2019/EVEN/08/21/
PHY–204 (B/C)/064

PG Even Semester (CBCS) Exam., May—2019

PHYSICS

(2nd Semester)

Course No. : PHYCC–204

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

Candidates are to answer *either* OPTION—B *or* OPTION—C

OPTION—B

Course No. : PHYCC–204(B)

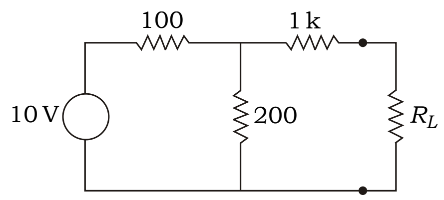
(INSTRUMENTATION)

Answer **five** questions, selecting **one** from each Unit

UNIT—I

1. *(a)* State and prove Norton's theorem. 9

(b) What is the Norton's equivalent of the network shown below? 5



2. *(a)* What are the static characteristics of a measurement system? Explain them briefly. 6

(b) Write short notes on any *two* of the following : 4×2=8

(i) Dynamic characteristics

(ii) Curve fitting

(iii) Errors of measurement

UNIT—II

3. *(a)* What are transducers? Classify them according to the electrical principles involved. 2+7=9

(b) What are the points to be considered for the selection of a transducer? Explain why the outputs of transducers are mostly in electrical form. 3+2=5

4. *(a)* Describe how a strain gage is used to convert a mechanical displacement into a change in resistance. Is it active or passive transducer? Explain. 7+2=9

(b) Explain how a thermocouple is used as a transducer to measure temperature of a source. 5

UNIT—III

5. *(a)* What are electromechanical indicating instruments? Describe how they are used to measure DC current and DC voltages. 4+4=8

(b) Describe with diagram, the working of an ohmmeter. 6

6. *(a)* Discuss the working of a CRO. 8

(b) Write short notes on any *two* of the following : 3×2=6

(i) Loading effect

(ii) Potentiometer

(iii) Bridges

UNIT—IV

7. Describe the working of a photo-luminescence spectrometer. Explain with proper diagram, how it differs from UV-visible spectrophotometer. 7+7=14

8. *(a)* Describe the working of FTIR. What is the advantage of FTIR over normal IR spectrometer? What is the interferogram of green monochromatic light? 4+2+1=7

(b) Write short notes on any *two* of the following : 3½×2=7

(i) XRD

(ii) SEM

(iii) TEM

UNIT—V

9. *(a)* What are different types of pump? Explain. 4

(b) Describe the working of a rotary pump. Explain the use of rotary pump in refrigerators. 7+3=10

10. *(a)* Describe how Pirani gage is used in the measurement of pressure in vacuum system. 6

(b) Write short notes on any *two* of the following : 4×2=8

(i) Cryopumps

(ii) Leak detection

(iii) Penning gage

OPTION—C

Course No. : PHYCC–204(C)

(NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING)

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Explain different types of errors, one's encounter in numerical computing. 10

(b) State and explain triangular inequality as applied to error propagation. 4

2. *(a)* State and discuss the main steps involved in numerical computing. 6

(b) What is convergence? How is it important in numerical computing? 2+3=5

(c) What is a flowchart? How is it useful for a programmer? 1+2=3

UNIT—II

3. *(a)* What are subprograms? How are they used in program development? 6

(b) List FORTRAN statements that are used to implement conditional execution statements. Explain with examples, how they are different in terms of implementation. 6

(c) Using library functions, construct FORTRAN statements for the following : 2

(i) $A = \sqrt{s(s-a)(s-b)(s-c)}$

(ii) $Z = \sin\left|\dfrac{x+y}{x-y}\right|$

4. *(a)* Write a FORTRAN program to calculate and print the following mean, variance and standard deviation of a set of N numbers : 5

$$\text{Mean} = \frac{1}{N}\sum_{i=1}^{N} x_i$$

$$\text{Variance} = \frac{1}{N}\sum_{i=1}^{N} x_i^2 - \frac{1}{N^2}\left(\sum_{i=1}^{N} x_i\right)^2$$

$$\text{Standard deviation} = \sqrt{\text{variance}}$$

(b) Write a FORTRAN program to evaluate the following function to 0·0001 percent accuracy : 5

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots$$

(c) Write a FORTRAN program to find all prime numbers less than 100. 4

UNIT—III

5. *(a)* Derive the secant formula. How is it different from the false position formula? 4+2=6

(b) Apply Newton-Raphson method to find the roots of the following equation : 4

$$e^{x} \quad x \quad 0$$

(c) The polynomial equation

$$p(x) \quad x^3 \quad 7x^2 \quad 15x \quad 9 \quad 0$$

has a root at $x \quad 3$. Find the quotient polynomial $q(x)$ such that

$$p(x) \quad (x \quad 3)\,q(x)$$ 4

6. *(a)* Find any one root of the following equation using bisection method : 7

$$\sin x \quad 2x \quad 1 \quad 0$$

(b) Write FORTRAN code by which the above Q. No. **6***(a)* be realized. 7

UNIT—IV

7. *(a)* Find the inverse of the following matrix using Gauss-Jordan elimination technique : 7

$$\begin{array}{ccc} 2 & 3 & 4 \\ 4 & 2 & 3 \\ 3 & 4 & 2 \end{array}$$

(b) Using Gauss elimination method with partial pivoting, solve the following sets of equations : 7

$$\begin{array}{llll} x_1 & x_2 & 2x_3 & 3 \\ 4x_1 & 2x_2 & x_3 & 5 \\ 3x_1 & x_2 & 3x_3 & 8 \end{array}$$

8. *(a)* Find the third-order Newton's interpolating polynomial to estimate cos 1 15, which agrees with the following data : 7

x	1·0	1·1	1·2	1·3
$\cos x$	0·5403	0·4536	0·3624	0·2675

(b) Write FORTRAN code for the above Q. No. **8***(a)*. 7

UNIT—V

9. *(a)* Applying both trapezoidal method and Simpson's $\frac{1}{3}$rd rule for $n \quad 4$ to compute the following integral : 5+5=10

$$_{1}^{2}\frac{e^{x}}{x}\,dx$$

(b) Write FORTRAN code to realize the above Q. No. **9***(a)* (only for Simpson's method). 4

10. *(a)* Using fourth-order Runge-Kutta method, estimate $y(0\ \ 5)$ of the following equation with $h\ \ \ 0\ 25$: 7

$$\frac{dy}{dx}\quad x\quad y \qquad\qquad y(0)\quad 1$$

(b) Write FORTRAN code for the above Q. No. **10***(a)*. 7

★ ★ ★