# TEACHING SCHEDULE 2019-2020

**CLASS:** S.Y.B.Sc**.**

**SUBJECT:** PHYSICS

**PAPER:** ELECTROMAGNETIC THEORY I

**PAPER CODE:** PHY-III.C-5

**DAY/ TIME:** MONDAY [01.30pm – 02.30pm], TUESDAY [09.30am – 10.30am]
TUESDAY [01.30pm – 02.30pm]

| Lecture No. | Topic/subtopic | Reference List | Page No. |
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| 1 | **1. Vector Analysis:**<br>Vector Algebra: Vector Operations, component form. | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 1-6 |
| 2 | Triple products, displacement and separation vectors | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 7-10 |
| 3 | Differential calculus: ordinary derivatives, gradient, del operator. | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 13-16 |
| 4 | The divergence and curl, Product rules, second derivatives. | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 17-24 |
| 5 | Integral calculus:<br>Line, surface and volume integrals, | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 24-28 |
| 6 | Fundamental theorem for divergences (statement and proof), fundamental theorem for curls (statement only) | Harper Charlie, Introduction to Mathematical Physics, Prentice Hall of India, 5th reprint, (1993) | 20-26 |
| 7 | Vector identities involving del operator | Harper Charlie, Introduction to Mathematical Physics, Prentice Hall of India, 5th reprint, (1993) | 30-31 |

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| 8 | Co-ordinate systems:<br>Spherical polar coordinate systems. | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 38-42 |
| 9 | Cylindrical coordinate systems | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 43-45 |
| 10 | **2. Electrostatics:**<br>Introduction, Coulomb's law, electric field. | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 58-61 |
| 11 | Electric field, Continuous charge distribution,<br>. | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 60-62 |
| 12 | Field lines, flux and Gauss's law | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 65-67 |
| 13 | Integral and differential form of Gauss's law, Applications of Gauss's law. | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 68-74 |
| 14 | Curl of E, Electric potential | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 76-81 |
| 15 | Electric Dipole. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 38-41 |
| 16 | Poisson's equation and Laplaces's equation, Summary, electrostatic boundary conditions. | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 83-90 |
| 17 | Work done to move a charge,<br>Energy of a point charge distribution, | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 90-93 |
| 18 | Energy of a continuous charge distribution, Comments on | Griffiths D.J., (2011), Introduction to | 93-96 |

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| | electrostatic energy | Electrodynamics, Prentice Hall of India, New Delhi | |
| 19 | Basic property of a conductor, induced charges | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 96-101 |
| 20 | Surface charge and force on the conductor, capacitors | Griffiths D.J., (2011), Introduction to Electrodynamics, Prentice Hall of India, New Delhi | 102-104 |
| 21 | **CA – I: WRITTEN TEST [30 MARKS]** | | |
| 22 | **3. Techniques to Solve Electrostatic Problems:** Poisson's equation, Laplace's equation, Ist and IInd uniqueness theorems, Laplace's equation in one dimension. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 51-55 |
| 23 | Solution to Laplacean equation in Spherical polar coordinates, Zonal harmonics. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 55-57 |
| 24 | Uncharged conducting sphere placed in uniform electric field | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 57-59 |
| 25 | Laplace's equation in rectangular co-ordinates, Laplace's equation in two dimensions. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 60-62 |
| 26 | Electrical image, A point charge near a conducting plane of infinite extent and grounded | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 62-65 |
| | A point charge near a conducting sphere: Sphere is earthed. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 65-67 |

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| 27 | A point charge near a conducting sphere: sphere is insulated. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 65-67 |
| 28 | **4. Electrostatic Fields in Matter:** Electric Polarisation, external field of a polarized dielectric. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 75-77 |
| 29 | External field of a rectangular slab of dielectric. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 77-80 |
| 30 | Electric field inside a polarized dielectric. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 81-83 |
| 31 | Gauss's law in dielectric, electric displacement vector, electric susceptibility and dielectric constant. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 83-87 |
| 32 | Continuation of electric susceptibility and dielectric constant . | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 83-87 |
| 33 | A point charge inside dielectric, parallel plate capacitor | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 87-89 |
| 34 | Boundary conditions on field vectors. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 89-91 |

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| 35 | Continuation of boundary conditions on field vectors,<br>Boundary value problems involving dielectrics. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 92-92 |
| 36 | Dielectric sphere placed in uniform electric field. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 93-94 |
| 37 | A problem based on dielectric placed in uniform electric field. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 94-96 |
| 38 | **CA – I MCQ TEST [30 MARKS]** | | |
| 39 | **5. Microscopic Theory of Dielectrics:**<br>Molecular field in a dielectric,<br>Clausius Mossotti relation. | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 101-104 |
| 40 | Clausius Mossotti relation continued… | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 101-104 |
| 41 | Polar and non-polar molecules<br>Induced dipoles. Non-polar molecules in a dielectric | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 104-106 |
| 42 | Polar molecules in dielectric: [The Langevin-Debye formula] | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 106-109 |
| 43 | Polar molecules in dielectric: [The Langevin-Debye formula] contd… | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 106-109 |

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| 44 | Permanent polarization: ferroelectricity | Reitz J. R., Milford F. J., (1979) Foundations of electromagnetic Theory, 3rd Ed. Addison-Wesley Publishing Company | 109-111 |
| 45 | Brief revision | | |

**References:**

1. Griffiths D. J., Introduction to Electrodynamics, Prentice Hall of India, 3rd Ed. (2011)

2. Harper Charlie, Introduction to Mathematical Physics, Prentice Hall of India, 5th reprint, (1993)

3. Reitz J. R., Milford F. J., Christy R. W., Foundations of Electromagnetic Theory, Addison-Wesley Publishing Company, 3rd Ed., (1979)

**Additional Reference:**

1. Mukherji U., Electromagnetic Field Theory and Wave Propagation, Narosa Publishing House, (2008)