Sanjay Ghodawat University, Kolhapur

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

2018-19
EXM/P/09/00

M. Sc-I | School of Science

PHS504 | Electrodynamics | Even Sem II

May 2019 | Examination: ESE, Max Marks: 20, Time 30 minutes

22nd May 2019, Wed. 2:30pm to 3:00pm

Seat No.: | PRN No.: | Student Sign:

Invigilator Sign: | Examiner Sign: | Marks Obtained:

Instructions:

1) All Questions are compulsory.
2) Mark √ to the correct option. Do not circle.
3) More than one options marked will not be considered for assessment.
4) Rough calculations on paper are not allowed.
5) Use non-programmable calculator is allowed.

Q.1	A. Select the correct alternative	Marks	Bloom's level	CO
1.	Energy density of an electromagnetic wave is given by	01	L1	504.1
a)	$u = \frac{1}{2}(\epsilon_o E^2 + \frac{1}{\mu_o} B^2)$	b)	$u = (\epsilon_o E^2 + \mu_o B^2)$	
c)	$u = \frac{1}{2}(\epsilon_o / E^2 + \mu_o / B^2)$	d)	$u = 2(\epsilon_o E^2 + \mu_o B^2)$	
2.	The Ohm's law in terms of current density is written as	01	L2	504.1
a)	$J = \sigma/E$	b)	$J = \sigma E$	
c)	$J = \sigma/E$	d)	$R = JE$	
3.	The Lienard-Wiechert scalar potential is given by---	01	L1	504.2
a)	$V(r,t) = \frac{1}{4\pi\varepsilon 0} \frac{q}{(Rc - R.v)}$	b)	$V(r,t) = \frac{1}{4\pi\varepsilon 0} \frac{c}{(Rc - R.v)}$	
c)	$V(r,t) = \frac{1}{4\pi} \frac{qc}{(Rc - R.v)}$	d)	$V(r,t) = \frac{1}{4\pi\varepsilon 0} \frac{qc}{(Rc - R.v)}$	
4.	The electric field in terms of scalar and vector potential is given by	01	L2	504.2
a)	$E = -\nabla V + \frac{\partial A}{\partial t}$	b)	$E = \nabla V + \frac{\partial A}{\partial t}$	
c)	$E = \nabla V - \frac{\partial A}{\partial t}$	d)	$E = -\nabla V - \frac{\partial A}{\partial t}$	
5.	The power radiated by the oscillating electric dipole is	01	L1	504.3
a)	$P = \frac{\mu_0 p_0^2}{12 \Pi c}$	b)	$P = \frac{p_0^2 \omega^2}{12 \Pi c}$	
c)	$P = \frac{\mu_0 p_0^2 \omega^4}{12 \Pi c}$	d)	$P = \frac{\mu_0 p_0^2 \omega^2}{12 c}$	
6.	Bremsstrahlung is also called as---	01	L2	504.3
a)	radiation	b)	infinite radiation	

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c) breaking radiation d) Collision radiation

7.	The tensor equation of an electromagnetic field is given by	01	L1	504.4

a) $\frac{\partial F^{\mu\upsilon}}{\partial x^{\upsilon}} = \mu_o I$ b) $\frac{\partial F^{\mu\upsilon}}{\partial x^{\upsilon}} = 0$

c) $\frac{\partial F^{\mu\upsilon}}{\partial x^{\upsilon}} = \mu_o \sigma$ d) $\frac{\partial F^{\mu\upsilon}}{\partial x^{\upsilon}} = \mu_o J$

8.	The antisymmetric tensor is represented as-----	01	L1	504.4

a) $t'^{\mu\nu} = \Lambda^{\mu}_{\lambda}\Lambda^{\nu}_{\sigma}t^{12}$ b) $t'^{\mu\nu} = \Lambda^{\mu}_{\lambda}\Lambda^{\nu}_{\sigma}t^{\lambda}$

c) $t'^{\mu\nu} = \Lambda^{\mu}_{\lambda}\Lambda^{\nu}_{\sigma}t^{\lambda\sigma}$ d) $t'^{\mu\nu} = \Lambda^{\mu}_{\lambda}\Lambda^{\nu}_{\sigma}t^{\sigma}$

Q.1 B. Fill in the blanks	Marks (6)	Bloom's level	CO
a) The electromagnetic force on a charge is _____	1	L2	504.1
b) The retarded time is always _____ than the time at infinite distance from the charge.	1	L2	504.2
c) The power radiated by a point charge in a circular motion is given by _____	1	L1	504.3
d) The distance (r) term responsible for emission of electromagnetic radiation is _____	1	L2	504.3
e) The relativistic energy for a particle at rest is _____	1	L2	504.4
f) The correction factor in Lorentz length contraction is _____	1	L1	504.4

Q.1 C. State true or false	Marks (6)	Bloom's level	CO
a) Velocity of an electromagnetic wave in the isotropic media is given by $c = \frac{1}{\mu_o \epsilon_o}$.	1	L1	504.1
b) The vector potential relates with the scalar potential by $A(r, t) = \frac{v}{c^3} V(r, t)$.	1	L1	504.2
c) When high speed electron hits a metal target, it rapidly decelerates giving off Bremsstrahlung radiations.	1	L1	504.3
d) The radiation that leaves the accelerated charge can go to the infinity.	1	L2	504.3
e) The de-Alembert's operator is variant under Lorentz transformations.	1	L2	504.4
f) The scalar product of velocity with itself is $\eta_{\mu}\eta^{\mu} = -c^2$.	1	L2	504.4

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PHS504 | Electrodynamics | Even Sem II

May 2019 | Examination: ESE, Max Marks: 80, Time 2.30 Hr | 3:00 pm to 5:00 pm

22nd May 2019 wed.

Instructions:
1) Questions Q.2, Q.3, Q.4 and Q.5 are compulsory.
2) Rough calculations on paper are not allowed.
3) Use non-programmable calculator is allowed.

		Marks (16)	Bloom's level	504.1
Q.2	**Answer the following questions**			
a)	State and derive Poynting theorem. Explain how it is used to verify the conservation of electromagnetic energy?	8	L3	
b)	Prove that the velocity of an electromagnetic wave in vacuum is 3×10^8 m/s.	8	L4	
	OR			
b)	Derive equation of continuity for charge. How it adds to the current density?	8	L4	

		Marks (16)	Bloom's level	504.2
Q.3	**Answer the following questions**			
a)	Derive equation for the magnetic field of moving point charge.	10	L3	
b)	Obtain Lienard-Wiechert potential.	6	L2	
	OR			
b)	Show that the retarded potentials satisfy the inhomogeneous wave equations.	6	L2	

		Marks (24)	Bloom's level	504.3
Q.4	**Answer the following questions**			
a)	Elaborate radiations emitted by an oscillating electric dipole.	16	L3	
b)	Illustrate the radiation emitted by a point charge at low velocity	8	L3	
	OR			
b)	What is Bremsstrahlung? Write angular distribution of power	8	L3	

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radiated by point charge for collinear velocity and acceleration.

Q.5	Answer the following questions	Marks (24)	Bloom's level	504.4
a)	Using field tensor $F^{\mu\upsilon}$ and dual tensor $G^{\mu\upsilon}$, derive Maxwell's equations.	12	L5	
b)	Obtain any two transformation equations for electric and magnetic fields using rest and moving frame of references.	8	L4	
	OR			
b)	Obtain any two transformation equations for tensor $t^{\mu\upsilon}$.	8	L4	
c)	Find out the scalar product of velocity four vector with itself.	4	L5	

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