ç'u 4- ykjUt cy D;k g\ ,d le:i pEcdh; {k= d yEcor xfreku vko'k dh ?k.ku vkofÝk ,o iFk dh f=T;k Kkr dhft ,A

What is Lorentz force? Obtain the frequency of rotation and radius of path of a charge moving in an uniform magnetic field perpendicularly.

**OR**

,fEi;j dk fu;e fyf[k, rFkk fl) dhft ,A

State and prove Ampere's law.

ç'u 5- ik;fVx lfn'k D;k g\ ;fn l; dh f=T;k $7\times10^8$ ehVj rFkk fodfjr Åtk $38\times10^{28}$ okV gk rk l; d i"B ij Åtk lpj.k ik;fVx lfn'k dk eku Kkr dhft ,A

What is Poynting vector? Radius of sun is $7\times10^8$ m and energy radiated by it is $38\times10^{28}$ Watts. Calculate the value of energy propagation Poynting vector on the surface of the sun.

**OR**

VkIQkej d fl)kr] dk;fof/k rFkk ljpuk le>kb,A ble gku oky fofHkUu Åtk {k; crkb,A

Explain the principle, working and construction of the transformer. What are various types of energy losses in it?

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Roll No..... Total No. of Sections : 03

Total No. of Printed Pages : 06

# Code No. : S-154

## Annual Examination - 2019

## B.Sc. Part - I

## PHYSICS

## Paper - II

## ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY

Max.Marks : 50

Time : 3 Hrs. Min.Marks : 17

**Vhi %** **[k.M ^v* esa nl vfry?kZkjh i'u gSa] ftUgsa gy djuk vfuok;Z gSA [k.M ^c* esa y?kZkjh ç'u ,oa [k.M ^l* esa nh?kZ mZkjh ç'u gSA [k.M ^v* dk lcls igyk gy djsaA**

**Note :** Section 'A', containing 10 very short-answer-type questions, is compulsory. Section 'B' consists of short-answer-type questions and Section 'C' consists of long-answer-type questions. Section 'A' has to be solved first.

### Section - 'A'

**fuEukfdr vfry?kZkjh ç'uksa d mZkj ,d ;k nks okD;k e nsaA**
**Answer the following very short-answer-type questions in one or two sentences.** **(1x10=10)**

ç'u 1- ;fn lfn'k $\vec{A}$ dk ifjek.k A g] rc $\vec{A}.\vec{A}$ vkj $\vec{A}\times\vec{A}$ d eku fyf[k,A

If magnitude of $\vec{A}$ is A, then write thevalues of $\vec{A}.\vec{A}$ and $\vec{A}\times\vec{A}$.

ç'u 2- v?k.kh {k= dk ,d mnkgj.k nhft ,A

Write an example of irrotational field.

**P.T.O.**

ç'u 3- o|r {k= $\vec{E}$ e $\vec{p}$ f}/ko vk?k.k oky f}/ko ij yxu oky cy vk?k.k dk 0;tdfyf[k,A

Write the expression of torque acting on a electric dipole of dipole moment $\vec{p}$ in a uniform electric field $\vec{E}$.

ç'u 4- ok;e fLFkr ,dkd /ku vko'k l fudyu oky lEi.k fo|r ¶yDl dk eku fyf[k,A

Write the value of the total electric flux emanating from a unit positive charge in air.

ç'u 5- Dykmfl;l-ekslkVh lehdj.k dk fyf[k,A

Write down Clausius-Mosotti equation.

ç'u 6- fo|r iofÝk dk ifjHkkf"kr dhft,A

Define electric susceptibility.

ç'u 7- LFkk;h /kkjk d fy; lkrR; lehdj.k fyf[k,A

Write the equation of continuity for steady current.

ç'u 8- pEcdRo rhork M dh ifjHkk"kk nhft,A

Define the intensity of Magnetisation.

ç'u 9- eDr vkdk'k e eDloy d lehdj.k D;k gkx\

Write Maxwell's equations for free space.

ç'u 10- ik;fUVx ie; dk Hkkfrd egRo D;k g\

What is physical significance of Poynting theorem?

## Section - 'B'

**fuEukfdr y?k mÝkjh; ç'uk d mÝkj 150&200 'kCn lhek e n**

**Answer the following short-answer-type questions with word limit 150-200** **(3x5=15)**

ç'u 1- fdlh fLFkfr lfn'k $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ gr fl) dhft, % div grad $\left(\frac{1}{r}\right) = 0$

For a position vector $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, prove that div grad $\left(\frac{1}{r}\right) = 0$



**OR**

fl) dhft, % $curl(\phi \vec{A}) = \phi\ curl\ \vec{A} - \vec{A} \times grad\phi$

tgk $\phi$ vfn'k {k= rFkk $\vec{A}$ lfn'k {k= gA

Prove that : $curl(\phi \vec{A}) = \phi\ curl\ \vec{A} - \vec{A} \times grad\phi$

where $\phi$ is a scalar field and $\vec{A}$ is a vector field.

ç'u 2- fo|r {k= e fLFkr f}/ko dh fLFkfrt Åtk dk eku ikIr dhft,A LFkk;h lryu dh fLFkfr] ekud fLFkfr ,o vLFkk;h lryu dh fLFkfr le>kb,A

Find the value of potential energy of an electric dipole in an electric field. Explain stable equilibrium state, standard state and unstable state.

**OR**

,d le:i vkof'kr xksy d vUnj] ckgj ,o lrg ij fLFkr fcUnvksa ij fo|r {k= dh rhork dh x.kuk xkl ie; dh lgk;rk l dhft,A

Using Gauss theorem, calculate the intensity of electric field due to an uniformly charged sphere at a point inside, outside and on the surface.

ç'u 3- foLFkkiu lfn'k $\vec{D}$ ifj.kkeh fo|r {k= $\vec{E}$ ,o /ko.k lkfn'k $\vec{P}$ dh 0;k[;k djr g, bue lc/k LFkkfir dhft,A

Explain the terms displacement vector $\vec{D}$, resultant electric field $\vec{E}$ and polarization vector $\vec{P}$ and esablish a relation between them.

**OR**

lekUrj vuukuh ifjiFk D;k g\ bl ifjiFk dh vuukuh vkofÝk] ifrck/kk rFkk /kkjk io/ku d fy, 0;td Kkr dhft,A

What is parallel resonant circuit? Obtain expressions for the resonant frequency, impedance and current magnification for the circuit.

**P.T.O.**

**OR**

xkl-Mkbot Ul ie; dk dFku fy[kdj fl) dhft,A

State and prove Gauss's divergence theorem.

ç'u 2- fo|r foHko D;k g\ fo|r f}/ko d dkj.k fo|r foHko dk 0;ad ikIr dhft,A

What is electrical potential? Obtain an expression for electrial potential due to electric dipole.

**OR**

$x$ - v'k ij vuUr vko'k iR;d $q$ dyke] Øe'k% $x = 1, 2, 4, 8$ ----- ehVj ij j[k gA $x = 0$ ij fo|r {k= dh x.kuk dhft,A

At infinite charges, each $q$ coulomb, are placed on $x$ - axis at $x = 1$, 2, 4, 8 ------ meter respectively. Calculate the electric field at $x = 0$.

ç'u 3- ,d L R ifjiFk e /kkjk viu vfUre LFkk;h eku dk ,d frgkb eku 5 ld.M e ikIr djrh gA bl ifjiFk dk le; fu;rkad dk eku Kkr dhft,A

In an L R circuit the current attaims one third of its final steady value in 5 sec. What is the time constant of the circuit?

**OR**

iR;korh /kkjk ifjiFk e vkIr 0;; 'kfDr d fy, 0;ad 0;RiUu dhft,A

Derive an expression for average power consumed in an A.C. circuit.

ç'u 4- fl) dhft, % $\vec{J}_{bound} = \text{curl}\,\vec{M}$

tgk ldrk d vFk lkekU; gA

Show that : $\vec{J}_{bound} = \text{curl}\,\vec{M}$

where all symbols have their usual meaning.

**P.T.O.**

(3) Code No. : S-154

**OR**

xkl-Mkbot Ul ie; dk dFku fy[kdj fl) dhft,A

State and prove Gauss's divergence theorem.

ç'u 2- fo|r foHko D;k g\ fo|r f}/ko d dkj.k fo|r foHko dk 0;ad ikIr dhft,A

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Show that : $\vec{J}_{bound} = \text{curl}\,\vec{M}$

where all symbols have their usual meaning.

**P.T.O.**

**OR**

fdlh pEcfdr inkFk d ,d VdM dk pEcdh; vk?k.k 0-9 ,fEi;j eh Vj$^2$ gA VdM dk æ0;eku 0-24 fdxk rFkk VdM d inkFk dk ?kuRo $8\times10^3$ fdxk@eh Vj$^3$ gA pEcdu rhork Kkr dhft ,A

The magnetic moment of a piece of magnetised substance is 0.9 Am$^2$. The mass of piece is 0.24 kg and density of its substance is $8\times10^3$ kg/m$^3$. Find the intensity of magnetisation.

ç'u 5- eDloy d lehdj.kk dk mi;kx djd /kkjk-vko'k d lkrR; lehdj.k dk LFkkfir dhft ,A

Obtain equation of continuity for current-charge from Maxwell's equations of electromagnetic field.

**OR**

fLFkj rFkk le; ifjorh {k=k d fy, lekdyu :i rFkk vodyu :i e eDloy lehdj.kk dk fyf[k,A

Write down Maxwell's equations in integral and differential form for static and time varying fields.

## Section - 'C'

**fuEukfdr nh?k mÙkjh; ç'uk d mÙkj 300&350 'kCn lhek e n**
**Answer the following long-answer-type questions with word limit 300-350** **(5x5=25)**

ç'u 1- fdlh vfn'k {k= d xfM,.V l D;k rkRi; g\ fl) dhft , fd %

$\vec{\nabla}\phi = \frac{\partial\varphi}{\partial n}\hat{n}$] tgk ldrk d vFk lkekU; gA

What is meant by Gradient of a scalar field? Prove that :

$\vec{\nabla}\phi = \frac{\partial\varphi}{\partial n}\hat{n}$, where the symbols have their usual meaning.

(4) Code No. : S-154

**OR**

fdlh pEcfdr inkFk d ,d VdM dk pEcdh; vk?k.k 0-9 ,fEi;j eh Vj$^2$ gA VdM dk æ0;eku 0-24 fdxk rFkk VdM d inkFk dk ?kuRo $8\times10^3$ fdxk@eh Vj$^3$ gA pEcdu rhork Kkr dhft ,A

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Obtain equation of continuity for current-charge from Maxwell's equations of electromagnetic field.

**OR**

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Write down Maxwell's equations in integral and differential form for static and time varying fields.

## Section - 'C'

**fuEukfdr nh?k mÙkjh; ç'uk d mÙkj 300&350 'kCn lhek e n**
**Answer the following long-answer-type questions with word limit 300-350** **(5x5=25)**

ç'u 1- fdlh vfn'k {k= d xfM,.V l D;k rkRi; g\ fl) dhft , fd %

$\vec{\nabla}\phi = \frac{\partial\varphi}{\partial n}\hat{n}$] tgk ldrk d vFk lkekU; gA

What is meant by Gradient of a scalar field? Prove that :

$\vec{\nabla}\phi = \frac{\partial\varphi}{\partial n}\hat{n}$, where the symbols have their usual meaning.