63/1 (SEM–4) PHY SE 4022/ 4032/4042 (SEC 2)

2022

PHYSICS

Paper : SEC–2 (A/B/C)

Full Marks : 50

Time : 2 hours

The figures in the margin indicate full marks for the questions

OPTION—1

Paper : SEC–2A

(Computational Physics Skill)

1. Choose the correct answer : 1×5=5

(a) An algorithm represented in the form of programming language is

(i) flowchart

(ii) pseudo code

(iii) program

(iv) None of the above

(b) Which command is used to remove files in Linux?

(i) rm

(ii) dm

(iii) erase

(iv) delete

(c) FORTRAN is the first widely-used high-level language developed in

(i) 1956

(ii) 1955

(iii) 1957

(iv) 1958

(d) Choose the invalid FORTRAN statement.

(i) IF (N.LT.O) Y = 2.3

(ii) DO 10 J = 1.13

(iii) IF (D) 11, 22, 33

(iv) WRITE (*, *) "123 = X"

(e) Which is correct syntax for LaTeX table?

(i) \begin {tables}

(ii) \start {tabular}

(iii) \open {table}

(iv) \begin {tabular}

2. Answer the following questions : 2×5=10

(a) What is the difference between algorithm and flowchart?

(b) How to rename a file in Linux?

(c) What are data types in FORTRAN?

(d) Why is it necessary to declare the return type of a user defined function in FORTRAN?

(e) Write a LaTeX code to write the following set of equations :

(i) $\vec{\nabla} \times \vec{E} = -\frac{d\vec{B}}{dt}$

(ii) $E^2 = P^2C^2 + m_0^2c^4$

3. Answer any *five* of the following questions : 5×5=25

(a) Draw a flowchart to read all elements of an array of real numbers of size 5×5.

(b) What is nested DO loop? Write the rules of nested DO loop giving valid examples.

(c) Explain the syntax of 'goto' statement in FORTRAN and describe its merits and drawbacks.

(d) Explain with example how one can insert figure and table of contents using LaTeX.

(e) Write the LaTeX code for including lists in a document with an example. Write the output of the following LaTeX code :

```
$m = m_0^sqrt {1-\frac{v^2}{c^2}} $\\
$n = n_{0} e^ {-\lambda t} $
```

(f) Explain how gnuplot input file is created and used for plotting.

(g) Describe the use of multiplot statement in gnuplot with examples.

4. Answer any *one* of the following questions : 10

(a) Draw the flowchart for finding the roots of quadratic equation. Write the FORTRAN program for the same.

(b) How can you plot three-dimensional graph in gnuplot with title of the graph and title of axis? Describe how a legend may be enabled in gnuplot. What is the use of 'load' statement in gnuplot?

OPTION—2

Paper : SEC–2B

(Applied Optics Skill)

1. Choose the correct answer : 1×5=5

(a) The full form of LASER is

(i) Light Amplification by Stimulated Emission of Radiation

(ii) Light Absorption by Stimulated Emission of Radiation

(iii) Light Absorbing Solar Energy Resource

(iv) Light Absorption by Spontaneous Emission of Radiation

(b) Optical fibre works on the principle of

(i) reflection

(ii) refraction

(iii) total internal reflection

(iv) interference

(c) Which person/persons was/were the first to develop the flexible fibre scope?

(i) Leith and Maiman

(ii) Gabor

(iii) Snitzer

(iv) Hopkins and Kapany

(d) The ratio of Einstein's A, B coefficients, i.e., A_{21}/B_{21} is proportional to

(i) ν

(ii) ν^2

(iii) ν^3

(iv) ν^4

(e) The father of halography is

(i) Dennis Gabor

(ii) Sir Isaac Newton

(iii) Michael Faraday

(iv) Stephen A. Benton

2. Answer the following questions : 2×5=10

(a) What are spontaneous and stimulated emission processes?

(b) Mention one application each of LED and photodiode.

(c) Write two basic characteristics of optical fibre.

(d) What is holography?

(e) Calculate the numerical aperture and hence the acceptance angle for an optical fibre. Given that the refractive indices of core and cladding are 1·45 and 1·40 respectively.

3. Answer any *five* of the following questions : 5×5=25

(a) What are Einstein's coefficients? Deduce the relation among them.

(b) What is optical pumping? Discuss various schemes of pumping.

(c) Derive an expression for numerical aperture of an optical fibre.

(d) Write a short note on LED.

(e) Write a short note on forensic science.

(f) What is an optical fibre? Describe different types of optical fibre with diagrams.

(g) Explain the mathematical treatment of holography.

4. Answer any *one* of the following questions : 10

(a) Describe the construction and working principle of Ruby laser. 5+5=10

(b) Describe the recording and reconstruction process of a holography. 5+5=10

OPTION—3

Paper : SEC–2C

(Renewable Energy and Energy Harvesting Skill)

1. Choose the correct answer : 1×5=5

(a) Which is the example of non-renewable energy resource?

(i) Solar cell

(ii) Wind energy

(iii) Geothermal energy

(iv) Natural gas

(b) The first windmill is constructed for generating power in the year

(i) 1886

(ii) 1887

(iii) 1888

(iv) 1889

(c) Photovoltaic cells convert ____ into electricity.

(i) water

(ii) wind

(iii) sunlight

(iv) None of the above

(d) Who invented the first solar power?

(i) Edmond Becquerel

(ii) Charles Brush

(iii) Jerry Whitfield

(iv) William Armstrong

(e) The difference between the temperature of the core and that of the surface of planet is termed as

(i) geothermal constant

(ii) geothermal coefficient

(iii) geothermal gradient

(iv) geothermal factor

2. Answer the following questions : 2×5=10

(a) What do you mean by non-conventional energy resources? Give example. 1+1=2

(b) Write in brief about tidal energy.

(c) Write the fundamentals about wind energy. What is a windmill? 1+1=2

(d) What is the environmental impact of big hydel power project?

(e) What is piezoelectric effect?

3. Answer any *five* of the following questions : 5×5=25

(a) How will you define solar energy and its importance? What is a solar pond? Give its application. 1+2+2=5

(b) Describe what are the environmental issues regarding excessive uses of non-renewable energy resources. How can it be overcome? Give your comments regarding the sustainability of non-renewable energy resources. 2+1+2=5

(c) Explain 'ocean energy potential' against wind and solar energy. Write briefly about wave energy devices. 3+2=5

(d) Write a short note on modeling of piezoelectric generator. Give example of piezoelectric energy harvesting. 3+2=5

(e) What is the need of photovoltaic systems? What are its characteristics? Draw the equivalent circuits of PV (photovoltaic) systems. 1+2+2=5

(f) What do you mean by ocean thermal energy and ocean bio-mass? 2½+2½=5

(g) What is hydropower resouce? Explain hydropower technologies. 1+4=5

(Continued)

4. Answer any *one* of the following questions : 10

(a) Explain nuclear energy. What are its limitations? What do you mean by nuclear holocoust? Give one case study regarding nuclear holocoust. 4+2+2+2=10

(b) Write short notes on the following topics : 2½×4=10

(i) Solar cell

(ii) Solar cooker

(iii) Wind turbines

(iv) Wave energy devices

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