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KHYBER PAKHTUNKHWA, PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATION FOR THE POSTS OF PROVINCIAL MANAGEMENT SERVICES (BPS-17).

2016

PHYSICS , PAPER-II

TIME ALLOWED: 03 HOURS **MAX:MARKS: 100**

NOTE: ATTEMPT ANY FIVE QUESTIONS

Q. No. 1 (a) Apply Guass's law to find out the electric field at an arbitrary point near a thin insulating sheet of infinite extent having a uniform charge density σ. 10

(b) What are the limitations of Coulomb's law? 03

(c) Two point charges, -q and $(\frac{1}{2})$q, are situated at the origin and at the point $(a,0,0)$, respectively. At what point along the x-axis does the electric field vanish? 07

Q. No. 2 (a) State and prove the uniqueness theorem. 10

(b) Explain why foods that contain water can be cooked in a microwave oven. 03

(c) Two spherical conducting shells of radii r_a and r_b are arranged concentrically and are charged to potentials φ_a and φ_b, respectively. If $r_a > r_b$, find the potential at points between the shells and at points $r > r_b$. 07

Q. No. 3 (a) What is magnetic vector potential? Give its physical significance. Derive an expression for the magnetic vector potential in terms of current density. 10

(b) Use the concept of magnetic pole density and surface density of magnetic pole strength to explain why the poles of a uniformly magnetized bar magnet lie at its ends. 03

(c) The magnetic moment of a macroscopic body is defined as $\int_V \vec{M}\,dv$. Prove the relationship: $\int_V \vec{M}\,dv = \int_V \vec{r}\,\rho_M\,dv + \oint_S \vec{r}\,\sigma_M\,da$; where S is the surface bounding V. 07

Q. No.4 (a) Draw a circuit diagram for a N-P-N transistor in common emitter configuration. Explain how it works as a voltage amplifier. What modification is needed to convert it into an oscillator? 10

(b) Explain how diode works as a rectifier. 03

(c) What are semiconductors? Explain how doping leads to the fabrication of N-type and P-type semiconductors. 07

Q. No. 5 (a) Draw a circuit diagram to demonstrate the use of a triode as a receiver. Explain how it works. 10

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	(b)	Do pure (undoped) semiconductors obey Ohm's law?	03
	(c)	Explain the difference between amplitude modulation and frequency modulation?	07
Q. No. 6	(a)	State and prove the law of radioactive decay. Use it to obtain the expression of half-life.	10
	(b)	In your body, are there more neutrons than protons? More protons than electrons? Discuss.	03
	(c)	All nuclei are made up of a neutron-proton mixture that can be called nuclear matter. Calculate its density.	07
Q. No.7	(a)	What is a nuclear reactor? How does it work? Discuss the major difficulties that still stand in the way of a working reactor.	10
	(b)	Explain the purpose of moderator in a nuclear reactor.	03
	(c)	The half-life of a radioactive isotope is 140 days. How many days it would take for the decay rate of a sample of this isotope to fall to one-fourth of its initial value?	07
Q. No. 8	(a)	A particle is trapped in a box and cannot escape from it. Discuss the validity of Heisenberg's uncertainity principle in this case.	10
	(b)	Discuss analogy between wave mechanics and classical mechanics.	03
	(c)	An electron of kinetic energy 12 eV can be shown to have a speed of 2.05 x 10^6 m/s. Assume that its speed can be measured with a precision of 1.50%. With what uncertainity can one simultaneously measure the position of the electron?	07