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2019/TDC/ODD/SEM/
PHSHCC-301T/072

TDC (CBCS) Odd Semester Exam., 2019

PHYSICS

(3rd Semester)

Course No. : PHSHCC-301T

(Mathematical Physics-II)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* questions : 2×2=4

(a) What do you mean by odd function and even function?

(b) Write down Dirichet's conditions for a Fourier series.

(c) Discuss the uses of Fourier series in Physics.

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2. Answer *(a)* or *(b)* :

(a) After writing down the orthogonality relations for sine and cosine functions find expressions for Fourier coefficients. 2+4=6

(b) *(i)* Sketch a graph from $x = -4\pi$ to 4π for the following function : 2

$f(x) = x, 0 < x \leq 2\pi$ and $f(x+2\pi) = f(x)$

(ii) Find Fourier series for the above function. 4

UNIT—II

3. Answer any *two* questions : 2×2=4

(a) Explain the terms ordinary and singular points in the context of ODE.

(b) What do you mean by regular and irregular singular points?

(c) What do you mean by indicial equation obtained during power series solution of ODE around regular singularity?

4. Answer *(a)* or *(b)* :

(a) *(i)* Write down Legendre's differential equation and check the nature of $x = 0$. 2

(ii) Hence obtain power series solution of it. 4

(b) Discuss Frobenius method of solving a differential equation. 6

UNIT—III

5. Answer any *two* questions : 2×2=4

(a) Discuss the use of Legendre polynomials in physics.

(b) Write down the generating function of Bessel function. Hence find inversion property $J_n(-x) = (-1)^n J_n(x)$.

(c) Prove, using generating function, that a Legendre's polynomial is either an odd function or an even function.

6. Answer *(a)* or *(b)* :

(a) Prove orthogonal property of legendre's polynomial. 6

(b) Prove the following recurrence properties : 3+3=6

(i) $np_n(x) = xp'_{n+1}(x) - p'_{n-1}$

(ii) $np_n(x) = (2n-1)x\, p_{n-1}(x) - (n-1)p_{n-1}(x)$

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UNIT—IV

7. Evaluate any *two* of the following using properties of gamma function/beta function/ Dirac delta function. 2×2=4

(i) $\int_0^\infty e^{-x} x^{5/2} dx$

(ii) $\int_0^{\pi/2} \sin^4 \theta \, d\theta$

(iii) Find $\Gamma\left(\frac{1}{2}\right)$

8. Answer *(a)* or *(b)* :

(a) *(i)* Prove that

$$\beta(m, n) = \beta(n, m)$$ 2

(ii) Prove that

$$\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$$

4

(b) *(i)* Prove that $\delta(x) = \delta(-x)$ 2

(ii) Explain how Dirac delta function can be represented as limit of a Gaussian function. 4

UNIT—V

9. Answer any *two* of the following questions : 2×2=4

(a) Define partial differential equation and its order.

(b) Write down Laplace's equation in spherical polar coordinates.

(c) Write down two applications of PDE in physics.

10. Answer *(a)* or *(b)* :

(a) Solve the following equation using method of variable separation : 6

$$\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$$

where

$v = 0$ for $y = 0$ and $y = a$, and

$v = v_0$ for $x = -b$ and $x = b$

(b) Write down the wave equation for vibrational modes of a stretched string. Hence solve it. 1+5=6

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2019/TDC/ODD/SEM/
PHSHCC-302T/073

TDC (CBCS) Odd Semester Exam., 2019

PHYSICS

(3rd Semester)

Course No. : PHSHCC-302T

(Thermal Physics)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **all** questions

UNIT—I

1. Answer any *two* of the following questions : 2×2=4

(a) State the Zeroth law of thermodynamics.

(b) Explain why gases have two specific heats while solids have only one.

(c) What are reversible and irreversible processes?

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2. Answer *either* [*(a)* and *(b)*] *or* [*(c)* and *(d)*] :

(a) State the first law of thermodynamics. Explain how first law of thermodynamics leads to the concept of internal energy. 1+2=3

(b) Show that, for one mole of an ideal gas $C_p - C_v = R$. (Symbols have their usual meanings) 3

(c) Write the second law of thermodynamics as stated by Kelvin-Planck and Clausius and discuss their equivalence. 3

(d) State and prove Carnot's theorem. 3

UNIT—II

3. Answer any *two* of the following questions : 2×2=4

(a) State the concept of entropy.

(b) Give the second law of thermodynamics in terms of entropy.

(c) Narrate the third law of thermodynamics.

4. Answer *either* [*(a)* and *(b)*] *or* [*(c)* and *(d)*] :

(a) Show that the entropy of a perfect gas remains constant in a reversible process. 3

(b) Discuss in brief the entropy of the universe. 3

(c) State and explain the temperature-entropy diagram for Carnot's cycle. 3

(d) Define the following : 3

(i) Enthalpy

(ii) Helmholtz free energy

(iii) Gibb's free energy

UNIT—III

5. Answer any *two* of the following questions : 2×2=4

(a) What do you mean by Joule-Kelvin coefficient for ideal gas?

(b) Discuss in brief the change of temperature during adiabatic process.

(c) Define phase transition. What is first order phase transition?

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6. Answer *either* [*(a)* and *(b)*] *or* [*(c)* and *(d)*] :

(a) Deduce Maxwell's first thermodynamic relations using the laws of thermodynamics. 3

(b) From the consideration of Maxwell's thermodynamic relations, show that $C_p - C_v = R$ (here the symbols have their usual meanings). 3

(c) Derive the Clausius-Clapeyron equation. 3

(d) Explain how the boiling point of a liquid and melting point of a solid are affected with the change of pressure. 3

UNIT—IV

7. Answer any *two* of the following questions : 2×2=4

(a) What do you mean by RMS and most probable speeds of an ideal gas?

(b) State the law of equipartition of energy.

(c) Define specific heats of gases.

8. Answer *either* [*(a)* and *(b)*] *or* [*(c)* and *(d)*] :

(a) Using Maxwell-Boltzman distribution law of velocities find an expression for the mean speed in an ideal gas. 3

(b) What do you mean by Doppler broadening of spectral lines? 3

(c) Related to the transport phenomenon in ideal gases, give a brief concept of the following : 3

(i) Viscosity

(ii) Thermal conductivity

(iii) Diffusion

(d) Discuss in brief the Brownian motion and its significance. 3

UNIT—V

9. Answer any *two* of the following questions : 2×2=4

(a) What do you mean by Boyle temperature?

(b) State the law of corresponding states.

(c) What is temperature of inversion?

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10. Answer *either (a) or (b)* :

(a) Discuss Andrew's experiment on CO_2 gas. 6

(b) What are critical constants of a real gas? Find the expressions for each of them. 6

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2019/TDC/ODD/SEM/
PHSHCC-303T/074

TDC (CBCS) Odd Semester Exam., 2019

PHYSICS

(3rd Semester)

Course No. : PHSHCC-303T

(Digital Systems and Applications)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* of the following : 2×2=4

(a) How the intensity of electron beam and the intensity of image are controlled in a CRO?

(b) Find 2's component of 1101001.

(c) Determine the decimal number represented by the binary number 101101·10101.

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2. Answer *either (a) or (b)* :

(a) Draw the block diagram of a CRO. How can the phase difference between two AC signals of same frequency and amplitude be measured using a CRO? 2+4=6

(b) Explain the operation of a NOT gate with the help of a transistor. Write down the truth table of an XOR gate. 4+2=6

UNIT—II

3. Answer any *two* of the following : 2×2=4

(a) State De Morgan's theorem.

(b) Show that

$$A \cdot (B + \overline{B}C) = A \cdot (B + C)$$

(c) What is the use of a multiplexer circuit?

4. Answer *either (a) or (b)* :

(a) Design a circuit to realize the function

$$Y = (A + BC)\,(B + \overline{C}A)$$

(i) using NAND gate only

(ii) using NOR gate only

(Complementary form of the literal can be taken as inputs.) 3+3=6

(b) Minimize the following four-variable logic function using K-map : 6

$$\int(A, B, C, D) = \sum m(0, 1, 2, 3, 5, 7, 8, 9, 11, 14)$$

UNIT—III

5. Answer any *two* of the following : 2×2=4

(a) Find 48–23 using 2's complement method. You can use 8-bit representation of numbers.

(b) What do you mean by toggling in a *J-K* flip-flop?

(c) Draw the block diagram of IC555.

6. Answer *either (a) or (b)* :

(a) Explain how 555 timer can be used as an astable multivibrator. Realize a full-adder with NAND gate. 4+2=6

(b) What is an adder? Explain full-adder operation with logic gates giving the truth table. 1+5=6

UNIT—IV

7. Answer any *two* of the following : 2×2=4

(a) Name one input and one output device of a computer.

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(b) What do you mean by a 'counter'?

(c) What is a 'cache memory'?

8. Answer *either (a) or (b)* :

(a) Explain the operation of mod-3 counter using block diagram, truth table and waveform chart. 6

(b) Write a short note on ROM. 6

UNIT—V

9. Answer any *two* of the following : 2×2=4

(a) Give an example each of 1-byte and 2-byte instructions.

(b) Define 'bus'.

(c) What is the difference between MOV and MVI instructions of a an 8085 microprocessor?

10. Answer *either (a) or (b)* :

(a) Draw the architecture of μP8085 and mention its various blocks. List the various registers of 8085. 4+2=6

(b) Write down the program to add two sixteen-bit numbers. Draw the corresponding flow chart. 4+2=6

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