***Lesson Plan***

***Faculty : Prof. Monica Khanore***

***Academic year: 2020-21***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CLASS | | | | | | TE Electronics, Semester V | | | |
| Academic Term | | | | | | Jul – Oct 2020 | | | |
| Subject | | | | | | **Engineering Electromagnetics** | | | |
| ***Periods (Hours) per week*** | | | | ***Lecture*** | | | ***4*** | | |
| ***Practical*** | | |  | | |
| ***Tutorial*** | | |  | | |
| ***Evaluation System*** | | | |  | | | ***Hours*** | | ***Marks*** |
| Theory examination | | | 3 | | 80 |
| Internal Assessment | | | -- | | 20 |
| Practical Examination | | | -- | | -- |
| Oral Examination | | | -- | | -- |
| Term work | | | -- | | 25 |
| Total | | | -- | | 125 |
|  | | | | | | | | | |
| ***Time Table*** | | | | ***Day*** | | | ***Time*** | | |
| Monday | | | 10-11am | | |
| Tuesday | | | 12.30-1.30 pm | | |
| Thursday | | | 9-10am | | |
| Friday | | | 11.30am-12.30pm | | |
| ***Course Content and Lesson plan*** | | | | | | | | | |
| **Week** | **Lecture**  **No.** | **Date** | | | **Topic** | | |  | |
| **Planned** | **Actual** | |  | | | **Remarks**  **(If any)** | |
| ***Module 1: Basic Laws of Electromagnetics and Maxwell’s Equations*** | | | | | | | | | |
| 1 | 1 | 13-07-20 | 13-07-20 | | Revision of vector algebra | | |  | |
| 2 | 14-07-20 | 14-07-20 | | Revision of vector algebra | | |  | |
| 3 | 16-07-20 | 16-07-20 | | Revision of vector algebra | | |  | |
| 4 | 17-07-20 | 17-07-20 | | Coulomb’s law, numerical problems on Coulomb’s law | | |  | |
| 2 | 5 | 20-07-20 | 20-07-20 | | Electric field intensity due to point charge, | | |  | |
| 6 | 21-07-20 | 21-07-20 | | Volume charge density, numerical problem, Electric field intensity due to line of charge | | |  | |
| 7 | 23-07-20 | 23-07-20 | | Electric field intensity due to surface charge density, Electric flux density, Gauss’s law, Divergence theorem | | |  | |
| 8 | 24-07-20 | 24-07-20 | | Divergence theorem, Workdone, electric potential | | |  | |
| 3 | 9 | 27-07-20 | 24-07-20 | | potential gradient, numerical problem, potential due to a dipole | | |  | |
| 10 | 28-07-20 | 27-07-20 | | Current, current density, continuity equation of current, Laplace’s and Poisson’s equations | | |  | |
| 11 | 30-07-20 | 28-07-20  30-07-20  31-07-20 | | Biot-Savart’s law, Ampere’s law, magnetic field due to surface current density, curl **H** Stoke’s theorem | | |  | |
| 12 | 31-07-20 | 03-08-20 | | Magnetic flux density, magnetic flux, scalar and vector magnetic potential | | |  | |
| 4 | 13 | 03-08-20 | 04-08-20 | | Boundary conditions | | |  | |
| 14 | 04-08-20 | 06-08-20 | | Numerical Problems on boundary conditions | | |  | |
| 15 | 06-08-20 | 07-08-20 | | Maxwell’s equations for static fields, derivation of Maxwell’s equations for time varying fields | | |  | |
| 16 | 07-08-20 | 10-08-20 | | Interpretation of Maxwell’s equations | | |  | |
| 5 | ***Module 2: Electromagnetic Waves*** | | | | | | | | |
| 17 | 10-08-20 | 10-08-20 | | Solution of wave Equation in partially conducting media, perfect dielectrics and free space | | |  | |
| 18 | 11-08-20 | 11-08-20 | | Uniform Plane Waves, propagation in free space, good dielectrics, numerical problems | | |  | |
| 19 | 13-08-20 | 13-08-20  14-08-20  18-08-20 | | Wave propagation in good conductors, skin effect and concept of Skin depth, numerical problems on skin depth | | |  | |
| 20 | 14-08-20 | 18-08-20 | | Polarization of wave: linear, circular elliptical | | |  | |
| 6 | 21 | 17-08-20 | 20-08-20 | | Polarization of wave continued, animations | | |  | |
| 22 | 18-08-20 | 11-09-20 | | Poynting vector, power flow in free space, dielectric and conducting media | | |  | |
| 23 | 20-08-20 | 22-09-20 | | Poynting vector numerical problems | | | 21-08-20 to 04-09-20 Revision of Module 1 and 2 | |
| 24 | 11-09-20 | 24-09-20  25-09-20 | | Reflection: perfect dielectric- normal incidence, Numerical problems | | |  | |
| 7 | UT1 14-09-20 to 16-09-20 | | | | | | | | |
| 25 | 17-09-20 | 29-09-20  29-09-20 | | Oblique incidence: direction cosines, parallel and perpendicular polarization diagrams, reflection from perfect conductor (Oblique incidence, perpendicular polarization) | | |  | |
| 26 | 18-09-20 | 01-10-20  05-10-20 | | Reflection: perfect dielectric -Reflection coefficient for parallel and perpendicular polarization | | |  | |
| 8 | 27 | 21-09-20 | 06-10-20 | | Brewster angle, numerical problems on Brewster angle, numerical problems on reflection | | |  | |
| 28 | 22-09-20 | 08-10-20 | | Numerical problems on reflection, reflection from perfect conductor (normal incidence), animations | | |  | |
| 29 | 24-09-20 | 13-10-20 | | Reflection from a conducting medium, numerical problem, Wave propagation in lossy media | | |  | |
| ***Module 3: Computational Electromagnetics*** | | | | | | | | |
| 30 | 25-09-20 | 02-11-20 | | FDM: Neumann type and mixed boundary conditions, Iterative solution of FDM | | |  | |
| 9 | 31 | 28-09-20 | 03-11-20 | | FDM solution using band matrix method, numerical problems | | |  | |
| 32 | 29-09-20 | 05-11-20  06-11-20 | | FEM | | |  | |
| 33 | 01-10-20 | 09-11-20 | | MOM | | |  | |
|  | ***Module 5: Transmission Lines*** | | | | | | | | |
| 10 | 34 | 05-10-20 | 13-10-20 | | Transmission line parameters and equivalent circuit | | |  | |
| 35 | 06-10-20 |  | | Transmission line equation and solution | | |  | |
| 36 | 08-10-20 | 14-10-20 | | Propagation constant, characteristic impedance, reflection and transmission coefficient | | |  | |
| 37 | 09-10-20 | 16-10-20 | | Input impedance, SWR | | |  | |
| 11 | 38 | 12-10-20 | 23-10-20  26-10-20  27-10-20  29-10-20 | | Smith chart, numerical problems | | |  | |
| ***Module 4: Fundamentals of Radiating Systems*** | | | | | | | | |
| 39 | 13-10-20 | 10-11-20 | | Concept of retarded potentials, Lorentz condition | | |  | |
| 40 | 15-10-20 | 10-11-20 | | Radiation from an alternating current element | | |  | |
| 41 | 16-10-20 | 10-11-20 | | Radiation from an alternating current element continued, half-wave dipole, quarter-wave, monopole, numerical problems | | |  | |
| 12 | 42 | 19-10-20 | 09-11-20 | | Antenna parameters: radiation patterns, beam-width, radiation intensity, directivity | | |  | |
| 43 | 20-10-20 | 09-11-20 | | Antenna parameters: power gain, band-width, radiation resistance and efficiency | | |  | |
| 44 | 22-10-20 |  | | Antenna parameters: effective length and effective area, numerical problems | | |  | |
| ***Module 6: Radio Wave Propagation*** | | | | | | | | |
| 45 | 23-10-20 |  | | Types of wave propagation: Ground, space and surface wave propagation | | | Could not be conducted due to shortage of classes. Study material was shared with students. | |
| 13 | 46 | 26-10-20 |  | | Space wave propagation: effect of imperfections of earth, curvature of earth, effect of interference zone | | |
| 47 | 27-10-20 |  | | Space wave propagation: lone of sight propagation, troposphere propagation and fading | | |
| 48 | 29-10-20 |  | | Sky wave propagation: reflection and refraction of waves, structure of ionosphere | | |
| 14 | 49 | 02-11-20 |  | | Measures of ionosphere propagation: critical frequency, angle of incidence, maximum usable frequency, skip distance, virtual height | | |
|  | UT2 23-11-20 to 26-11-20 | | | | | | | | |
| ***Total*** | 49 |  |  | |  | | |  | |

**Recommended Books:**

1. W.H. Hayt, and J.A. Buck, “Engineering Electromagnetics”, McGraw Hill Publications, 7th Edition, 2006

2. R.K. Shevgaonkar, “Electromagnetic Waves”, TATA McGraw Hill Companies, 3rd Edition, 2009

3. Edward C. Jordan and Keth G. Balmin, “Electromagnetic Waves and Radiating Systems”, Pearson Publications, 2nd Edition, 2006

4. Matthew N.D. Sadiku, “Principles of Electromagnetics”, Oxford International Student 4th Edition, 2007

5. J.D. Kraus, R.J. Marhefka, and A.S. Khan, “Antennas & Wave Propagation”, McGraw Hill Publications, 4th Edition, 2011

**Examination Scheme**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Module | | Lecture Hours | Marks distribution in Test (For internal assessment/TW) | | Approximate Marks distribution in Sem. End Examination |
| Test 1 | Test 2 |
| 1 | Basic laws of EM and Maxwell’s equations | 10 | 10 | -- | 22 marks |
| 2 | Electromagnetic waves | 12 | 10 | -- | 37 marks |
| 3 | Computational Electromagnetics |  |  | 5 |  |
| 4 | Fundamentals of Radiating Systems | 6 | -- | 5 | 20 marks |
| 5 | Radio wave propagation | 6 | -- | 5 | 20 marks |
| 6 | Transmission Lines | 8 | -- | 5 | 20 marks |

**Internal Assessment (IA):**

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of the tests will be considered as final IA marks

**End Semester Examination:**

1. Question paper will comprise of 6 questions, each carrying 20 marks.

2. Total 4 questions need to be solved.

3: Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.

4: Remaining questions will be selected from all the modules

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| **Submitted By** | **Approved By** |
|  |  |
| Prof. Monica Khanore | i) Dr. D. V. Bhoir Sign: |
|  |  |
| Sign: | ii) Prof. K. Narayanan Sign: |
|  |  |
|  | iii) Prof. Shilpa Patil Sign: |
|  | iv) Prof. Monica Khanore Sign: |
|  |  |
| **Date of Submission:** | **Date of Approval:** |
|  | |
| **Remarks by PAC (if any)** | |
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