

**PHYSICS**  
**PHSHCC-101L**  
**MATHEMATICAL PHYSICS-I**  
**Total Mark 30**

Q.1. Answer one of the following questions (selected by lottery) by writing flowchart, code and output. Attach screenshot (s) of the code and output. (Marks = 10)

- a) Find sum & average of the list {1,-9,2,0,3,8,-4,6,-7,5}
- b) Find largest of the given list below of numbers and its location it's position  
{1,-9, 2, 0, 13, 28, -49, 6, -7, 5}
- c) Find maximum, minimum, and range of the following numbers  
{1,-90, 24, 0, 3, 87,-4,63,-7,95}
- d) Find solution of quadratic equation  $3x^2 + 4x + 1 = 0$
- e) Find values of sine for angles  $13^\circ$ ,  $45^\circ$  and  $75^\circ$  using their series expansion.
- f) Find values of cosine for angles  $11^\circ$ ,  $34^\circ$  and  $73^\circ$ , using their series expansion.
- g) Find exponential function using their series expansion for the values 3, 5, 9.

Q.2. Answer one of the following questions (selected by lottery) by using Bisection method. Write down flowchart, code and output and attach screenshot (s) of the code and output. (Marks = 10)

- a)  $x^2 + 5x - 6 = 0$
- b)  $x - \tan(x) = 0$

Q.3. Answer two of the following questions selected by lottery. (Marks = 10)

- a) Write short note on do loop used in programming languages like Fortran.
- b) Write briefly, with examples, a note on if statement used in programming languages like Fortran.
- c) Write a note on Fortran variables and their Types.
- d) What do you mean by a programming language? Explain the types of programming languages briefly.
- e) Write a note on flowchart. What are symbols used in a flowchart?

**Sets**

- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| Set I :: 1(a), 2(a), 3(a) and 3(b),  | Set II :: 1(c), 2(b), 3(c) and 3(b)   |
| Set III :: 1(d), 2(a), 3(c) and 3(d) | Set IV :: 1(e), 2(b), 3(d) and 3(e)   |
| Set V :: 1(f), 2(a), 3(a) and 3(e)   | Set VI :: 1(a), 2(b), 3(a) and 3(b)   |
| Set VII :: 1(c), 2(a), 3(c) and 3(b) | Set VIII :: 1(d), 2(b), 3(c) and 3(d) |
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**PHYSICS**  
**1<sup>st</sup> SEMESTER**  
**C-102-**  
**MECHANICS LAB**

**Instructions**

1. *Make a single pdf file from your answer scripts*
2. *The pdf file name should contain only paper code and roll number (For example if the paper code is PSHCC102L and Roll No is 1234567 the pdf file name will be PSHCC102L\_123457.pdf)*
3. *You have to answer 1 set from the following.*

**Marks Distribution**

Category	Marks
Apparatus	2
Theory & working	14
Tables	2
Precautions & Discussions	2
Questions	10
Total	30

**SET 1**

1. To determine the diameter of a wire using vernier calliper, screw gauge and travelling microscope and hence find its cross section.
2. Questions (3+3+4)
  - (i) What are positive and negative zero error in vernier callipers?
  - (ii) Calculate the Least Count of a travelling microscope.
  - (iii) If there is 1 mm marks on the main scale of a vernier calliper and 20 equal divisions on the Vernier scale matches with 16 main scale divisions. For this Vernier callipers, calculate its least count.

**SET II**

1. To determine the MI of unknown body by suitable method.
2. Questions (1+4+3+2)
  - (i) What is the difference between centre of mass and centre of gravity?
  - (ii) State and prove the law of conservation of angular momentum.
  - (iii) Define moment of Inertia. What is its SI unit and dimensional formula?
  - (iv) Define parallel axes and perpendicular axis theorem.

### SET III

1. To determine the value of  $g$  using Bar pendulum.
2. Questions (2+2+3+3)
  - (i) What is a periodic motion? Give examples.
  - (ii) What is simple harmonic motion?
  - (iii) What is the difference between simple pendulum and compound pendulum?
  - (iv) Obtain the expression for variation of  $g$  with depth of a planet.

### SET IV

1. To determine the diameter of a wire using vernier calliper, screw gauge and travelling microscope and hence find its cross section.
2. Questions (2+3+1+4)
  - (i) What are positive and negative zero error in vernier callipers?
  - (ii) Define pitch of a screw gauge. How can least count of screw gauge be calculated?
  - (iii) What is advantage of screw gauge over vernier calliper?
  - (iv) Calculate the least count of vernier calliper and travelling microscope.

### SET V

1. To determine the value of  $g$  using Bar pendulum.
2. Questions (3+2+2+3)
  - (i) "All periodic motions are not simple harmonic but all simple harmonic motions are periodic". Justify this statement.
  - (ii) Give some examples of compound pendulum.
  - (iii) Out of simple pendulum, bar pendulum and Kater's pendulum, which one gives the most accurate value of  $g$  and why?
  - (iv) Define the length of a pendulum. Illustrate with diagrams on length of pendulum for both simple pendulum and compound pendulum.

### SET VI

1. To determine the MI of unknown body by suitable method.
2. Questions (2+3+5)
  - (i) Explain the significance of moment of inertia.
  - (ii) Obtain the expression of radius of gyration for a rigid body. What is its SI unit?
  - (iii) Define torque and angular momentum. Derive the relation between them.

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**Assignment**  
**3<sup>rd</sup> SEMESTER**  
**PHSHCC-301L**  
**MATHEMATICAL PHYSICS-II**  
*Full Marks = 30      Pass Mark = 12*

**Instructions:**

- i. Assignment should be in own hand writing of the student.
- ii. Students should write roll number and registration number in each page of the assignment. Student will submit the soft copy (Scanned) of the answer script in a single pdf file.
- iii. Answer any three set of questions.

**Questions**

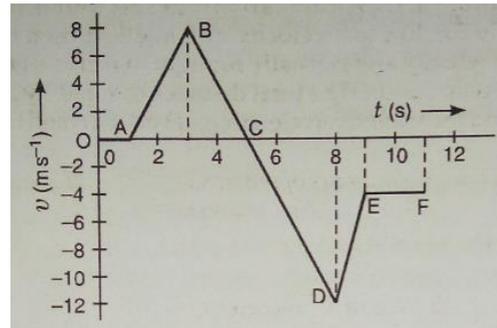
**Set 1:**

- i. Draw the velocity time graph for a particle in uniform motion. 2
- ii. Show that displacement of an object in the time interval  $(t' - t)$  is numerically equal to the area under the velocity-time graph between the instants  $t$  and  $t'$  respectively. 8

**Set 2:**

Adjacent Fig. shows velocity-time graph for the motion of an object.

- i. Compute the acceleration for each phase of the motion.
- ii. Describe how the object moves during the last time segment. 8+2



**Set 3:**

- i. What do you mean by eigen value of a matrix? Explain. 2
- ii. Write the characteristic equations of the matrix  $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$  and hence find its eigen values. 8

**Set 4:**

- i. When does inverse of any matrix exist? 2
- ii. If a matrix  $A$  satisfies a relation  $A^2 + A - I = 0$ , prove that  $A^{-1}$  exists and  $A^{-1} = I + A$ , where  $I$  is identity matrix. 8

**Set 5:**

- i. What do you mean by Force constant of a helical spring? Explain.
- ii. Find the force constant of a helical spring for the following data set

**2**  
**8**

Observations	1	2	3	4
Weight(gram)	0	100	200	300
Reading on the scale	5.5	10.4	15.6	20.5

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**TDC (CBCS) Odd Semester Examination:2021**

**PHYSICS**

**(3<sup>rd</sup> Semester)**

**Course No.:PHSHCC-302-LAB**

PHYSICS-C-302-LAB

(Thermal Physics Lab)

**Full Marks: 30**

(Answer **any one set** of Questions from the following):

**Questions:**

**Set 1:**

**1. Determine Mechanical Equivalent of Heat, J, by Joule's/Callender and Barne's constant flow method.**

- Define mechanical equivalent of heat and state its SI Unit.
- What precautions would you take so that the current in your circuit may remain fairly steady?
- Can you measure specific heat of liquid by this method?
- Instead of DC if you send AC in the circuit, then what will happen?
- What is the law of production of heat here?
- What type of voltmeter is suitable for this experiment?

**Set 2:**

**2. Determine the coefficient of thermal conductivity of 'cu' by Searle's Apparatus or any other suitable method.**

- Define thermal conductivity. How does it differ from thermoelectric conductivity?
- What are the unit and dimension of thermal conductivity 'K'?
- Does the value of 'K' depend on the dimension of the rod?
- Is the method suitable for a bad conducting substance?
- What do you mean by 'steady state'? What is 'variable state'?
- Why constant-level water tank is necessary for this experiment?

**Set 3:**

**3. Determine the coefficient of linear expansion by Optical Lever method or any other suitable method.**

- Define coefficient of linear expansion. Does its value depend on unit of length and scale of temperature.
- Is the experiment for one degree centigrade rise of temperature the same at all parts of the scale of temperature?
- Why do you call it an Optical Lever?
- What precautions would you take in focusing the microscope?
- Will the coefficient of linear expansion depend on the length of the rod?
- Will value of expansion coefficient change if you use a different temperature range?

**Set 4:**

**4. Study the variation of Thermo e.m.f of thermocouple with difference of temperature.**

- a) What is the neutral temperature of a couple?
- b) What are the laws of: intermediate metals and intermediate temperatures?
- c) What is the relationship between the thermo e.m.f (E) and temperature(t)?
- d) State the practical applications of a thermocouple.
- e) Define pyro-electricity.
- f) What is an inversion temperature?
- g) Why do you use the potentiometer and not a voltmeter to measure thermo e.m.f?

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**PHYSICS-C-303-**  
**DIGITAL SYSTEMS AND APPLICATIONS LAB**

**Instructions**

1. *Make a single pdf file from your answer scripts*
2. *The pdf file name should contain only paper code and roll number (For example if the paper code is PSHCC303L and Roll No is 1234567 the pdf file name will be PSHCC303L\_123457.pdf)*
3. *You have to answer 1 set from the following.*

**Marks Distribution**

Category	Marks
Apparatus	2
Theory & working	14
Tables	2
Precautions & Discussions	2
Questions	10
Total	30

**SET 1**

1. To verify the truth tables of AND, OR, NOT, NOR and NAND Gates.
2. Questions (3+3+4)
  - (i) What is the difference between analog electronics and digital electronics? Explain with examples.
  - (ii) Convert  $(467.21)_{10}$  into binary no. Show the calculation steps.
  - (iii) Draw the circuit diagram and truth table for NAND gate functioning as OR gate.

**SET II**

1. To design and verify the De Morgan's theorem using breadboard.
2. Questions (3+3+4)
  - (i) Draw the logic diagram of NAND gate, NOR gate and OR gate.
  - (ii) Explain the Demorganisation process.
  - (iii) Write the different types of Boolean expressions. What are Min Term and Max Term?

**SET III**

1. To design and verify Half Adder and Full Adder.
2. Questions (2+2+2+2+2)
  - (i) What are the total no. of inputs in half adder?
  - (ii) If P and Q are the inputs of a half adder, then what will be its carry?
  - (iii) If X and Y are the inputs of a half adder, then what will be its SUM?
  - (iv) What are the limitations of half added?
  - (v) What logic circuit can be used to perform a 2-bit addition and why?

**SET IV**

1. To verify the truth tables of AND, OR, NOT, NOR and NAND Gates
2. Questions (5+4+1)
  - (i) Which gate is considered as universal gate? Explain with logic diagrams.
  - (ii) What is a combinational circuit? Explain with examples.
  - (iii) What is an inverter in relation to logic gates?

**SET V**

1. To design an astable multivibrator of given specifications using 555 Timer.
2. Questions (3+1+6)
  - (i) Define duty cycle and frequency cycle.
  - (ii) Define a multivibrator.
  - (iii) What are astable, monostable and bistable multivibrators?

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**Assignment**  
**PHSHCC-501L**  
**QUANTUM MECHANICS AND APPLICATIONS**

*Full Marks = 30      Pass Mark = 12*

**Instructions:**

- i. *Assignment should be in own hand writing of the student.*
- ii. *Students should write roll number and registration number in each page of the assignment. Student will submit the soft copy (Scanned) of the answer script in a single pdf file.*
- iii. *Answer any three set of questions.*

**Questions**

**Set 1:**

- iii. What is Zeeman effect? 2
- iv. Explain Normal and anomalous effect in detail. 8

**Set 2:**

- iii. What are the physical significance of wave function? 2
- iv. Obtain the expressions of momentum and kinetic energy operator in terms of  $x, y$  and  $z$ . 8

**Set 3:**

- iii. Can we measure kinetic and potential energies of a particle simultaneously with arbitrary precision? Justify. 2
- iv. Prove the relation  $[\hat{x}, \hat{p}_x^n] = i\hbar n \hat{p}_x^{n-1}$ . 8

**Set 4:**

- iii. Show that momentum of a free particle  $[\hat{H}, \hat{p}_x] = 0$  2
- iv. Prove the relation  $[\hat{x}, [\hat{x}, \hat{H}]] = -\frac{\hbar^2}{m}$ , where  $\hat{H}$  is the Hamiltonian operator. 8

**Set 5:**

- i. What is a tunnel diode? How is it different from normal junction diode? 2
- ii. Explain the tunneling effect of a tunnel diode in detail. Also draw and explain the I-V characteristics of a tunnel diode. 8



**TDC (CBCS) Odd Semester Examination: 2021**

**PHYSICS**

**(5<sup>TH</sup> SEMESTER)**

**Course No.:PHSHCC-502 LAB**

PHYSICS-C-502-LAB

(SOLID STATE PHYSICS)

**Full Marks: 30**

(Answer **any one set** of Questions from the following):

**Questions:**

**Set 1:**

**1 .Measure Dielectric Constant of a Dielectric material by suitable method.**

- a) What do you understand by a dielectric and the dielectric constant of a material?
- b) Distinguish between non-polar and polar molecules. Give examples.
- c) Explain electric polarization of matter on the basis of dielectric.
- d) What is the value of the capacity of a parallel plate capacitor with dielectric between the plates partly glass and partly air?
- e) The plates of a parallel plate capacitors are 2cm apart. A slab of dielectric constant 5 and thickness 1cm is introduced between the plates with its faces parallel to them. The distance between the plates is so changed that the capacitance remains unchanged. Find the new distance between the plates.

**Set 2:**

**2. Determine the Hall coefficient of a semiconductor sample.**

- a) Define Hall effect. What information do you obtained from Hall effect experiment?
- b) Mention some important applications of Hall effect.
- c) What is Hall angle and mobility.
- d) Write down the expression for Hall coefficient. What is its unit in SI system? Why is the Hall coefficient positive for some metals?
- e) A current of 50A is established in a slab of copper 0.5cm thickness wide. The slab is placed in a magnetic field  $B=1.5T$ . The magnetic field is perpendicular to the plane of the slab and to the current. The free electron concentration in copper is  $8.48 \times 10^{28}$ electron/m<sup>3</sup>.what is the magnitude of Hall voltage across the width of the slab.

**Set 3:**

**3. Study the PE Hysteresis loop of a Ferro electric crystals.**

- a) Define the terms: retentivity, coercivity, hysteresis and hysteresis loop.
- b) What are the factors responsible for hysteresis loss?
- c) How would you use the hysteresis curves to select materials for the construction of: Permanent magnets, Electromagnets and Transformer cores?
- d) A material core has 10 turns per cm of wire wound uniformly upon it which carries a current of 2.0 ampere. The flux density in the material is  $1.0 \text{ web/m}^2$ . Calculate the magnetizing force  $H$  and the magnetization  $I$  of the material. What would be the relative permeability of the core?

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