take g = $10m/s^2$

$K_e = 9.00 \times 10^9 Nm^2/C^2$

Question ONE (30MKS)

a)Differentiate between electromotive force and potential difference. (2mks)

b)Differentiate between a dimension and a unit (2mks)

c)A current of 0.1A flows through a 20Ω resistor. What is the voltage across the resistor? (3mks)

d)What is the difference between a series circuit and a parallel circuit? (2mks)

e)A 20 V battery powers a series circuit with a 15 Ω resistor and a 35 Ω resistor. What is R_{eq} and what is the current in the circuit? (2mks)

f)i) State the majority carriers for a p-type semi conductor. (2mks)

ii) p- type and n-type semiconductors are made from a pure semiconductor by a process known as "doping".

i) What is doping? (1mk)

ii) Explain how the doping produces an n-type semiconductor. (2mks)

d) When a mass is attached to a spring, the acceleration is $a = \frac{kx}{m}$ where *a* is acceleration, *x* is a length, *m* is mass, and *k* is a spring constant. Find the units of *k*. (3mks)

e) State the three Newton's laws of motion (3mks)

f) A car of mass 1000 kg accelerates from rest to 20 m/s in a time of 5 seconds. Calculate the forward thrust of the car. (3mks)

g) The force on an aircraft of mass 725 kg due to the engine is 15 000 N. The air resistance on the plane is 9925 N. (3mks)

Find the acceleration of the plane

i)The figure 1 below shows a circuit containing three capacitors C_1, C_2 and C_3

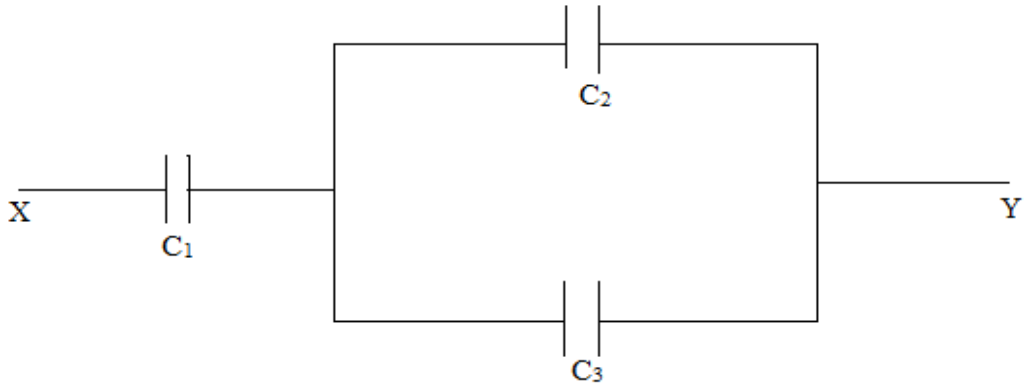


figure 1

If C1= 6µF, C2=4.5µF and C3 = 7.5µF. Calculate the effective capacitance. (3mks)

Question TWO (15MKS)

a) Distinguish between intrinsic and extrinsic semiconductors. (2mks)

b) Figure 2(a) and fig 2(b) shows a p-n junction connected to a battery. It is observed that the current in 2(a) is greater than the current in 2(b).

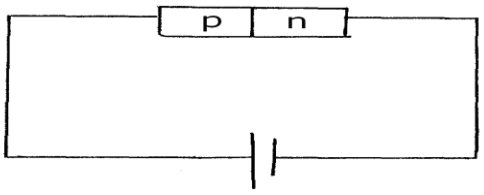


fig2(a)

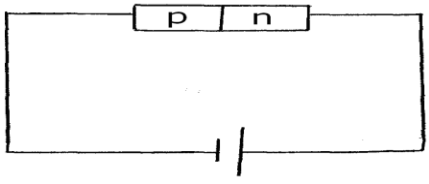


fig2(b)

State the reason for this observation (2mks)

c) Explain how doping produces a p-type semi conductor for pure semi conductor material. (3mks)

d) You are provide with 4 diodes, A resistor, an a.c of low voltage and enough connecting wires In the spaces provided below, sketch the circuit diagram for a full wave rectifier and indicate the terminals where the output voltage v may be connected. (4mks)

e) Sketch the graph of output voltage against time for the rectifier (2mks)

f)A capacitor is now connected across the output. Explain its effect on the output. (2mks)

Question THREE (15MKS)

a)Use superposition to find Ix **in the** figure 3 **(4mks)**

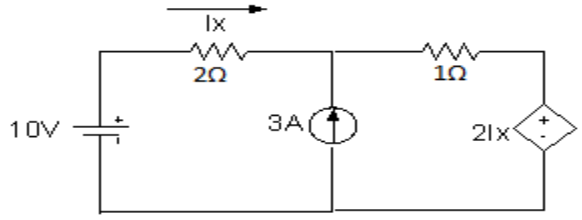


figure 3

b) Determine the two mesh currents, i_1 and i_2, in the circuit below in figure 4 (4mks)

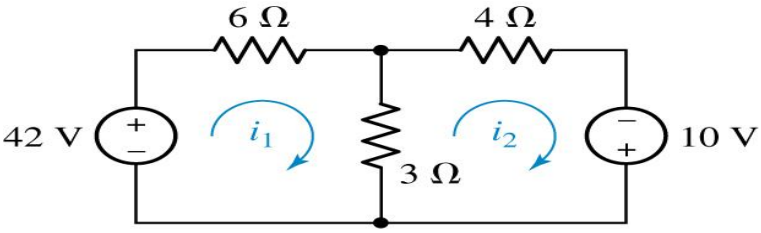


figure 4

c) A generator produces 10 A at 600 V. The primary coil in a transformer has 20 turns. How many secondary turns are needed to step up the voltage to 2400 V? (3mks)

d) Find the currents i_1 i_2 *and* i_3 in the circuit shown below in figure 5 (4mks)

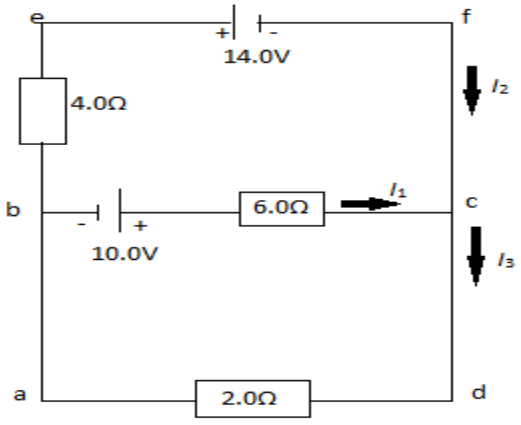
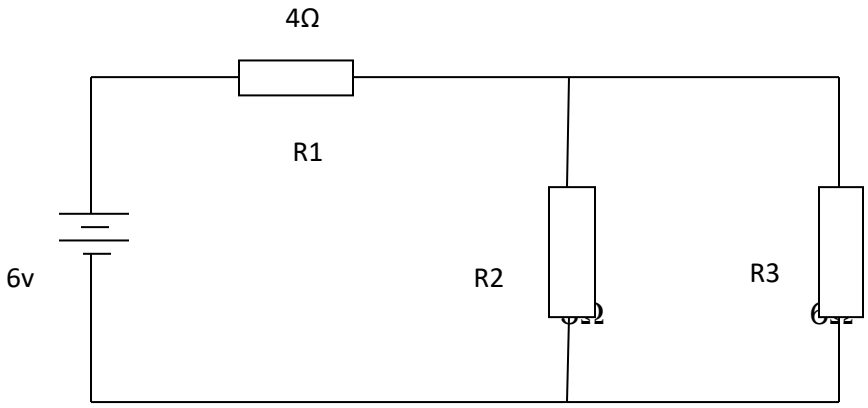


figure 5

Question FOUR (15MKS)

a)State ohm's law (1mk)

b) The figure 6 below shows a circuit



Calculate figure 6

i)The total resistance of the circuit (3mks)
ii)The total current flowing in the circuit (2mks)
ii) The voltage drop across R1 (2mks)
c) Define capacitance (1mks)
This is the ability to store charge
d) Figure 7 shows an arrangement of capacitors to a 12V d.c. supply.

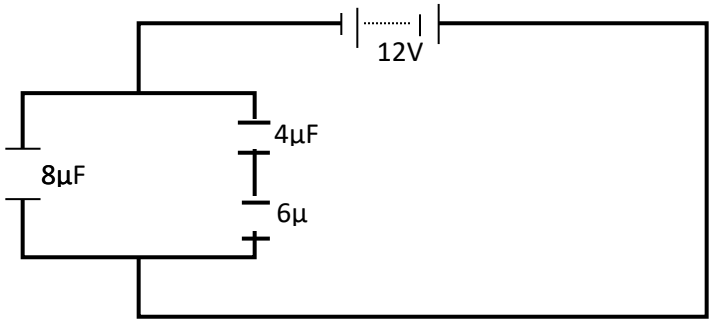


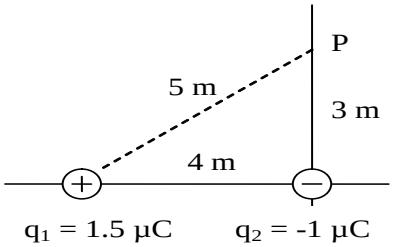
figure 7

Determine
(i) Effective capacitance (3mks)
(iii) Charge across the 8μF capacitor. (3mks)

Question FIVE (15MKS)

a)A force of 1.6 x 10^{-3} N exists between 2 charges; 1.3 μC and 3.5μC. How far apart are they? (3mks)

b)What is the electric potential at point P in the diagram to the right? (4mks)



c) A charge $q_1 = 2.00\mu C$ is located at the origin and a charge $q_2 = -6.00\mu C$ is located at (0, 3.00)m. Find the electric potential due to these charges at point P whose coordinates are(4.00, 0)m (4mks)

d)Find the force on the charge q_2 in the diagram below due to the charges q_1 and q_2. (4mks)