Mark Scored:

KATHMANDU UNIVERSITY
End Semester Examination
August, 2018

Level : B.E./B.Sc./B. Pharm./B. Tech.
Year : I
Course : PHYS 102
Semester : II

Exam Roll No. :
Time: 30 mins.
F. M. : 15

Registration No.:
Date AUG 0 8 2018

SECTION "A"
[15Q × 1 = 15 marks]

Choose and tick the most appropriate answer. The symbols, unless mentioned otherwise, have their usual meanings.

1. Which one of the following vector functions can be expressed as curl of another vector function as well as gradient of some scalar function.
[a] $\vec{v} = x\hat{i} + y\hat{j} + z\hat{k}$
[b] $\vec{v} = y^2z^2\hat{i} + z^2x^2\hat{j} + x^2y^2\hat{k}$
[c] $(y^2+z^2)\hat{i} + (z^2+x^2)\hat{j} + (x^2+y^2)\hat{k}$
[d] $\vec{v} = yz\hat{i} + zx\hat{j} + xy\hat{k}$

2. ϕ_0 is the total electric flux crossing a spherical surface of radius R when a point charge q is placed at the center of the spherical shell. When the same point charge is placed at a distance $\frac{R}{2}$ from the center, the total electric flux crossing the surface is
[a] ϕ_0 [b] $\frac{\phi_o}{2}$ [c] $2\phi_o$ [d] $\frac{\phi_o}{4}$

3. Which one of the following statements is NOT true for the perfect conductor?
[a] The electric field is zero everywhere inside the conductor.
[b] The electric field is constant everywhere inside the conductor.
[c] The electric charge density is zero everywhere inside the conductor.
[d] The electric potential is non-zero constant everywhere inside the conductor.

4. If $\vec{P}$ is the polarization of a dielectric medium, then $\nabla \cdot \vec{P} = 0$ concludes that
[a] there are only free charges inside the dielectric material.
[b] there are only bound charges inside the dielectric material.
[c] there are neither bound nor free charges inside the dielectric material.
[d] there are both bound and free charges inside the dielectric material but the total is zero.

5. A magnetic dipole placed in a uniform magnetic field remains at equilibrium, when its dipole moment
[a] is parallel to the magnetic field.
[b] makes an angle of $\frac{\pi}{2}$ with magnetic field.
[c] is anti-parallel to the magnetic field.
[d] makes an angle of $\frac{\pi}{4}$ with magnetic field.

6. A circular loop of radius R, carrying a steady current, lies on xy-plane with center at origin. If the magnetic field at a distance R above the loop is B and that of at the center is B_0, then
[a] $2B = B_0$ [b] $B^2 = 8B_0^2$ [c] $8B^2 = B_0^2$ [d] $B = 2B_0$

7. The self-inductance of a long solenoid
[a] does not depend on the radius of the solenoid.
[b] depends on the current flowing along the solenoid.
[c] does not depend on the current flowing along the solenoid.
[d] does not depend on the number of the turns per unit length.

8. The power transported per unit area by the electromagnetic fields $\left(\vec{E} \,\&\, \vec{B}\right)$ outward from a surface which encloses the field is called Poynting vector which is expressed as

[a] $\frac{1}{\varepsilon_0}\left(\vec{E}\times\vec{B}\right)$ [b] $\frac{1}{\sqrt{\epsilon_0\mu_0}}\left(\vec{E}\times\vec{B}\right)$ [c] $\left(\vec{E}\times\vec{B}\right)$ [d] $\frac{1}{\mu_0}\left(\vec{E}\times\vec{B}\right)$

9. Which one of the following statements is equivalent to Faraday law?
[a] Time varying electric field induces a magnetic field.
[b] Time varying magnetic field induces an electric field.
[c] Magnetic flux in a current loop is directly proportional to the current.
[d] The direction of induced current is such that it opposes the effect producing it.

10. In Raman spectra, stokes lines have
[a] higher energy but are less intense than anti-stokes lines.
[b] lower energy but are more intense than anti-stokes lines.
[c] lower energy as well as less intense than anti-stokes lines.
[d] higher energy as well as more intense than anti-stokes lines.

Fill the blanks with appropriate answer.

11. "The surface integral of a vector over a closed surface is equal to the volume integral of divergence of the vector in the region enclosed by the surface." This statement is named as ..... theorem.

12. When an atom is placed in an external electric field, an atomic dipole is induced. The induced dipole moment increases with increase of the electric field. The induced dipole moment per unit applied electric field is called .....

13. If a particle of mass m and charge Q is projected normally into a uniform magnetic field of magnitude B, then the frequency of revolution of the particle about the field direction is .....

14. The SI unit of magnetization is .....

15. The half-life of radon in 3.8 days. The time required to left over only $\left(\frac{1}{20}\right)^{th}$ of radon sample is .....days

KATHMANDU UNIVERSITY
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Level : B.E./B.Sc./B. Pharm./B. Tech.
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Time : 2 hrs. 30 mins.

Course : PHYS 102
Semester : II
F. M. : 40

SECTION "B"
[5Q × 3 = 15 marks]

1. Show that the electric field at the center of a cavity sphere constructed inside a uniformly polarized medium with polarization, $\vec{P}$, is given by $\frac{\vec{P}}{3\varepsilon_0}$

OR

Find the electric potential inside and outside of a spherical shell of radius R which carries a uniformly distributed total charge Q.

2. Given $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, show that q $\nabla \cdot \left(r^n \hat{r}\right) = (n+2) r^{n-1}$ for $r \neq 0$.

3. Explain the terms diamagnetism, paramagnetism and ferromagnetism.

OR

What is flux rule for motional emf? Prove it for an arbitrary loop moving with arbitrary velocity in an arbitrary magnetic field.

4. Using Ampere's law, find the magnetic field inside and outside of a long metal wire of radius R which carries a volume current, $J = kr$, where k is a constant and r is the distance from the axis.

5. Obtain the Neumann formula for mutual inductance and hence state the reciprocity theorem.

OR

Derive electromagnetic wave equation in vacuum.

SECTION "C"
[5Q × 5 = 25 marks]

6. Find the electric field a distance z above a circular disc of radius R which carries a uniform surface charge σ.

OR

Find the electrostatic energy stored in a solid sphere of radius R which carries a uniformly distributed total charge Q.

7. What do you mean magnetic vector potential? Show that the expression of magnetic vector potential is $\vec{A} = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{l}}{r}$ for a steady current I.

8. Find the electric potential and field at any point due to a short electric dipole.

OR

Show that the energy stored in a magnetic field $\vec{B}$ is $\frac{1}{2\mu_0} B^2$.

9. What do you mean by Q-value and threshold energy for nuclear reaction? Obtain the expressions for these quantities.

10. How did Maxwell correct the Ampere's law? Deduce the Maxwell's equations in a medium.

OR

Prove the Poynting's theorem and then show that Poynting vector $\vec{S}$ satisfies the continuity equation, $\nabla \cdot \vec{S} = -\frac{\partial}{\partial t}(U_{em} + U_{mech})$, where U_{em} and U_{mech} are the electromagnetic and mechanical energy densities respectively.

KATHMANDU UNIVERSITY
School of Science/ School of Engineering
End-Semester Examinations
August, 2018

Examination Time: 11:00 A.M. to 2.00 P.M.

Date	Day	I - II	II – II	III-I	III – II	IV – I
August 8	Wednesday	PHYS 102 ARCH 161			EEEG 309 MEEG 309 MEEG 317 COMP 302 GEOM 315 CIEG 308 ENVS 335 PHAR 311 BIOT 306 PHYS 311 CHEG 305	MGTS 403
August 9	Thursday		MATH 208 ENVS 224 PHAR 214 BIOT 210 HBIO 213 PHYS 213	MGTS 301		
August 10	Friday	ENVE 101 CHEM 102			GEOM 307 ENVS 306	
August 12	Sunday	MATH 106			ETEG 301 EPEG 301 MEEG 318 COMP 314 CIEG 309 MGTS 302 BIOT 307 PHYS 312 CHEG 310 CHEM	COMP 401
August 13	Monday		EEEG 214 MEEG 207 COMP 232 GEOM 206 CIEG 208 ENVS 204 BIOL 206 BIOT 208 HBIO 215 PHYS 212 CHEG 211	COMP 307	ENVS 318 ENVS 345	
August 14	Tuesday	ENGG 112 ENVS 101 PHAR 111 BIOT 101 STAT 101				

Controller of Examinations

KATHMANDU UNIVERSITY
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Date	Day	I - II	II – II	III-I	III – II	IV – I
August 15	Wednesday	ARCH 112			EPEG 315 ETEG 303 MEEG 302 COMP 306 MATH 322 GEOM 319 CIEG 312 ENVS 303 ENVE 311 PHAR 313 BIOT 308 PHYS 313 CHEG 312	COMP 472
August 16	Thursday		EEEG 215 MEEG 202 COMP 231 CEEG 201 CIEG 206 CHEM 212 HBIO 212 PHYS 211 CHEG 213	COMP 315		
August 17	Friday	MATH 104 MATH 102 MATH 103				
August 19	Sunday	ENGT 102 NEPT 101			MEEG 308 COMP 304 COMP 409 CIEG 314 GEOM 306 ENVS 337 MEEG 306 PHAR 315 BIOT 309 PHYS 314 CHEG 313	COMP 421
August 20	Monday		MCSC 202 PHYS 207 CHEM 203 BIOT 207	COMP 316	EPEG 318 ETEG 304	

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Date	Day	I - II	II – II	III-I	III – II	IV – I
August 21	Tuesday				CHEG 314 GEOM 313	
August 22	Wednesday		BIOL 207		MGTS 303	COMP 478
August 23	Thursday	COMP 116 COMP 102	COMP 204 CIEG 207 PHAR 212	COMP 317	COEG 301 ETEG 305 ENVS 331 ENVE 399 BIOT 305	
August 24	Friday		COMP 201 MEEG 206 BIOT 209 INAN 211 STAT 221 CHEG 210		COMP 341 GEOM 310 CIEG 313 CIEG 318 CHEG 315 CHEG 323 PHAR 316	
August 27	Monday		MATH 207 GEOM 204 CIEG 209 ENVE 205 BIOT 206 MATH 217 CHEG 212	COMP 342	COMP 342 COMP 323 CIEG 310 ENVS 336 INAN 301	COMP 484

Note: *Examinations will be conducted as per this schedule and under no circumstance the dates and times will be changed unless the University publishes prior notice.*

Controller of Examinations