

PG Even Semester (CBCS) Exam., May—2017

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—A
or OPTION—B or OPTION—C

OPTION—A

Course No. : PHYCC-204A

(OUR ATMOSPHERE)

Answer **one** question from each Unit

UNIT—I

1. (a) Describe the structure and composition of earth's atmosphere. 6

- (b) Determine the apparent molecular weight of Venusian atmosphere assuming that it consists of 95% of CO₂ and 5% of N₂ by volume. 3

- (c) Define virtual temperature. Explain its physical significance. Show that

$$T_v = \frac{T}{1 - \frac{e}{p}(1 - \epsilon)}$$

where the symbols used have their usual meanings. 1+1+3=5

2. (a) Explain why—
- (i) the gas constant of moist air is greater than that of dry air;
 - (ii) frost point temperature is higher than dew point temperature;
 - (iii) when lifted, dry air parcel cools more rapidly than moist air. 2×3=6
- (b) Under what condition, the hypsometric equation predicts an exponential decrease of pressure with height? 3
- (c) Derive a relationship for the height of a given pressure surface (p) in terms of pressure p_0 and temperature T_0 at sea level assuming that the temperature decreases uniformly with height at a rate $TK \text{ km}^{-1}$. 5

(3)

UNIT—II

3. (a) Define mesoscale in meteorology. What are its subscales? Mention one atmospheric process of each of these subscales. What are the dynamical distinctions between a mesoscale and a synoptic scale? $1+1\frac{1}{2}+1\frac{1}{2}+5=9$
- (b) What are the different forms of precipitation? Explain in brief. 5
4. (a) Describe the physical processes behind cyclonic, convective and orographic precipitations. 6
- (b) Describe two commonly used rain-reading gauges. 4
- (c) Define Rossby number. What is its physical significance? $2+2=4$

UNIT—III

5. (a) Discuss Koppen classification of world climatic zones. 10
- (b) What is the effect of Indian Ocean dipole on Indian monsoon? 4
6. (a) What are the types of climate classification? Give the salient features of one system of each type. $1+8=9$
- (b) Describe the spatial and temporal pattern of temperature over India. 5

(4)

UNIT—IV

7. What is meant by 'air masses'? How are they identified? How do they influence weather of a region? Name five common types of air masses with their meteorological symbols. Draw a schematic diagram locating these air masses in Northern and Southern hemispheres. $1+1+2+5+5=14$
8. (a) What is 'lake effect'? 4
- (b) What are frontal systems? Discuss the weather conditions between the passage of warm and cold fronts. $4+6=10$

UNIT—V

9. What is 'climate'? What is the difference between climate variability and climate change? Give a brief account of four observational evidences in favour of global climate change. What are the effects of climate change on human health? $2+2+6+4=14$
10. Discuss the causes and effect of global warming. Discuss the effect of global warming on Indian climate. $10+4=14$

(5)

OPTION—B

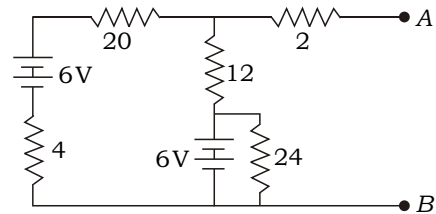
Course No. : PHYCC-204B

(INSTRUMENTATION)

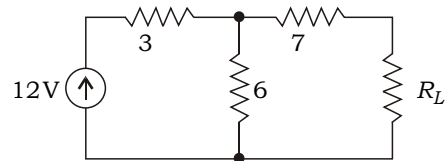
Answer **one** question from each Unit

UNIT—I

1. State and prove Thevenin's network theorem. Obtain Thevenin's equivalent circuit for the network shown in the figure below : 8+6=14



2. State and prove Norton's network theorem. Convert the following linear network into Thevenin's equivalent network and then into Norton's equivalent network, and show that the power delivered to the load R_L in both the cases is same : 14



(6)

UNIT—II

3. What are the differences between electrical and mechanical transducers? What are the basic requirements of a transducer? Discuss the classification of electrical transducers and their advantages. 2+5+3+4=14
4. Discuss the principle and working of a piezoelectric pressure transducer. Discuss the advantages and limitations of it. 5+5+4=14

UNIT—III

5. Briefly discuss the principle of a potentiometer and its applications in a measurement system. Explain the theory of a strain gauge balancing circuit. 4+10=14
6. Discuss the working principle of a CRO. Explain the function of a sweep generator. 10+4=14

UNIT—IV

7. What is a monochromator? Explain the working of a UV-Vis spectrometer. 2+12=14
8. What are secondary electrons? Discuss the working and applications of a TEM. 2+12=14

(7)

UNIT—V

9. Discuss the working principle of a rotary pump. Mention four specific applications of this pump in instrumentation. 10+4=14
10. How can partial pressure measurement be performed by different types of gauges? Write briefly on leak detection techniques. 7+7=14

OPTION—C

Course No. : PHYCC-204C

(NUMERICAL ANALYSIS AND
COMPUTER PROGRAMMING)

Answer **one** question from each Unit

UNIT—I

1. (a) Distinguish between accuracy and precision. 2
- (b) How are accuracy and precision related to significant digits? 4

(8)

- (c) How do mathematical models contribute to errors in numerical computing? 4
- (d) Distinguish between round-off errors and truncation errors. 4
2. (a) Distinguish between absolute errors and relative errors. 4
- (b) Discuss how error propagate with addition, subtraction, multiplication and division of two numbers. 8
- (c) Estimate the relative error in $z = x - y$, when $x = 0.1234 \times 10^4$ and $y = 0.1232 \times 10^4$ as stored in a system with four-digit mantissa. 2

UNIT—II

3. (a) Distinguish between stop and end statements. 3
- (b) Describe the three basic control structures used in executing the solution steps. 6
- (c) Write a FORTRAN program to arrange an array in ascending order. 5

4. (a) Write a subprogram in FORTRAN (both function subprogram and subroutine subprogram) to evaluate the factorial of a number which is given by

$$n! = n(n-1)(n-2) \dots 1$$

Using this subprogram, write a main program to calculate the binomial coefficient

$$b = \frac{n!}{(n-r)! r!}$$

This gives the number of combinations of n objects taking r at a time. $5+5=10$

- (b) Write a program in FORTRAN to calculate mean, variance and standard deviation of a set of N numbers, where the data are stored in a file named 'DATA.DAT' and the result is to be written in a file named 'RESULT.TXT'. 4

UNIT—III

5. (a) Using fixed point iteration method, find both the roots of the following equation : $3^{1/2} + 3^{1/2} = 7$

$$e^x - x - 2 = 0$$

- (b) Write FORTRAN code to find both the roots of the above equation using fixed point iteration method. $3^{1/2} + 3^{1/2} = 7$

6. (a) What is synthetic division? How is it used to obtain the multiple roots of a polynomial? $2+3=5$

- (b) The polynomial equation

$$p(x) = x^3 - 7x^2 + 15x - 9 = 0$$

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

$$p(x) = (x-3)q(x) \quad 5$$

- (c) Write a FORTRAN code to implement the above result i.e., finding the coefficient of $q(x)$. 4

UNIT—IV

7. (a) Solve the following system of equations by simple Gauss elimination method : 7

$$2x_1 + 3x_2 + 4x_3 = 5$$

$$3x_1 + 4x_2 + 5x_3 = 6$$

$$4x_1 + 5x_2 + 6x_3 = 7$$

- (b) Write a FORTRAN code to obtain the above result. 7

8. (a) Fit a straight line to the following set of data : 7

x	1	2	3	4	5
y	3	4	5	6	8

- (b) Write a FORTRAN code to implement the above result. 7

UNIT—V

9. (a) Use Simpson's method with $n = 4$ (no. of segments) to estimate

$$\int_0^1 \frac{dx}{1+x^2}$$

correct to five decimal places. 7

- (b) Write a FORTRAN code to implement the above result. 7

10. (a) Using fourth-order Runge-Kutta method, estimate $y(0.5)$ of the following equation with $h = 0.25$: 7

$$\frac{dy}{dx} = x + y, \quad y(0) = 1$$

- (b) Write a FORTRAN code to implement the above result. 7
