# Nirma University

## Institute of Technology

Semester End Examination (IR/RPR), May - 2024

Bachelor of Science (Computer Science and Engineering), Semester-I
B. Tech. in CH / EC / EI / CSE, Semester-I
B. Tech. in CL / ME / EE / CSE, Semester-II
Int. B. Tech. (CSE) - MBA, Semester-I / II

1SP201 Physics

Roll/ Exam No. _____ Supervisor's initial with date _____

Time : 3 Hours Max. Marks: 100

Instructions:
1. All questions are compulsory.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | | |
|---|---|---|---|---|
| 1 | A | **Answer the following:** | | 6 |
| CLO2 | i. | What is the importance of pumping in laser production? | | |
| BL2 | ii. | A laser beam can be focused on an area equal to the square of its wavelength. For a Ruby laser, the wavelength is 694.3 nm. If the laser radiates energy at the rate of 1mW, find the intensity of the focused beam. | | |
| | B | **Answer the following:** | | 14 |
| | i. | Explain the principal of three level laser system with necessary diagrams. | | |
| | ii. | Discuss sol-gel technique for preparation of nano materials with necessary diagrams. | | |
| 2 | A | **Answer the following:** | | 06 |
| CLO3 | i. | Why surface to volume ratio is important to understand nano materials? | | |
| BL3 | ii. | Classify and brief the types of optical fiber based on the material. | | |
| | B | **Answer the following:** | | 14 |
| | i. | Discuss the positive and negative role of nano materials on environment. | | |
| | ii. | Describe how one can send signals from one place to another place using a communication link setup with optical fiber. | | |
| 3 | | **Perform the numerical:** | | 10 |
| CLO2 BL3 | i. | Determine the momentum and energy of an electron combined in a box of length 3Å for the ground state and the first excited state. Find the corresponding de Broglie wavelength. | | |
| | ii. | For a step index fiber with core of refractive index 1.54 and cladding refractive index 1.50 calculate the following when fiber is kept in water: fractional refractive index, numerical aperture, acceptance angle and number of modes The diameter of fiber is 15mm, it is operated at a wavelength of 1.5 mm and its length is 10 Km. | | |

## Section – II

| | | | | |
|---|---|---|---|---|
| 4 | A | **Answer the following:** | | |
| CLO2 BL2 | i. | An aircraft is generating noise of 103 dB. What will be the intensity of sound in $W/m^2$. | | 06 |
| | ii. | Explain the effect of doping on Fermi level of N type semiconductor. | | |
| | B | **Answer the following:** | | |
| | i. | Elaborate different methods of generating ultrasonic waves. | | 14 |
| | ii. | Describe working principle of an optical fiber sensor and explain intensity modulated optical fiber sensor. | | |
| 5 | A | **Answer the following:** | | |
| CLO4 BL3 | i. | What are the various characteristic of sound waves? | | 06 |
| | ii. | Classify the different ranges of vacuum along with proper unit. | | |
| | B | **Answer the following:** | | |
| | i. | Derive the Schrödinger's time dependent equation. | | 14 |
| | ii. | Explain roughing pump with necessary diagram. | | |
| 6 | | **Answer the following:** | | |
| CLO2 BL3 | i. | A ceiling fan operates at a sound intensity level of 75 dB. If it is operated in room with an existing sound intensity level of 70dB, What will be the resultant intensity level ? | | 10 |
| | ii. | Consider a collision between an x-ray photon of initial energy 20.0 keV and an electron at rest in which the photon is scattered backward and the electron is knocked forward. Find the energy of the backscattered photon and the kinetic energy of the recoiled electron. | | |

# Nirma University

## Institute of Technology

Semester End Examination (IR/RPR), April - 2025

B. Tech. in All Programmes, Semester - I /II

Int. B. Tech. (CSE) - MBA, Semester - I / II

Bachelor of Science (CSE), Semester - I

1SP201CC22 / 1SP201 Physics

Roll/ Exam No. | Supervisor's initial with date

Time: 3 Hours | Max. Marks: 100

Instructions
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | |
|---|---|---|---|
| **1** **CLO2** **BL2** | **A** | **Answer the following:** | **6** |
| | i. | Write the postulates of Quantum Mechanics. | |
| | ii. | What is the difference between core and cladding? | |
| | **B** | **Answer the following** | **14** |
| | i. | Derive the energy expression of a particle trapped inside an infinite square well. | |
| | ii. | Explain the role of two-level system to understand the basic mechanism of LASER. Give its limitations. | |
| **2** **CLO3** **BL3** | **A** | **Answer the following:** | **06** |
| | i. | Define the concept of a wave function in quantum mechanics. | |
| | ii. | Write the drawbacks of a LASER device working on three level principle. | |
| | **B** | **Answer the following:** | **14** |
| | i. | Describe the optical fiber communication flow to transmit the signal. | |
| | ii. | Analyze the working principle of Ion sputter pump and identify its limits. | |
| **3** **CLO3** **BL3** | | **Perform the numerical** | **10** |
| | i. | A photon of wavelength 10Å is incident on an electron at rest at an angle of 90°. Calculate the Compton shift, the wavelength of scattered photon and the energy of recoiling electron. | |
| | ii. | Consider a lower energy level situated 250 $cm^{-1}$ from the ground state. There are no other energy levels nearby. Determine the fraction of the population found in this level compared to the ground state population at a temperature of 300 K. | |

## Section – II

| | | | |
|---|---|---|---|
| 4<br>CLO2<br>BL3 | A | **Answer the following:**<br>i. State the physical significance of Fermi energy.<br>ii. Discuss the basic requirements for hearing the good quality sound. | 06 |
| | B | **Answer the following**<br>i. Discuss the laser ablation method for the thin film deposition.<br>ii. Describe the methods used to generate ultrasonic waves. | 14 |
| 5<br>CLO1<br>BL4 | A | **Answer the following:**<br>i. Explain the role of surface to volume ratio for nanomaterials.<br>ii. Differentiate between linear and circular accelerator. | 06 |
| | B | **Answer the following:**<br>i. Analyze the behavior of fermi level in doped semiconductor under the influence of temperature.<br>ii. Discuss the working of intensity modulated temperature sensors based on fiber. | 14 |
| 6<br>CLO2<br>BL3 | | **Answer the following:**<br>i. Determine the momentum and energy of an electron confined in a box of length 15Å for the first and second excited state.<br>ii. The two sound intensity levels, as recorded at a place are 75 dB and 85 dB respectively. Calculate the resultant sound intensity at the same point due to the combined effect. | 10 |

# Nirma University

## Institute of Technology

Semester End Examination (IR/RPR), December - 2024

B. Tech. in All Programmes / Int. B. Tech. (CSE) - MBA, Semester-I/II

Bachelor of Science (CSE), Semester-I

1SP201CC22/1SP201 Physics

Roll/
Exam No. _____ Supervisor's initial
with date _____

Time : 3 Hours Max. Marks: 100

Instructions:
1. All questions are compulsory.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | |
|---|---|---|---|
| 1 | A | **Answer the following:** | 6 |
| CLO2 BL2 | i. | What are the different types of pumping in laser production? | |
| | ii. | The spontaneous emission rate to the stimulated emission rate is given by: $$R = \exp(h\nu/kT) - 1$$ Determine the spontaneous emission to the stimulated emission for tungsten of temperature of 2000 K in the visible range. | |
| | B | **Answer the following:** | 14 |
| | i. | Explain the construction and working of a semiconductor laser system with necessary diagrams. | |
| | ii. | Differentiate between SEM and TEM used for the characterization of nanomaterials. | |
| 2 | A | **Answer the following:** | 06 |
| CLO3 BL3 | i. | Give the properties of CNT. | |
| | ii. | Classify the types of optical fiber based on materials. | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss CVD technique used for the deposition of thin film. | |
| | ii. | Explain point to point communication through optical fiber. | |
| 3 | | **Perform the numerical:** | 10 |
| CLO2 BL3 | i. | Light of frequency $6 \times 10^{14}$ Hz incident on a metal surface ejects photoelectrons with a maximum kinetic energy of $2 \times 10^{-19}$ J. Calculate the work function of the metal, giving your answer in eV. | |
| | ii. | Consider the optical fibre with core index 1.46, diameter 50 micrometre and surrounded by air. Determine the index of refraction of the cladding necessary to make maximum entrance angle 10°. | |

## Section – II

| | | | |
|---|---|---|---|
| 4 | A | **Answer the following:** | 06 |
| CLO2 BL2 | i. | Write the Sabine's formula and explain the important parameter required to control the value of reverberation time. | |
| | ii. | Differentiate between direct and indirect band gap semiconductor. | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss the reverse piezoelectric effect for the production of ultrasonic waves. Enlist the advantages and disadvantages of the method. | |
| | ii. | Explain the construction and working of a Geiger Muller counter. | |
| 5 | A | **Answer the following:** | 06 |
| CLO4 BL3 | i. | How the ultrasonic waves are used for cleaning. | |
| | ii. | What are the characteristics of wave function? | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss the effect of temperature on p-type and n-type of semiconductor. | |
| | ii. | Explain rotary pump with necessary diagram. | |
| 6 | | **Answer the following:** | 10 |
| CLO2 BL3 | i. | Two sources A and B emit sound waves of different frequencies. The two sound pressure levels, as recorded at a place are 80 dB and 70 dB respectively. Calculate the resultant sound pressure level at the same point due to the combined effect. | |
| | ii. | A particle limited to the x- axis has the wave function $\psi = ax$ between $x = 0$ and $x = 1$ and $\psi = 0$ elsewhere. Find the probability that the particle can be found between $x = 0.45$ and $x = 0.55$. | |

# Nirma University

## Institute of Technology

Supplementary Examination (SPE), August - 2023

B. Tech. in CSE, Semester-I

Int. B. Tech. (CSE) - MBA, Semester-II

B. Tech. in CL / CH / ME / EE, Semester-II

1SP201 Physics

Roll/
Exam No.

Supervisor's initial
with date

Time : 3 Hours

Max. Marks: 100

Instructions :

1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | |
|---|---|---|---|
| 1 CO2 | A | **Answer the following:** | 6 |
| | i. | What is photoelectric effect? | |
| | ii. | The core of refractive index of an optical fiber is 1.6 and that of cladding is of 1.5. Calculate acceptance angle of the fiber. | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss ball milling technique for the synthesis of nanomaterials with necessary diagrams. | |
| | ii. | Explain construction and working of Ruby laser in detail with necessary diagrams. Give its limitations. | |
| 2 CO3 | A | **Answer the following:** | 06 |
| | i. | What are carbon nanotubes? | |
| | ii. | What is the internal structure of optical fiber? | |
| | B | **Answer the following:** | 14 |
| | i. | Describe properties and applications of nanomaterials. | |
| | ii. | Describe the working and construction of liquid level sensor. | |
| 3 CO3 | | **Perform the numerical:** | 10 |
| | i. | What must be the width of one dimensional infinite potential well if an electron trapped in it in the n=3 state is to have an energy of 4.7 eV? | |
| | ii. | A glass clad fiber is made with core glass of refractive index 1.5 and the cladding is doped to give refractive index difference of 0.0005. Determine the cladding refractive index. | |

**Section – II**

| | | | |
|---|---|---|---|
| 4 CO2 | A | **Answer the following:** | 06 |
| | i. | What are the sound waves? | |
| | ii. | Enlist the various units of pressure. | |

| | | | |
|---|---|---|---|
| | B | **Answer the following:** | 14 |
| | i. | Explain the method for the production of ultrasound. Give the applications and properties of ultrasound. | |
| | ii. | Describe Geiger Muller counter for detecting nuclear radiations. | |
| 5 | A | **Answer the following:** | 06 |
| CO3 | | | |
| | i. | What do you mean by 1 dB noise? | |
| | ii. | What are the various categories of semiconductors? | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss the scanning electron microscope in detail with necessary diagrams. | |
| | ii. | Explain rotary pump with necessary diagram. | |
| 6 | | **Answer the following:** | 10 |
| CO3 | i. | The sound from a drill gives a noise level of 95 dB at a point few meters away from it. What is the noise level at this point when four such drills are working at the same distance away? | |
| | ii. | What would be the reverberation time of hall of volume 12000 $m^3$ and absorption coefficient 0.2 and surface area 1000 $m^2$? | |

# Nirma University

## Institute of Technology

Supplementary Examination (SPE), February - 2024

B. Tech. in CH / EC / CSE / EI Engineering, Semester-I

Bachelor of Science (Computer Science and Engineering), Semester-I

1SP201 Physics

Roll/ Exam No. _____ Supervisor's initial with date _____

Time : 3 Hours Max. Marks: 100

Instructions :
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | |
|---|---|---|---|
| 1 CO2 | **A** | **Answer the following:** | **6** |
| | i. | What is the importance of active medium in laser production? | |
| | ii. | A laser beam can be focused on an area equal to the square of its wavelength. For a He-Ne laser, the wavelength is 632.8 nm. If the laser radiates energy at the rate of 1mW, find the intensity of the focused beam. | |
| | **B** | **Answer the following:** | **14** |
| | i. | Explain Febry-Perot resonator with necessary diagrams. | |
| | ii. | Discuss sputtering technique for thin film deposition with necessary diagrams. | |
| 2 CO3 | **A** | **Answer the following:** | **06** |
| | i. | What do mean by quantum confinement? Give its importance. | |
| | ii. | The acronym of laser should be LOSER. Why? | |
| | **B** | **Answer the following:** | **14** |
| | i. | Enlist properties and applications of nanomaterials. | |
| | ii. | Describe optical fiber communication link with lay out. | |
| 3 CO3 | | **Perform the numerical:** | **10** |
| | i. | What is the photon energy for an electromagnetic wave with a wavelength equal to the Compton wavelength of an electron? | |
| | ii. | The normal temperature of an optical source is 1000 K. Show that, in the visible optical region, the emission is predominantly due to spontaneous emission. | |

## Section – II

4 CO2 **A Answer the following:** **06**

i. A bullet of mass 40 gm travels with the velocity of 1100 m/s. What wavelength will be associated with it?
ii. With proper sketch, showcase the position of Fermi level in n-type semiconductor at absolute temperature and explain the effect of temperature on it.

**B Answer the following:** **14**

i. Describe the conditions for the good acoustics in the auditorium hall.
ii. Describe Geiger Muller counter for detecting nuclear radiations.

5 CO3 **A Answer the following:** **06**

i. What is reverse piezoelectric effect for the production of ultrasound?
ii. What are the various categories of semiconductors based on bandgap? Give examples of each.

**B Answer the following:** **14**

i. Derive the wave function for a free particle confined in a 1D box of length L. Also deduce its normalized wave function.
ii. Explain diffusion pump with necessary diagram.

6 **Answer the following:** **10**

CO3 i. A hall has a volume of 12500 $m^3$ and reverberation time of 1.5 sec. If 200 cushioned chairs are additionally placed in the hall, what will be the new reverberation time of the hall? The absorption of each chair is 0.7 O.W.U.
ii. X rays of wavelength 0.2 Å are scattered from a target. Calculate the wavelength of X rays scattered through 45°. Also find the maximum KE of recoil electron.

# Nirma University

## Institute of Technology

Supplementary Examination (SPE), July - 2024

B. Tech. in CL / ME /EE / CSE, Semester-I/II

Bachelor of Science (Computer Science and Engineering), Semester-I

1SP201 Physics

Roll/ Exam No. _____ Supervisor's initial with date _____

Time : 3 Hours Max. Marks: 100

Instructions:
1. All questions are compulsory.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | | |
|---|---|---|---|---|
| **1** | **A** | **Answer the following:** | | **6** |
| **CLO2** | i. | What is the importance of optical resonator in laser production? | | |
| **BL2** | ii. | A laser beam can be focused on an area equal to the four times of its wavelength. For a He-Ne laser, the wavelength is 632.8 nm. If the laser radiates energy at the rate of 2mW, find the intensity of the focused beam. | | |
| | **B** | **Answer the following:** | | **14** |
| | i. | Explain the principal of four level laser system with necessary diagrams. | | |
| | ii. | Discuss the ball milling technique for preparation of nano materials with necessary diagrams. | | |
| **2** | **A** | **Answer the following:** | | **06** |
| **CLO3** | i. | What do mean by quantum confinement? Give its importance. | | |
| **BL3** | ii. | List out the role of cladding in optical fiber. | | |
| | **B** | **Answer the following:** | | **14** |
| | i. | Explain the construction and working on Transmission Electron Microscope. | | |
| | ii. | Discuss the difference between step index and graded index multi-mode optical fiber. | | |
| **3** | | **Perform the numerical:** | | **10** |
| **CLO2** **BL3** | i. | Find the probabilities of the particle trapped in a box of length L in the region from 0.45L to 0.55L for the ground state and the first excited state. | | |
| | ii. | For a step index optical fiber with core of refractive index 1.52 and cladding refractive index 1.48 calculate the following when fiber is kept in water: fractional refractive index, numerical aperture, acceptance angle and number of modes The diameter of fiber is 15mm, it is operated at a wavelength of 1.5 mm and its length is 10 Km. | | |

## Section – II

| | | | |
|---|---|---|---|
| 4 | A | **Answer the following:** | 06 |
| CLO2 BL2 | i. | A drill is generating noise of 95 dB. What will be the intensity of sound in $W/m^2$. | |
| | ii. | Differentiate between direct and indirect band gap semiconductor. | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss the defects related to sound arising in a room and their remedies. | |
| | ii. | Explain the construction and working of a Scintillation counter. | |
| 5 | A | **Answer the following:** | 06 |
| CLO4 | i. | List out the applications of ultrasonic waves. | |
| BL3 | ii. | What are the failures of classical Physics? | |
| | B | **Answer the following:** | 14 |
| | i. | Explain construction and working of $CO_2$ laser. | |
| | ii. | Explain diffusion pump with necessary diagram. | |
| 6 | | **Answer the following:** | 10 |
| CLO2 BL3 | i. | Two sources A and B emit sound waves of different frequencies. The two sound pressure levels, as recorded at a place are 70 dB and 60 dB respectively. Calculate the resultant sound pressure level at the same point due to the combined effect. | |
| | ii. | X rays of wavelength 0.1 nm are scattered at such an angle that the recoil electron has the maximum kinetic energy. Calculate the wavelength of the scattered ray and the energy of the recoil electron. | |

# Nirma University

## Institute of Technology

Semester End Examination (IR/RPR), April - 2025

B. Tech. in All Programmes, Semester - I /II

Int. B. Tech. (CSE) - MBA, Semester - I / II

Bachelor of Science (CSE), Semester - I

1SP201CC22 / 1SP201 Physics

Roll/ Exam No. | Supervisor's initial with date

Time: 3 Hours | Max. Marks: 100

Instructions
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | |
|---|---|---|---|
| **1** **CLO2** **BL2** | **A** | **Answer the following:** | **6** |
| | i. | Write the postulates of Quantum Mechanics. | |
| | ii. | What is the difference between core and cladding? | |
| | **B** | **Answer the following** | **14** |
| | i. | Derive the energy expression of a particle trapped inside an infinite square well. | |
| | ii. | Explain the role of two-level system to understand the basic mechanism of LASER. Give its limitations. | |
| **2** **CLO3** **BL3** | **A** | **Answer the following:** | **06** |
| | i. | Define the concept of a wave function in quantum mechanics. | |
| | ii. | Write the drawbacks of a LASER device working on three level principle. | |
| | **B** | **Answer the following:** | **14** |
| | i. | Describe the optical fiber communication flow to transmit the signal. | |
| | ii. | Analyze the working principle of Ion sputter pump and identify its limits. | |
| **3** **CLO3** **BL3** | | **Perform the numerical** | **10** |
| | i. | A photon of wavelength 10Å is incident on an electron at rest at an angle of 90°. Calculate the Compton shift, the wavelength of scattered photon and the energy of recoiling electron. | |
| | ii. | Consider a lower energy level situated 250 $cm^{-1}$ from the ground state. There are no other energy levels nearby. Determine the fraction of the population found in this level compared to the ground state population at a temperature of 300 K. | |

## Section – II

| | | | |
|---|---|---|---|
| 4<br>CLO2<br>BL3 | A | **Answer the following:**<br>i. State the physical significance of Fermi energy.<br>ii. Discuss the basic requirements for hearing the good quality sound. | 06 |
| | B | **Answer the following**<br>i. Discuss the laser ablation method for the thin film deposition.<br>ii. Describe the methods used to generate ultrasonic waves. | 14 |
| 5<br>CLO1<br>BL4 | A | **Answer the following:**<br>i. Explain the role of surface to volume ratio for nanomaterials.<br>ii. Differentiate between linear and circular accelerator. | 06 |
| | B | **Answer the following:**<br>i. Analyze the behavior of fermi level in doped semiconductor under the influence of temperature.<br>ii. Discuss the working of intensity modulated temperature sensors based on fiber. | 14 |
| 6<br>CLO2<br>BL3 | | **Answer the following:**<br>i. Determine the momentum and energy of an electron confined in a box of length 15Å for the first and second excited state.<br>ii. The two sound intensity levels, as recorded at a place are 75 dB and 85 dB respectively. Calculate the resultant sound intensity at the same point due to the combined effect. | 10 |

# Nirma University

## Institute of Technology

Semester End Examination (IR/RPR), December - 2024

B. Tech. in All Programmes / Int. B. Tech. (CSE) - MBA, Semester-I/II

Bachelor of Science (CSE), Semester-I

1SP201CC22/1SP201 Physics

Roll/
Exam No. _____ Supervisor's initial
with date _____

Time : 3 Hours Max. Marks: 100

Instructions:
1. All questions are compulsory.
2. Figures to right indicate full marks.
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**Section – I**

| | | | |
|---|---|---|---|
| 1 | A | **Answer the following:** | 6 |
| CLO2 BL2 | i. | What are the different types of pumping in laser production? | |
| | ii. | The spontaneous emission rate to the stimulated emission rate is given by: $$R = \exp(h\nu/kT) - 1$$ Determine the spontaneous emission to the stimulated emission for tungsten of temperature of 2000 K in the visible range. | |
| | B | **Answer the following:** | 14 |
| | i. | Explain the construction and working of a semiconductor laser system with necessary diagrams. | |
| | ii. | Differentiate between SEM and TEM used for the characterization of nanomaterials. | |
| 2 | A | **Answer the following:** | 06 |
| CLO3 BL3 | i. | Give the properties of CNT. | |
| | ii. | Classify the types of optical fiber based on materials. | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss CVD technique used for the deposition of thin film. | |
| | ii. | Explain point to point communication through optical fiber. | |
| 3 | | **Perform the numerical:** | 10 |
| CLO2 BL3 | i. | Light of frequency $6 \times 10^{14}$ Hz incident on a metal surface ejects photoelectrons with a maximum kinetic energy of $2 \times 10^{-19}$ J. Calculate the work function of the metal, giving your answer in eV. | |
| | ii. | Consider the optical fibre with core index 1.46, diameter 50 micrometre and surrounded by air. Determine the index of refraction of the cladding necessary to make maximum entrance angle 10°. | |

## Section – II

| | | | |
|---|---|---|---|
| 4 | A | **Answer the following:** | 06 |
| CLO2 BL2 | i. | Write the Sabine's formula and explain the important parameter required to control the value of reverberation time. | |
| | ii. | Differentiate between direct and indirect band gap semiconductor. | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss the reverse piezoelectric effect for the production of ultrasonic waves. Enlist the advantages and disadvantages of the method. | |
| | ii. | Explain the construction and working of a Geiger Muller counter. | |
| 5 | A | **Answer the following:** | 06 |
| CLO4 BL3 | i. | How the ultrasonic waves are used for cleaning. | |
| | ii. | What are the characteristics of wave function? | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss the effect of temperature on p-type and n-type of semiconductor. | |
| | ii. | Explain rotary pump with necessary diagram. | |
| 6 | | **Answer the following:** | 10 |
| CLO2 BL3 | i. | Two sources A and B emit sound waves of different frequencies. The two sound pressure levels, as recorded at a place are 80 dB and 70 dB respectively. Calculate the resultant sound pressure level at the same point due to the combined effect. | |
| | ii. | A particle limited to the x- axis has the wave function $\psi = ax$ between $x = 0$ and $x = 1$ and $\psi = 0$ elsewhere. Find the probability that the particle can be found between $x = 0.45$ and $x = 0.55$. | |

# Nirma University

## Institute of Technology

Supplementary Examination (SPE), February - 2025

B. Tech. in All Programmes, Semester-I

Bachelor of Science (CSE), Semester-I

1SP201CC22 Physics

Roll/
Exam No. _____ Supervisor's initial with date _____

Time: 3 Hours Max. Marks: 100

Instructions
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | | |
|---|---|---|---|---|
| 1 CLO1 BL2 | A | **Answer the following:** | | 06 |
| | i. | Write the applications of LASER. | | |
| | ii. | What is numerical aperture and relative refractive index. | | |
| | B | **Answer the following** | | 14 |
| | i. | Derive the normalized wave function for the particle confined in an infinite square well potential. | | |
| | ii. | Explain the process of stimulated absorption, spontaneous emission and stimulated emission. | | |
| 2 CLO3 BL4 | A | **Answer the following:** | | 06 |
| | i. | State the postulates of a wave function in quantum mechanics. | | |
| | ii. | Write the important characteristics of LASER. | | |
| | B | **Answer the following:** | | 14 |
| | i. | Describe the working of Graded Index optical fiber with suitable diagram. Provide its advantages and disadvantages. | | |
| | ii. | Explain the working principle of Rotary pump and identify its limits. | | |
| 3 CLO2 BL3 | | **Perform the numerical** | | 10 |
| | i. | Consider a lower energy level situated 200 cm-1 from the ground state. There are no other energy levels nearby. Determine the fraction of the population found in this level compared to the ground state population at a temperature of 300 K. | | |

ii. Given the numerical aperture to be 0.2441 and refractive index of the core to be 1.5, calculate the refractive index of the cladding as well as the acceptance angle.

## Section – II

| | | | |
|---|---|---|---|
| 4 CLO2 BL3 | A | **Answer the following:** | 06 |
| | i. | Discuss the role of Molecular Orbital Theory (MOT) in formation of bandgap in semiconductors. | |
| | ii. | Write the classification of sound waves. | |
| | B | **Answer the following** | 14 |
| | i. | Discuss the construction and working of Ball Milling technique for the nano materials with its advantages and disadvantages. | |
| | ii. | Elaborate the concept of Fermi energy and how it varies with temperature in semiconductors. | |
| 5 CLO4 BL4 | A | **Answer the following:** | 06 |
| | i. | Enlist the properties of CNTs. | |
| | ii. | Differentiate between linear and circulator accelerators. | |
| | B | **Answer the following:** | 14 |
| | i. | Explain the construction and working of $CO_2$ Laser. Give its advantages and disadvantages. | |
| | ii. | Analyze the working principle of an intensity modulated sensor for temperature measurement. | |
| 6 CLO2 BL3 | | **Answer the following:** | 10 |
| | i. | Determine the momentum an energy of an electron combined in a box of length 2Å for the ground state and the second excited state. | |
| | ii. | The two sound pressure levels, as recorded at a place are 85 dB and 80 dB respectively. Calculate the resultant sound pressure level at the same point due to the combined effect. | |

# Nirma University

## Institute of Technology

Supplementary Examination (SPE), July - 2025

B. Tech. in CH / EC Engineering, Semester-I

B. Tech. in CL / ME / EE / CSE / AI&ML, Semester-II

1SP201CC22 Physics

Roll/
Exam No.

Supervisor's initial
with date

Time: 3 Hours

Max. Marks: 100

Instructions
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | |
|---|---|---|---|
| **1** **CLO2** **BL2** | **A** | **Answer the following:** | **6** |
| | i. | Draw the box where particle is confined in an infinite potential well with proper boundaries. You may decide the box boundaries. | |
| | ii. | What is role of outer jacket in optical fiber? | |
| | **B** | **Answer the following** | **14** |
| | i. | Derive the time dependent Schrodinger equation. | |
| | ii. | Explain the role of optical resonator in a laser system. | |
| **2** **CLO3** **BL3** | **A** | **Answer the following:** | **06** |
| | i. | List out the two main difference between classical and quantum mechanics. | |
| | ii. | Write the drawbacks of a LASER device working on three level principle. | |
| | **B** | **Answer the following:** | **14** |
| | i. | Describe the types of multimode optical fiber to transmit the signal. | |
| | ii. | Analyze the working principle of rotary pump and identify its limits. | |
| **3** **CLO3** **BL3** | | **Perform the numerical** | **10** |
| | i. | A photon of wavelength 20 Å is incident on an electron at rest at an angle of 90°. Calculate the Compton shift, the wavelength of scattered photon and the energy of recoiling electron. | |
| | ii. | Consider an energy level situated 200 $cm^{-1}$ from the ground state. Determine the fraction of the population found in this level compared to the ground state population at a temperature of 300 K. | |

## Section – II

| | | | |
|---|---|---|---|
| 4<br>CLO2<br>BL3 | A | **Answer the following:**<br>i. Show the Fermi level for intrinsic semiconductor.<br>ii. Write the Sabine's formula and list out the most effective variable to control the reverberation time. | 06 |
| | B | **Answer the following**<br>i. Discuss the ball milling method for the synthesis of nano material.<br>ii. Describe the inverse piezoelectric method. | 14 |
| 5<br>CLO1<br>BL4 | A | **Answer the following:**<br>i. Explain the role of nanomaterials in current technical advancements.<br>ii. State the important components of circular accelerator. | 06 |
| | B | **Answer the following:**<br>i. Analyze the behavior of fermi level in n-type and p-type semiconductor.<br>ii. Discuss the working of force sensors based on fiber. | 14 |
| 6<br>CLO2<br>BL3 | | **Answer the following:**<br>i. Determine the momentum and energy of an electron combined in a box of length 20Å for the first and third excited state.<br>ii. The two sound intensity levels, as recorded at a place are 80 dB and 75 dB respectively. Calculate the resultant sound intensity at the same point due to the combined effect. | 10 |

# Nirma University

## Institute of Technology

Semester End Examination (IR/RPR), December - 2023

Bachelor of Science (Computer Science and Engineering), Semester-I

B. Tech. in All Programmes, Semester-I/II

Int. B. Tech. (CSE) - MBA, Semester-I

1SP201 Physics

Roll/
Exam No.

Supervisor's initial
with date

Time : 3 Hours

Max. Marks: 100

Instructions :

1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | |
|---|---|---|---|
| 1 CO2 | A | **Answer the following:** | 6 |
| | i. | Enlist the characteristics and applications of LASER. | |
| | ii. | The core of refractive index of an optical fiber is 1.5 and that of cladding is of 1.4. Calculate acceptance angle of the fiber. | |
| | B | **Answer the following:** | 14 |
| | i. | Explain construction and working of semiconductor laser in detail with necessary diagrams. | |
| | ii. | Discuss laser ablation technique for the synthesis of nanomaterials with necessary diagrams. | |
| 2 CO3 | A | **Answer the following:** | 06 |
| | i. | What are nanostructures? Give their classification based on quantum confinement. | |
| | ii. | What do you mean by pumping in lasing actions? Give its importance. | |
| | B | **Answer the following:** | 14 |
| | i. | Elaborate construction and working of transmission electron microscope. | |
| | ii. | Describe the working and construction of force sensor. | |
| 3 CO3 | | **Perform the numerical:** | 10 |
| | i. | Consider a collision between an x-ray photon of initial energy 50.0 keV and an electron at rest. The photon is scattered backward and the electron is knocked forward. Find the energy of the backscattered photon and the kinetic energy of the recoiled electron. | |
| | ii. | The normal temperature of an optical source is 1000 K. Show that, in the visible optical region, the emission is predominantly due to spontaneous emission. | |

## Section – II

| | | | |
|---|---|---|---|
| 4 CO2 | A | **Answer the following:** | 06 |
| | i. | The change in the intensity level (loudness) of 1 dB alters the intensity by 26%. Justify the statement | |
| | ii. | What is forbidden energy bandgap? Compare and contrast direct and indirect bandgap semiconductors. | |
| | B | **Answer the following:** | 14 |
| | i. | Explain acoustic grating method for the determination of velocity of ultrasound. | |
| | ii. | Describe the construction and working of a detector for the detection of nuclear radiations. | |
| 5 CO3 | A | **Answer the following:** | 06 |
| | i. | What do you mean by threshold of audibility? | |
| | ii. | What is the de Broglie wavelength of neutron accelerated by a potential difference of 20 kV? | |
| | B | **Answer the following:** | 14 |
| | i. | What do you mean steady state of quantum system? Derive Schrodinger's time independent wave equation. | |
| | ii. | Explain Pirani Gauge to measure the low pressure. | |
| 6 CO3 | | **Answer the following:** | 10 |
| | i. | The sound from a noisy fan gives a noise level of 55 dB at a point 3 meters away from it. What is the noise level at this point when another fan with 50 dB installed at the same distance away? | |
| | ii. | For PZT crystal of length 4 cm, calculate the fundamental frequency of vibration in piezoelectric oscillator. The Young's modulus of PZT is 100 GPa and density is 3300 $kg/m^3$. | |

# Nirma University

## Institute of Technology

Semester End Examination (IR/RPR), June - 2023

B. Tech. in CL / CH / ME / EE, Semester-II

B. Tech. in EI / EC / CSE, Semester-I

Int. B. Tech. (CSE) - MBA, Semester-II

1SP201 Physics

Roll/ Exam No. | Supervisor's initial with date

Time : 3 Hours | Max. Marks: 100

Instructions :
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

**Section – I**

| | | | |
|---|---|---|---|
| **1 CO2** | **A** | **Answer the following:** | **6** |
| | i. | What would be the photon energy for an electromagnetic wave with a wavelength equal to the Compton wavelength of an electron? | |
| | ii. | The core of refractive index of an optical fiber is 1.6 and that of cladding is of 1.5. What should be the maximum angle that the light rays can make with the axis of core of the optical fiber so that light is totally reflected inside the optical fiber? | |
| | **B** | **Answer the following:** | **14** |
| | i. | Discuss laser ablation for the synthesis of nanomaterials with necessary diagrams. | |
| | ii. | Explain construction and working of Ruby laser in detail with necessary diagrams. Give its limitations. | |
| **2 CO3** | **A** | **Answer the following:** | **06** |
| | i. | What is the meaning of quantum confinement? Enlist the parameters responsible for it. | |
| | ii. | Differentiate between step index and graded index optical fibers. | |
| | **B** | **Answer the following:** | **14** |
| | i. | Give the construction and working of an instrument to check the surface morphology of a material. | |
| | ii. | Describe optical fiber communication link with necessary block diagram. Give its advantages over traditional metallic coaxial cable system. | |
| **3 CO3** | | **Perform the numerical:** | **10** |
| | i. | If the energy levels E1 and E2 are separated by an energy $\Delta E$ such that the corresponding transition frequency falls in the middle of the visible range, calculate the ratio of the populations of the two levels in thermal equilibrium at room temperature. | |

ii. Find the probabilities of finding the particle trapped in a box of length L in the region from 0.45L to 0.55L for the ground state and the first excited state with wave function $\psi = A \sin {}^{n\pi x}/_{L}$.

## Section – II

| | | | |
|---|---|---|---|
| 4 CO2 | A | **Answer the following:** | 06 |
| | i. | The sound intensity in a street during heavy traffic is $10^{-8}$ W/m$^2$. What will be the corresponding loudness level in dB? | |
| | ii. | What are the various units of pressure utilized in vacuum technology? Give correlation amongst them. | |
| | B | **Answer the following:** | 14 |
| | i. | Explain magnetostriction method for the production of ultrasound. Give the applications and properties of ultrasound. | |
| | ii. | What are the Fermi velocity and Fermi energy? Write the expression for the distribution function for the Fermionic system. Label each term in the expression. Demonstrate that the probability of Fermionic energy levels in conductors is zero if $E>E_F$ and unity if $E< E_F$ at T= 0 K. | |
| 5 CO3 | A | **Answer the following:** | 06 |
| | i. | What are acoustical waves? Enlist the three characteristics of musical sound. | |
| | ii. | Differentiate between the direct and indirect bandgap semiconductors. | |
| | B | **Answer the following:** | 14 |
| | i. | Discuss the rotary pump in detail with necessary diagrams and give its advantages. | |
| | ii. | In a laboratory of nuclear weapons, a newly recruited technician wants to determine radioactivity by a gamma ray source. Which detector he should use? Provide him a step-by-step guidance and describe the construction and working of detector. Inform him about its limitations. | |
| 6 CO3 | | **Answer the following: (any Two)** | 10 |
| | i. | In the musical event there are three sets of speakers each generating 75 dB sound. If the third set of speakers is switched off then what would be the resultant sound intensity? | |
| | ii. | Calculate the frequency to which piezoelectric oscillator circuit should be tuned so that a piezoelectric crystal of thickness 1 mm vibrates in its fundamental mode to generate ultrasonic waves. [Young's modulus and density of material of crystal are 80 GPa and 2654 kg/m$^3$]. | |