# Department of Humanities & Science

**F.E. (Common to all Branches) (semester I)**

## Course Outcomes & Assessment Plan

**Subject: Engineering Physics-I**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Pract. | Tut. | Theory | TW/Pract | Tut. | Total |
| FEC102 | Engineering Physics-I | 02 | 01 | -- | 02 | 0.5 | -- | 2.5 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory | | | | Term Work | Pract | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | Test1 | Test2 | Av of Test 1 & 2 | | | | | |
| FEC102 | Engineering Physics-I | 15 | 15 | 15 | 60 | 25 | -- | -- | 100 |

| Module | Detailed Contents | Hrs. |
|---|---|---|
| 01 | **QUANTUM PHYSICS**<br>**(Prerequisites : Dual nature of radiation, Photoelectric effect Matter waves- wave nature of particles, de-Broglie relation, Davisson-Germer experiment)**<br>De Broglie hypothesis of matter waves; properties of matter waves; wave packet, phase velocity and group velocity; Wave function; Physical interpretation of wave function; Heisenberg uncertainty principle; non existence of electron in nucleus; Schrodinger's time dependent wave equation; time independent wave equation; Particle trapped in one dimensional infinite potential well, Quantum Computing. | 07 |
| 02 | **SOLID STATE PHYSICS - CRYSTALLOGRAPHY**<br>**(Prerequisites : Crystal Physics (Unit cell, Space lattice, Crystal structure, Simple Cubic, Body Centered Cubic, Face Centered Cubic, Diamond Structure, Production of X-rays)**<br>Miller indices; interplanar spacing; X-ray diffraction and Bragg's law; Determination of Crystal structure using Bragg's diffractometer; | 03 |

| | | |
|---|---|---|
| **03** | **SOLID STATE PHYSICS - SEMICONDUCTORS**<br>**(Prerequisites: Intrinsic and extrinsic semiconductors, Energy bands in conductors, semiconductors and insulators, Semiconductor diode, I-V characteristics in forward and reverse bias)**<br>Direct & indirect band gap semiconductor; Fermi level; Fermi dirac distribution; Fermi energy level in intrinsic & extrinsic semiconductors; effect of impurity concentration and temperature on fermi level; mobility, current density; Hall Effect; Fermi Level diagram for p-n junction (unbiased, forward bias, reverse bias); Applications of semiconductors: LED, Zener diode, Photovoltaic cell. | **06** |
| **04** | **OPTICS-I**<br>**(Prerequisites : Wave front and Huygen's principle, reflection and refraction, Interference by division of wave front, Youngs double slit experiment)**<br>Interference by division of amplitude, Interference in thin film of constant thickness due to reflected and transmitted light; origin of colours in thin film; Wedge shaped film; Newton's rings.<br>Applications of interference - Determination of thickness of very thin wire or foil; determination of refractive index of liquid; wavelength of incident light; radius of curvature of lens; testing of surface flatness; Anti-reflecting films and Highly reflecting film. | **06** |
| **05** | **SUPERCONDUCTORS AND SUPERCAPACITORS**<br>(Prerequisites : Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current, Ohm's law, electrical resistance, V-I characteristics (linear and non-linear), electrical resistivity and conductivity temperature dependence of resistance)<br>**Superconductors:** Critical temperature, critical magnetic field, Meissner's effect, Type I and Type II and high Tc superconductors;<br>**Super capacitors:** Principle, construction, types, materials and applications, comparison with capacitor and batteries : Energy density, Power density, | **02** |
| **06** | **ENGINEERING MATERIALS AND APPLICATIONS**<br>(Prerequisites: Paramagnetic materials, diamagnetic materials, ferromagnetic materials, crystal physics, Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance)<br>**Liquid crystals:** Nematic, Smectic and cholesteric phases, Liquid crystal display.<br>**Multiferroics :** Type I & Type II multiferroics and applications, Magnetoresistive Oxides: Magnetoresistance, GMR and CMR materials,<br>introduction to spintronics. | **02** |

## Objectives

1. To understand basic physics concepts and founding principles of technology.
2. To develop scientific temperament for scientific observations, recording, and inference drawing essential for technology studies.

**Course Outcomes:** On completion of the course, the students will be able to

| CO code | CO Statement | Blooms Level |
|---|---|---|
| **FEC102.1** | Illustrate the fundamentals of quantum mechanics and its application. | 2 (Understanding) |
| **FEC102.2** | Illustrate the knowledge of crystal planes, X-ray diffraction and its application. | 2 (Understanding) |
| **FEC102.3** | Illustrate the knowledge of Fermi level in semiconductors and applications of semiconductors in electronic devices. | 2 (Understanding) |
| **FEC102.4** | Illustrate the knowledge of interference in thin films and its various applications. | 2 (Understanding) |
| **FEC102.5** | Illustrate the basic knowledge of superconductors and super capacitors. | 2 (Understanding) |
| **FEC102.6** | Illustrate the knowledge of engineering materials and applications. | 2 (Understanding) |

## CO Assessment Tools:

| | **Direct assessment tools & weightage** | | | | **Indirect assessment tools** |
|---|---|---|---|---|---|
| **CO** | **End Sem Exam** | **Class Test** | **Practical performance** | **Tutorials** | **Exit Survey** |
| **FEC102.1** | 40% | T 2- 20% | 20% | 20% | 100% |
| **FEC102.2** | 40% | T1-20% | 20% | 20% | 100% |
| **FEC102.3** | 40% | T1-20% | 20% | 20% | 100% |
| **FEC102.4** | 40% | T2-30% | 20% | 20% | 100% |
| **FEC102.5** | 40% | T2-30% | ---- | 30% | 100% |
| **FEC102.6** | 40% | T2-30% | ---- | 30% | 100% |

**Final attainment of CO = 80% of direct attainment + 20% of indirect assessment**

**Relationship of course outcomes with program outcomes**

## CO-PO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FEC102.1** | **3** | * | * | * | * | * | * | * | * | * | * | * |
| **FEC102.2** | **3** | * | * | * | * | * | * | * | * | * | * | * |
| **FEC102.3** | **3** | * | * | * | * | * | * | * | * | * | * | * |
| **FEC102.4** | **3** | * | * | * | * | * | * | * | * | * | * | * |
| **FEC102.5** | **3** | * | * | * | * | * | * | * | * | * | * | * |
| **FEC102.6** | **3** | * | * | * | * | * | * | * | * | * | * | * |

## Practical

Five practical will be conducted as per schedule.

## Rubrics for practical Grading:

| Indicator | Poor | Average | Good |
|---|---|---|---|
| Punctuality(2) | Two sessions late(0) | One session late (1) | In time submission(2) |
| Preparedness (2) | No idea about experiment(0) | Read the manual and have some idea(1) | Read Manual and know the procedure(2) |
| Participation (3) | No involvement(0) | Passive involvement(2) | Active involvement(3) |
| Presentation(3) | Poor readability and somewhat structured (1) | Readable with one or two mistakes and structured (2) | Very well written and structured without any mistakes (3) |

## Suggested Experiments: (Any five)

1. Determination of radius of curvature of a lens using Newton's ring set up
2. Determination of diameter of wire/hair or thickness of paper using Wedge shape film method.
3. Study of Miller Indices.
4. Study of Hall Effect.
5. Determination of energy band gap of semiconductor.
6. Study of Zener diode as voltage regulator.
7. Study of I/V characteristics of LED
8. Determination of 'h' using Photo cell.
9. Study of I / V characteristics of semiconductor diode
10. Charging and discharging characteristics of supercapacitor.
11. Simulation study of orientational ordering in Nematic like 2D liquid crystal.
12. Simulation experiments based on engineering materials using open source simulation softwares like Avogadro, Chimera, JMOL etc.

## The distribution of Term Work marks will be as follows –

1. Attendance (Theory and Practical) : 05 marks
2. Project Groupwise ( TOPIC Presentation) : 10 marks
3. Laboratory work (Experiments and Journal) : 10 marks

## Assessment:

**Internal Assessment Test:**

Assessment consists of two class tests of 15 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

## End Semester Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 15 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of 2 to 3 marks will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. In question paper weightage of each module will be proportional to number of respective lecture hrs as mentioned in the syllabus.

## References


1. A text book of Engineering Physics-Avadhanulu & Kshirsagar, S. Chand
2. A textbook of Optics - N. Subramanyam and Brijlal, S.Chand
3. Fundamentals of optics by Jenkins and White, McGrawHill
4. Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher
5. Modern Engineering Physics – Vasudeva, S.Chand
6. Concepts of Modern Physics- Arther Beiser, Tata McGraw Hill
7. A text book of Engineering Physics-Avadhanulu & Kshirsagar, S. Chand
8. A textbook of Optics - N. Subramanyam and Brijlal, S.Chand
9. Fundamentals of optics by Jenkins and White, McGrawHill
10. Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher
11. Modern Engineering Physics – Vasudeva, S.Chand
12. Concepts of Modern Physics- Arther Beiser, Tata McGraw Hill
13. A Text Book of Engineering Physics, S. O. Pillai, New Age International Publishers.
14. Introduction to Solid State Physics- C. Kittle, John Wiley& Sons publisher
15. Ultracapacitors: The future of energy storage- R.P Deshpande, McGraw Hill
16. Advanced functional materials – Ashutosh Tiwari, Lokman Uzun, Scrivener Publishing LLC.

| Lect No | Topic Planned | Planned Date | Actual Date | Mapped CO | Content Delivery Method |
|---|---|---|---|---|---|
| 1 | Introduction to syallabus and University exam pattern | 13/08/2019 | 13/08/2019 | All | |
| 2 | Dual nature of radiation, Photoelectric effect Matter waves-wave nature of particles, de-Broglie relation, Davisson-Germer experiment | 19/08/2019 | 16/08/2019 | CO1 | |
| 3 | De Broglie hypothesis of matter waves; properties of matter waves; wave packet, phase velocity and group velocity; | 20/08/2019 | 20/08/2019 | CO1 | |
| 4 | Numericals on De Broglie Wavelength and Wave function; Physical interpretation of wave function; | 22/08/2019 | 22/08/2019 | CO1 | |
| 5 | Heisenberg uncertainty principle; non existence of electron in nucleus; Numericals on H.U.P | 26/08/2019 | 26/08/2019 | CO1 | |
| 6 | Schrodinger's time dependent wave equation; time independent wave equation; | 29/08/2019 | 29/08/2019 | CO1 | |
| 7 | Particle trapped in one dimensional infinite potential well | 09/09/2019 | 09/09/2019 | CO1 | |
| 8 | Numericals and Quantum Computing | 12/09/2019 | 16/09/2019 | CO1 | |
| 9 | Crystal Physics and Miller indices; | 16/09/2019 | 19/09/2019 | CO2 | |
| 10 | Interplanar spacing; X-ray diffraction and Bragg's law; | 19/09/2019 | 23/09/2019 | CO2 | |
| 11 | Determination of Crystal structure using Bragg's diffractometer; | 23/09/2019 | 26/09/2019 | CO2 | |
| 12 | Intrinsic and extrinsic semiconductors, Energy bands in conductors, semiconductors and insulators, | 26/09/2019 | 28/09/2019 | CO3 | |
| 13 | Direct & Indirect band gap semiconductor; Fermi level; Fermi dirac distribution; Mobility, Current density; | 30/09/2019 | 30/09/2019 | CO3 | |
| 14 | Fermi energy level in intrinsic & extrinsic semiconductors; effect of impurity concentration and temperature on fermi level; | 03/10/2019 | 30/09/2019 | CO3 | |
| 15 | Hall Effect and Numericals. | 10/10/2019 | 09/10/2019 | | |
| 16 | Fermi Level diagram for p-n junction (unbiased, forward bias, reverse bias); | 14/10/2019 | 09/10/2019 | CO3 | |
| 17 | Applications of semiconductors: LED, Zener diode, Photovoltaic cell. | 17/10/2019 | 10/10/2019 | CO3 | |
| 18 | Wave front and Huygen's principle, reflection and refraction, Interference by division of wave front, Youngs double slit experiment | 21/10/2019 | 11/10/2019 | CO3 | |
| 19 | Interference by division of amplitude, Interference in thin film of constant thickness due to reflected and transmitted light; | 24/10/2019 | 16/10/2019 | CO4 | |
| 20 | Origin of colours in thin film; Wedge shaped film; Newton's rings | 28/10/2019 | 17/10/2019 | CO4 | |
| 21 | Numericals on Wedge shaped film; Newton's rings | 31/10/2019 | 18/10/2019 | CO4 | |
| 22 | Applications of interference- Determination of thickness of very thin wire or foil; determination of refractive index of liquid; wavelength of incident light; | 06/11/2019 | 19/10/2019 | CO4 | |
| 23 | Applications of interference- radius of curvature of lens; testing of surface flatness; Anti-reflecting films and Highly reflecting film. | | 22/10/2019 | CO4 | |
| 24 | Superconductors: Critical temperature, critical magnetic field, Meissner's effect, Type I and Type II and high Tc superconductors; | | 23/10/2019 | | |
| 25 | Supercapacitors: Principle, construction, types, materials and applications, comparison with capacitor and batteries : Energy density, Power density, | | 24/10/2019 | CO5 | |
| 26 | Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance | | 24/10/2019 | CO5 | |
| 27 | Liquid crystals: Nematic, Smectic and cholesteric phases, Liquid crystal display. | | 30/10/2019 | CO5 | |
| 28 | Multiferroics : Type I & Type II multiferroics and applications, | | | | |
| 29 | Magnetoresistive Oxides: Magnetoresistance, GMR and CMR materials, | | 31/10/2019 | CO6 | |
| 30 | Introduction to spintronics | | 06/11/2019 | CO6 | |