

## U.G. 6th Semester Examination-2024

**PHYSICS****[HONOURS]**

Discipline Specific Elective (DSE)

Course Code : PHY-H-DSE-T-03

(Nanomaterials and Applications)

Full Marks : 40

Time : 2½ Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any **five** questions: 2×5=10
- i) What is the range of dimension of nanoparticles?
  - ii) What is a quantum dot laser?
  - iii) What do you mean by quasi particles? Give examples.
  - iv) Define specific surface area.
  - v) What do you mean by Van der Wall forces?
  - vi) Define grain boundary of a nano particle.
  - vii) Explain the advantages of nanosensing.

*[Turn Over]*

viii) The golden colour of gold particle is lost in nano dimension –explain.

2. Answer any **two** questions:  $5 \times 2 = 10$

i) Explain in detail why band gap of nano materials increases with the size reduction. 5

ii) Why are the direct band gap materials preferred over indirect band gap materials for optoelectronic device application? 5

iii) Compare the two approaches (top-down and bottom-up) for the synthesis of nanoparticles. 5

iv) What are topological defects? Discuss its effects on two dimensional systems. 2+3

3. Answer any **two** questions:  $10 \times 2 = 20$

i) What is the difference between electrical band gap and optical band gap? In which ways exciton is different from phonon? Show that DOS of 1D system is proportional to  $1/(\sqrt{E})$ , where E is the energy of the system. 3+2+5

ii) What is the basic difference between electrical and thermal conduction? Discuss briefly the electrical transport property of two dimensional nanomaterials and its derivatives.

2+8

- iii) Briefly explain the meaning of quantum confinement. How can you tune the band gap of two dimensional nanomaterials? How band gap is related with electron transmission for a two probe system? How electron transmission occurs in a nanosystem? 2+2+4+2
- iv) a) In which ways optical switches are advantageous compared to electrical switch? 3
- b) What are the reasons of surface defects in nanofilms? Discuss its effect on electronic conduction. 4
- c) What do you understand by photo luminescence? State its use. 3

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**U.G. 6th Semester Examination-2024**

**PHYSICS**

**[HONOURS]**

**Discipline Specific Elective (DSE)**

**Course Code : PHY-H-DSE-T-03**

**(Medical Physics)**

Full Marks : 40

Time :  $2\frac{1}{2}$  Hours

*The figures in the right-hand margin indicate marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**GROUP-A**

1. Answer any **five** questions:  $2 \times 5 = 10$ 
  - i) Give three applications of X-rays.
  - ii) Define Gray and how it is related to rad?
  - iii) Mention major components of the cardiovascular system.
  - iv) State inverse square law related to radiation.
  - v) List various non-ionizing electromagnetic radiation.
  - vi) Differentiate artificial and natural radioactivity.

*[Turn Over]*

vii) What is an effective dose?

viii) What is thermography?

### GROUP-B

Answer any **two** questions:  $5 \times 2 = 10$

2. Write a short note on Bremsstrahlung and rotating anode X-ray tube. 5
3.
  - i) What is Computed tomography (CT) scanner?
  - ii) How does it work? 2+3
4. Write down the principle and function of the scintillation counter. 2+3
5.
  - i) What is a pocket dosimeter and why is it used?
  - ii) What are the biological effects of radiation? Give example. (2+1)+2

### GROUP-C

Answer any **two** questions:  $10 \times 2 = 20$

6.
  - i) What are the effects of electromagnetic waves on human body?
  - ii) What is meant by exposure and absorbed dose? 5+5
7.
  - i) Illustrate with a neat diagram the construction and working of the Scintillation Counter.
  - ii) How does the TLD badge work? (3+4)+3

8. i) What is NMR?  
ii) How does MRI work?  
iii) Give briefly the properties of Ultra-sound. 3+5+2
9. i) Discuss briefly Therapeutic nuclear medicine.  
ii) Write some types of nuclear medicine.  
iii) What is a Telecobalt machine? How is Co-60 used in cancer treatment? 3+2+(3+2)
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## U.G. 6th Semester Examination-2024

**PHYSICS****[HONOURS]**

Discipline Specific Elective (DSE)

Course Code : PHY-H-DSE-T-03

(Digital Signal Processing)

Full Marks : 40

Time :  $2\frac{1}{2}$  Hours*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.***GROUP-A**

1. Answer any **five** questions:  $2 \times 5 = 10$
- a) What are the advantages and disadvantages of DSP?
  - b) Give the combined conditions for causality and stability of any DTLTI systems in Z domain.
  - c) What do you mean by band decomposition?
  - d) Explain the term "whitening filter".
  - e) Give the steps for checking time invariance with a suitable example.
  - f) State Parseval's Theorem.

*[Turn Over]*

- g) State transposition theorem.
- h) State any two properties of DTFT.

**GROUP-B**

2. Answer any **two** questions:  $5 \times 2 = 10$
- a) State the desirable properties required to convert an analog filter to a digital IIR filter give methods for the same. 5
  - b) State and prove any two properties of Z transform. 2+3
  - c) Derive the expression for convolution sum. 5
  - d) Give the steps for obtaining tabular and functional convolution sum with suitable examples. 5

**GROUP-C**

3. Answer any **two** questions:  $10 \times 2 = 20$
- a) Discuss the following by giving suitable mathematical expressions: Group Delay, Linear Phase System, Maximum Phase System. 3+4+3
  - b) What is the design specifications needed for designing a high pass FIR filter design using Kaiser Window? Explain Design procedure briefly. 5+5



c) What is the effect of round off noise in digital filters? Analyze the direct form of IIR structure. 5+5

d) Check whether the given systems are linear, shift variant, causal and stable :

i)  $y[n] = x[4n+1]$

ii)  $y[n] = x[n]u[n]$  5+5