



**TECHNICAL UNIVERSITY OF MOMBASA**  
**Faculty of Applied & Health**  
**Sciences**

DEPARTMENT OF MATHEMATICS & PHYSICS  
CERTIFICATE IN BUILDING & CIVIL ENGINEERING (CBCE 14S)

APS 1501: PHYSICAL SCIENCE FOR ENGINEERS

**END OF SEMESTER EXAMINATION**  
**SERIES: DECEMBER 2014**  
**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown  
This paper consists of **THREE** printed pages

### Question One (Compulsory)

- a) Define the following terms:  
(i) Time constant  
(ii) Transmission ratio  
(iii) Mutual inductance (10 marks)
- b) With the aid of a graph, explain the Ohm's law. (2 marks)
- c) Using symbols differentiate between step-up and step-down transformers. (2 marks)
- d) Calculate the maximum and the minimum resistance given the colour codes below (all answer in  $K\Omega$ )  
(i) Red, green, yellow  
(ii) Blue, black, purple, silver  
(iii) Yellow, red, yellow, gold (6 marks)

### Question Two

- a) Three capacitors of  $30\mu\text{F}$ ,  $20\mu\text{F}$  and  $3600\mu\text{F}$  capacitor are connected-parallel. The network is then supplied with 30v d.c.  
(i) Draw the circuit diagram  
(ii) Calculate the total capacitance in the circuit  
(iii) Charge across the  $3600\mu\text{F}$  capacitor  
(iv) Energy in the circuit (8 marks)
- b) Define the following terms:  
(i) Intrinsic semiconductor  
(ii) Extrinsic semiconductor  
(iii) Doping (6 marks)
- c) With the aid of circuit diagrams, explain the following with regard to diodes:  
(i) Forward biasing  
(ii) Reverse biasing (6 marks)

### Question Three

- a) Using circuit diagram and wave form diagrams, explain the operation of a full wave bridge rectifier. (10 marks)
- b) Three resistors of  $200K\Omega$ ,  $100K\Omega$  and  $80K\Omega$ , are, connected parallel, they are then connected in series to  $50K\Omega$  and  $75K\Omega$  resistors. The network is then supplied with 50V d.c  
(i) Calculate the total resistance in circuit  
(ii) Total current in the circuit  
(iii) Current through  $200K$ ,  $100K$  and  $80K$  resistors  
(iv) Total power dissipated by the circuit (10 marks)

#### Question Four

- a) Define the following terms:  
(i) Depletion layer  
(ii) Base  
(iii) Emitter  
(iv) Collector (4 marks)
- b) With the aid of circuit diagram, explain the three bipolar transistor configurations. (6 marks)
- c) Using graph sketches explain the following bipolar transistor characteristic:  
(i) Input  
(ii) Output characteristics  
(iii) Transfer characteristics (10 marks)

#### Question Five

- a) Define the following terms:  
(i) Resistance  
(ii) Reactance  
(iii) Impedance (6 marks)
- b) Determine the colour codes for the following resistor:  
1.9M $\Omega$   $\pm$  20%  
(i)  
330k $\Omega$   $\pm$  10%  
(ii)  
470 $\Omega$   $\pm$  5%  
(iii)  
4.7M $\Omega$   $\pm$  2%  
(iv) (4 marks)
- c) A capacitor is connected in series to a resistor of 100K $\Omega$  for charging. If took 0.05 $\mu$ s to charge the capacitor to its time constant. Calculate the value of that capacitor. (4 marks)
- d) A transformer with a turns ratio of 8:1 is supplied with 110V, 60Hz. If the secondary current is 10A. Calculate:  
(i) Primary current  
(ii) Secondary voltage  
(iii) Input power (6 marks)