

Seat No. : _____

NS-121
December-2015
M.Sc., Sem.-I
403 : (Physics)
(Electrodynamics – 1 & Programming in ‘C’)

Time : 3 Hours]

[Max. Marks : 70

- Instructions :** (1) All symbols carry usual meanings.
(2) Attempt all questions.

1. (a) Prove that the retarded potential satisfies the inhomogeneous wave equation. 7

OR

Derive expressions for E (field) and B (field) for the radiation from arbitrary distribution of charge & current.

- (b) Show that the retarded potentials satisfy the Lorentz gauge condition ? 7

[First prove that, $\left(\mathbf{J} \cdot \frac{\mathbf{J}}{r}\right) = \frac{1}{r} (\nabla \cdot \mathbf{J}) + \frac{1}{r} (\nabla' \cdot \mathbf{J}) - \nabla' \cdot \left(\frac{\mathbf{J}}{r}\right)$, where ∇ and ∇' denotes derivatives with respect to r and r' corresponding. NOTE that $\mathbf{J}(r', (t - r/c))$ depends on r' .]

OR

Prove that the radiation resistance of a wire joining the two ends of the dipole is

$$790 \left(\frac{d}{\lambda}\right)^2 \Omega.$$

2. (a) Write down the theory of Lienard-Wiechart potentials of the moving charge q on specified trajectory. 7

OR

Derive the formula of the total power radiated by a point charge. Explain Lienard generalized equation of Lorentz formula.

- (b) Show that the electric field of a point charge in motion can be represented more compactly as, $E = \frac{q}{4\pi\epsilon_0} \frac{1}{(r \cdot u)} \frac{\partial}{\partial t_r} \left(\frac{ru}{r \cdot u} \right)$ [NOTE : r and t are treated as constants]. 7

OR

Consider a particle of charge moves in a circle of radius R at constant angular velocity w (the circle lies in the XY plane, at t = 0 time the charge is at (R, 0) on the +X direction) find out the Lienard-Wiechart potentials for point on the Z-axis.

3. (a) (i) With help of a block diagram explain switch statement. 3
 (ii) Write a program to read 10 numbers one by one and obtain and print factorial of them. 4

OR

- (i) Write a program to compute and display the sum of all integers between 10 and 100 that are divisible by 6 but not divisible by 4. Program also should count and display number of such values. 3
 (ii) Write a program to print first 10 lines of Floyd's triangle. 4

```
1
2 3
4 5 6
7 8 9 10
```

- (b) (i) Write a program to read a series of 100 values and store them in an array, then find out and print highest value in the series. 3
 (ii) A table of marks scored in 4 subjects by 100 students is given. Write a program to store the marks and find out and print total marks obtained for each student. 4

OR

Standard deviation of a series of values is given by the following equation :

$$s = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - m)^2}$$

Write a program to read user specified number of values, calculate and print the standard deviation of the series. 7

4. (a) (i) Write a program to initialize a string with maximum of 25 characters. Read a character from user and check how many times that character is repeated in the string. 3
- (ii) Write a program to copy one string into another string. The program also should print both strings and number of characters copied (without using string handling functions) 4

OR

A palindrome is a word which spells same forward and backward. Write a program that reads a string from the keyboard and check whether the string is a palindrome or not. 7

- (b) (i) Explain the need for user defined functions. Describe elements of user defined functions. 4
- (ii) Write a program to read radius from user call function to calculate and print surface area and volume of a sphere. 3

OR

Write a program to read 100 values, call a function to sort the values in descending order. The program should print the original array and sorted array from main() 7

5. Answer **all** questions : 14

- (a) In the retarded potential theorem, if $T_r = T - \frac{r}{c}$, what does the term $\frac{r}{c}$ indicate ?
- (b) Write down Poisson equations.
- (c) Write the equation of Poynting vector in terms of electric and magnetic fields.
- (d) Write the relation between P_{mag} and P_{elec} .
- (e) What is radiation zone ?
- (f) Fill in the blank : $(\mathbf{v} \cdot \nabla)\mathbf{w} = \underline{\hspace{2cm}}$?
- (g) What is the field reaction ?
- (h) Write a statement using conditional operator to get absolute value of a number.
- (i) Point out errors in the following statements :

if (code > 1);

a + b = c;

- (j) What is the limitation of using scanf() function for reading strings ?
- (k) Write down output of the following statement :
- ```
char x[10] = "physics";
printf("%d %d", sizeof(x), strlen(x));
```
- (l) Write down output of the following statements :
- ```
for(i=10; i<=20; i=i+5)  
printf("*");
```
- (m) Write down prototype of a function which receives two integer values and return a float value.
- (n) Distinguish between automatic variable and static variable.
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