REPUBLIC OF RWANDA

MINISTRY OF EDUCATION
SOUTHERN PROVINCE
RUHANGO DISTRICT

PHYSICS
GRADE: S5
COMBINATION: MPC,PCM,MPG and PCB
DATE: 27 MARCH 2025
PERIOD: 08:30AM - 11:30PM

END OF TERM II EXAMINATIONS 2024-2025/100MARKS

INSTRUCTIONS:

1. Write your names on the answer sheet.
2. Do not open this question paper until you are told to do so.
3. This paper consists of two sections: **A** and **B.**
   - **Section A:** Attempt **all** questions. **(70 marks)**
   - **Section B:** Attempt any **three** questions**.** **(30 marks)**

SECTION A: ATTEMPT ALL QUESTION /70MARKS

Multiple choice question /17marks

Q1. Choose the correct answer or the suitable term that completes the statement

i) An example of fossil fuel is:

A. Sediment B. Non – renewable C. Coal D. hydropower **(1mark)**

ii) consider the following statements related to a nuclear power plant.

A. It works on the principle of controlled chain production. **(1mark)**

B. the moderator's function is to slow down the fast – moving the secondary neutrons produced during fission.

1) A is true and B is false. (2) Both A and B are false. (3) both A and B are true

(iv) B is true and A is False **(1mark)**

iii) Complete, A black gold is referred to as,……..A. Coal B. Solar energy C. Petroleum D. Natural gas

2. If the distance between two object increases, their gravitational potential energy will,……

(i) A. increase B. Decrease C. remain constant D. first increase then decrease

(ii). the weight of an object will be minimum when it is placed at the North pole

B. at South pole C. at the centre of the Earth D. None of the above

(iii). Mass and radius of the eath is M and R. work done to bring a 1kg mass from surface to infinity is :A $\frac{-GM}{2R}$ B. $\frac{-GM}{R}$ C. $\frac{-\sqrt{GM}}{2R}$ D. $\frac{-\sqrt{2GM}}{R}$

3. (i)The work done in moving a unit positive test charge over a closed path in an electric field is _____.

a. Always 1
b. Infinite
c. Zero
d. Negativ

(ii) .A surface that has the same **electrostati**c potential at every point on it is known as _____.

a. Equal-potential surface
b. Same potential surface
c. Equi-magnitude surface
d. Equipotential surface

(iii). Consider the following two statement

1.Krchhoff's junction law follows conservation of charge

2. Kirchhoff's loop law follows from conservative nature of electric field

A. Both 1 and 2 are correct
B. 2 is correct but 1 is wrong
C. 1 is correct but 2 wrong
D. Both 1 and 2 are wrong

(iv) . when two waves of the same frequency and amplitude move with the same speed in the opposite direction produces,…….A. stationary waves B. Beat C. progressive wave .D none of the above

(v) A section taken through a progressive wave in which all particles are in phase is called... A. Crest B. Wave front C. Wave length D. Trough

4. (i) Which of the following is said to have taken place when waves bend around an obstacle? A. Depletion B. Refraction C. Diffraction D. Interference

(ii) The amount of work done in bringing a unit positive charge from infinity to a point in electric field is called: a) Electrostatic force b) Coulomb's force c) Resistance
d) Electric potential

5. Thermionic emission is a process by which electrons are ejected from a metal surface: a) When that metal carries high electric current
b) When electromagnetic radiation with high energy falls on it c) When the metal has been highly electrically heated d) None of the above is correct

(iv) Choose the correct answer: At resonance:
a) The amplitude attains its minimum value
b) The forcing frequency attains its maximum value
c) Both natural and forcing frequencies are equal d) None is of the above is correct

6. The first cosmic velocity of a projectile from the Earth can be calculated using the formula (where G: gravitational constant, Radius of the earth, M mass of the earth, g acceleration due to gravity)

a) $v=\sqrt{g r_e}$ b) $v=\sqrt{\frac{2GM}{R_E}}$ C) $v=\sqrt{\frac{GM}{R_E^{\,2}}}$ d) $v=\frac{2GM}{R_E}$ **/ 1 mark**

7. In the equation below b, is viscous frictional coefficient, k is the spring constant and m is the mass, Match the following related to the types of damped oscillation **/3marks**

Equations	Type
1. $b=\sqrt{4mk}$	A: Overdamped

2. $b<\sqrt{4mk}$	B: Underdamped
3. $b>\sqrt{4mk}$	C: Critically damped

8. (a) what is meant by simple harmonic motion **/2marks**
(b) A pendulum clock was taken from the bottom of a mountain to the top of a mountain does it lose time? Or gain time? Justify your answer **/2marks**
c) How would you change the length of a pendulum if its period is doubled? **/2marks**
d) A certain simple pendulum has a period on the earth of 1.6s. What is its period on the mars where the acceleration is 3.71m/s2 [acceleration due to gravity of earth is 9.82m/s2] **/2marks**

9. (a) What is meant by Damped Oscillation? **/1marks**
(b) Explain why a company of soldiers are advice not marching in steps across a suspended bridge **/2marks**
c) A 2.2kg mass oscillates on a spring of force constant 250N/m with a period of 0.615sec
(i) is the system damped or not? How do you know? **/2marks**
(ii) if it is damped find the damping constant b **/2marks**
(iii) Is the system underdamped, critically damped, or overdamped? How do you know **/2marks**

10.(a) Distinguish between (i) mechanical waves and electromagnetic waves **/2marks**
(ii) Longitudinal waves and transverse waves **/2marks**
b) A progressive wave is represented by the equation $y(x, t) = 0.003 \cos(20x + 200t)$where x and y are in metres and t is second

Find (i)The direction of the wave movement (1mark)
(ii)The wave number (1mark)
(iii)The wavelength of the wave (1mark)
(iv)The frequency of the wave (1mark)
(v) Wave speed (1mark)

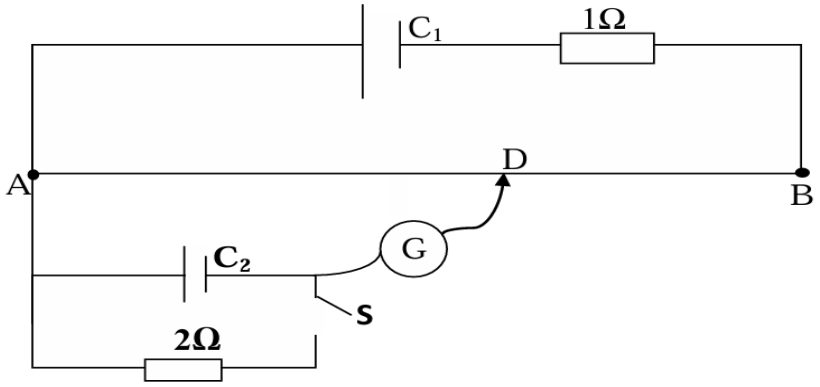
Q11. (a) state the principle of superposition of wave **/1marks**
(b) (i) Sketch this standing wave and indicating the number of nodes and antinodes of a stretched string vibrating at the 3rd harmonics **/2marks**
(**ii)** Calculate the frequency of the third harmonic in a stationary wave when a string of mass 4.0 g and length 1.2 m is put under 100 N of tension. **/2marks**

12. A photocell is connected in series with a direct current supply and a micro ammeter.
(a) Sketch a labeled circuit using these components and indicate the positive and negative terminals of supply and the ammeter. **(2marks)**
(b) Explain why the arrangement would not work if the supply were connected the wrong way round **(2marks)**

13.(a) List two phenomena that illustrate the wave nature **(2marks)**
(b) On what factor does the black body radiation depends? **(1mark)**

(c) Define the term black body. **(1mark)**

14. In the circuit below, AB is a uniform wire of length 1m and resistance 4.0 Ω. C1 is an accumulator of e.m.f. 2 V a negligible internal resistance. C2 is a cell of e.m.f. 1.5 V



(a) Find the balance length AD when the switch is open. **/2marks**
(b) If the balance length is 75.0 cm when the switch is closed, find the internal resistance of C2. **/ 2 marks**

15. (a) how does gravitational force depends on distance between two bodies? **/ 1 marks**
b) How are Kepler's laws of planetary motion important to astronomy**/ 2marks**
(c) Define gravitational potential at a point **/ 1marks**
(d) The mean distance of the earth from the sun is 149.6×10^6Km. and the mean distance of mercury from the sun is 57.9x106Km. the period of earth's revolution is 1 year. Prove that the period of mercury's revolution is 0.24years**/ 2marks**
(e) suppose that the gravitational force between two massive sphere is 100N. if the distance between the sphere is doubled what will be the force between the masses. Explain your answers**. / 2marks**

SECTION B ATTEMPTS ANY 3 QUESTIONS/ 30MARKS

Q16(a) A 0.5 kg mass is attached to the end of an ideal spring with force constant K = 450N/m, undergoes simple harmonic motion with an amplitude of 0.04m. Compute

a. The maximum speed of the mass **/1marks**
b. the speed of the mass at x= - 0.015m **/2marks**
iii) The maximum acceleration of the mass **/1marks**
iv) The acceleration of the mass at x= -0.015m **/1marks**
v) The total mechanical energy **/1marks**

b) A mass of 1kg is connected to two springs connected in series their spring constant are k_1= 20N/m and k_2= 30N/m respectively
(i) find the total extension produced/ **2marks**
(ii) extension produced by each spring /**2marks**

Q17. (a) Photo electric effect is defined as the ejection of electron from the metal surface due to the absorption of photon. Define the following term as applied in photoelectric effect.
i) Work function (W_o) **/1 mark**
(ii) Threshold wavelength **/1 mark**

c) In photoelectric effect experiment, which of the following factors will, increase, decrease, will not affect the maximum kinetic energy of photoelectrons? Justify your answer on the basis of Einstein photoelectric equation

$\frac{1}{2}mv^2_{max} = hf - W_o$.

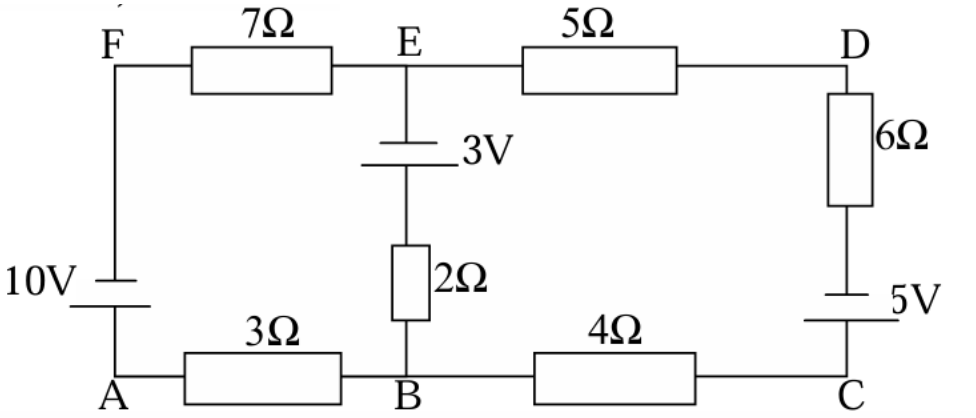
(i) Use a light of high frequency
(ii) (ii) use a light of high wavelength
(iii) use a metal surface of high work function
(iv) (iv) use a light of high intensity **/4marks**

d) What is the maximum kinetic energy of electrons ejected from calcium by 420 nm violet light, given that the binding energy (or work function) of electrons for calcium metal is 2.71 eV? **/4marks**

18. a) (i) state Bohr's postulate on atomic model **(3marks)**
(ii) Propose any 3 deficiency of Bohr's model of Hydrogen atom **(1.5marks)**
b) The frequency associated with an energy change of hydrogen atom is 6.166x 10^{14} Hz and the final energy level is 4. Determine the initial energy level. **(1.5marks)**
c) Draw an energy level diagram for hydrogen atom to indicate emission of ultraviolet, visible and infrared spectral lines **(2marks)**
d) The energy of the ground state of mercury atom is $E_1 = -10.4eV$ on a scale in which an electron completely free of the atom is at zero energy
(i) Determine the energy corresponding to the third excited state **(1marks)**
(ii) Calculate the ionization potential of the mercury. **(1marks)**

19.(a) (i)state Neutron's law of gravitational **(2marks)**
(ii) Sketch a graph to show the variation of acceleration due to gravity with distance. **(2marks)**
b) A satellite is launched in a circular orbit about the equator at a height of 3.6 10^4km above the surface of the earth. Given that the mass of the earth is 5.98 10^{24} kg and that its radius is 6400km, find the:
i) radius of the orbit, **(2marks)**
ii) speed with which the satellite is launched, **(2marks)**
iii) period of the satellite **(2marks)**

20.(a) state Kirchhoff's laws **/2marks**
(i) In the figure below. Find the current flowing through the 3Ω, 2Ω and 4Ω **/6marks**
(ii) If a very high resistance voltmeter is connected across BD, what will be its reading. **2marks**



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