

2020

**MATRICULATION EXAMINATION**

**DEPARTMENT OF MYANMAR EXAMINATION**

**PHYSICS**

**Time Allowed: (3) Hours**

**WRITE YOUR ANSWERS IN THE ANSWER BOOKLET**

**The symbols in this paper have their usual significance**

**SECTION (A)**

(Answer ALL questions)

1. Choose the correct answer from the following. (4 marks)

- (i) The resistance of a/an ----- increases with increasing temperature.  
(A. insulator, B. conductor, C. semiconductor )
- (ii) When a ray of light passes from water to air, the velocity of light -----.  
(A. decreases, B. increases, C. remains constant )
- (iii) The force applied to an elastic body is called -----.  
(A. pressure, B. strain, C. stress )
- (iv) All natural cobalt is -----, which is stable.  
(A. cobalt-58, B. cobalt-59, C. cobalt-60)

2. Match the following. (4 marks)

(i)	Gastroscope	A. amplifier
(ii)	Machine	B. light pipe
(iii)	Solenoid	C. appliance work to be done
(iv)	Transistor	D. cylindrical coil of wire

3. The animal has a skin temperature of  $33^{\circ}\text{C}$  and is in a room where the walls are at temperature  $29^{\circ}\text{C}$ . If the emissivity is 1 and the body surface area is  $1.5\text{ m}^2$ , find the rate of heat loss due to radiation. ( $\sigma = 5.685 \times 10^{-8}\text{ W m}^{-2}\text{ K}^{-4}$ ) (4 marks)
4. Define lateral displacement of a ray passing through a glass slab with parallel sides together with ray diagram. Does it depend on the thickness of the glass slab? (4 marks)
5. A machine with a velocity ratio of 8 requires 1000 J of work to raise a load of 250 N through a vertical distance of 2 m. Find the efficiency and mechanical advantage of the machine. (4 marks)
6. Define resistance of a conductor in words and in symbols by using Ohm's law. Draw an electric circuit for measurement of current and voltage to demonstrate Ohm's law. (4 marks)

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7. Describe how stationary waves can be produced. Illustrate first and third harmonics of a vibrating string. Where an antinode is formed in the resonance tube? Why? (4 marks)
8. How far apart are two electrons if the force each exerts on the other is equal to the weight of an electron? ( $g = 10 \text{ m s}^{-2}$ , charge of electron =  $1.6 \times 10^{-19} \text{ C}$ , mass of electron =  $9.1 \times 10^{-31} \text{ kg}$ ,  $K = \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$ ) (4 marks)
9. Which are used as fuel in a nuclear reactor? What are the mainly consisting of uranium isotopes in natural uranium? Also give their content in percentages. (4 marks)  
Draw a circuit diagram for biasing a pnp transistor.

### SECTION (B)

(Answer any **FOUR** questions)

10. (a) What is a barometer? On what is the height of mercury column in a barometer depending? (8 marks)  
The density of the lead block is  $11.5 \text{ g cm}^{-3}$  and it is floating in mercury of density  $13.6 \text{ g cm}^{-3}$ . What portion of the lead block is immersed in mercury? What force is needed to press the block to immerse it totally if the mass of the lead block is  $4 \text{ kg}$ ? Why is the lead block floating in mercury? ( $g = 10 \text{ ms}^{-2}$ )
- (b) (i) How does the total emissive power of a black body depend on the absolute temperature? If the absolute temperature of a black body is doubled, how is the total emissive power affected? Why can the interior of the body be kept warm even in a cold environment? (8 marks)
- (ii) Find the first two harmonics of an open organ pipe of length  $4.5 \text{ m}$  and diameter  $2.5 \text{ cm}$ . Velocity of sound in air is  $340 \text{ ms}^{-1}$ .
11. (a) Show that the refractive index of the medium in which the object is situated is equal to the reciprocal of the sine of the critical angle. (8 marks)  
A cube of ice of refractive index  $1.31$  is placed on a glass slab of refractive index  $1.5$ . If a ray of light passing from the glass slab to the ice has an angle of incidence of  $65^\circ$ , will the ray enter the ice?
- (b) How far must a lens of focal length  $10 \text{ cm}$  be placed from an object to produce an image on a screen where the image is two times the size of the object? Draw a ray diagram which shows your result. (8 marks)



12. (a) Is the surface of a charged conducting sphere an equipotential surface? (8 marks)  
 Why? Draw the equipotential surfaces between two parallel plates having charges of equal magnitude and opposite signs.  
 A 6 V battery is connected to two parallel metal plates. If an electron is placed on the negatively charged plate what is the velocity of the electron when it strikes the positively charged plate?  
 (charge of electron =  $1.6 \times 10^{-19}$  C, mass of electron =  $9.1 \times 10^{-31}$  kg)
- (b) How can you test whether an electric field exists at a certain point? When a charge is given to a conducting object of any shape, how does the charge spread out? (8 marks)  
 Two charges,  $+20 \mu\text{C}$  and  $-5 \mu\text{C}$ , are 2 m apart. Where is the electric field intensity in their vicinity equal to zero? Draw a diagram to illustrate your answer.
13. (a) Draw a magnetic field around a solenoid. Is it identical with that of a bar magnet? Can a solenoid be considered as a bar magnet? (8 marks)  
 A galvanometer has a resistance of  $2 \Omega$  and gives a full scale deflection when a current of 1 mA flows through it. How can it be converted for use as an ammeter reading up to 10 A, and a voltmeter reading up to 50 V?
- (b) Write down the relation between the practical unit of electrical energy and the unit of work. If one kW lamp is used for one hour what would the meter show? Why is electrical energy transformed into heat energy when a current flows through a resistor? (8 marks)  
 Find the rate of production of heat by each resistor when the  $2 \Omega$  and  $3 \Omega$  are connected in series to a 12 V battery having internal resistance  $1 \Omega$ .  
 Draw the circuit diagram to show your answer. ( $J = 4.2 \text{ J cal}^{-1}$ )
14. (a) What is a nuclear reactor? Why is a moderator needed in a nuclear reactor? (8 marks)  
 Which nucleus is struck by a neutron in nuclear fission? How do you understand by the term chain reaction?  
 How many junctions are there in a transistor? What are they? Explain how a transistor can be used as a current amplifier.
- (b) What is a logic gate? Draw a diagram of fire alarm using logic gates and explain how it works together with its truth table. (8 marks)



15. (a) Define efficiency in terms of mechanical advantage and velocity ratio. (8 marks)  
Where is the term efficiency in physics and engineering used? Does the mechanical advantage of a machine depend on the friction present?  
A ray of light in air is incident on the surface of a glass slab 4 cm thick at an angle of  $60^\circ$ . It emerges from the slab and travels into the air from the other side of the glass slab. If the refractive index of glass is 1.5, find the lateral displacement between the incident ray and the emergent ray.
- (b) What is the capacitance of a capacitor? Write down the sub- multiple units of farad used for practical purposes. Is there any kind of material that, when inserted between the plates of a capacitor, reduces its capacitance? The plates of a parallel-plate capacitor are  $50 \text{ cm}^2$  in area and 1 mm apart. When the capacitor is connected to a 45 V battery, what is the charge on either plate? ( $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$ ) (8 marks)

(OR)

15. (a) How continuous spectrum and characteristic spectrum of X-rays are produced? Draw a neat diagram of X-ray tube. (8 marks)
- (b) Define the electromotive force of a source connected to an external circuit. How must a voltmeter be connected to a battery to measure the electromotive force of the battery? (8 marks)  
When a 12 V battery of negligible internal resistance is connected to a resistor, a current of 3 A flows through it. When another battery of e.m.f 6 V is in the circuit in series with the first one, the current flowing through the resistor remains at 3 A. Find the internal resistance of the second battery.