Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FIRST/SECOND SEMESTER EXAMINATION JUNE-2025

(Common for CM/ME/CS/EC/EE Branches)

PH-1401 PHYSICS

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions.

1(a) Explain the Davisson-Germer experiment, focusing on the numerical justification for matter waves. ***08***

(b) Why is the Compton effect hard to observe with visible light? ***03***

(c) A proton is moving with a speed 2×10^{8} m/sec. Find the wavelength of matter wave associated with it ***03***

2(a) Explain the 'particle in a one-dimensional box' problem in detail, utilizing the time-independent Schrödinger equation. What are the main consequences of this problem? ***08***

(b) Explain the Schrödinger equations along with the concept of operators in quantum mechanics. ***03***

(c) Compute the energy of first energy level for an electron in a square well of width 3 Å. ***03***

3(a) Explain briefly diffraction at double slit and further explain missing order interference maximas in this case. ***08***

(b) What is meant by diffraction of light? Distinguish between Fresnel and Fraunhofer classes of diffraction. ***03***

(c) If a movable mirror of Michelson's interferometer is moved through a distance 0.06 mm, 200 fringes crossed the field of view. Find the wavelength of light. ***03***

4(a) Explain the fundamental principles behind a cyclotron's operation. What factors restrict its ability to accelerate particles to very high energies? ***08***

(b) Why must the length of successive cylinders be increased in a LINAC? ***03***

(c) A cyclotron with its dees of radius 2 m has a magnetic field of 0.75 wb/m^2. Calculate the maximum energy to which protons can be accelerated. ($m_p = 1.67\times10^{-27}$ kg) ***03***

5(a) Explain the construction and working of He-Ne laser with neat energy level diagram. ***08***

(b) Explain the following : ***06***

(i) Absorption (ii) Spontaneous emission (iii) Stimulated emission
(iv) Active medium (v) Pumping (vi) Characteristics of laser light.

P.T.O.

6(a) Explain the following : ***10***

(i) Propagation mechanisms of light waves in optical fiber
(ii) Acceptance angle and acceptance cone
(iii) Step index fiber and graded index fiber
(iv) Dispersion in fiber
(v) V-number

(b) Calculate the numerical aperture and acceptance angle of optical fiber of refractive indices for core and cladding as 1.62 and 1.52 respectively. ***04***

7(a) Explain the following (**any three**) : ***12***

(i) Ordinary and extra ordinary ray
(ii) Negative and positive crystals
(iii) Brewster's law of refraction
(iv) Double refraction
(v) Quarter wave plate and half wave plate

(b) The refractive index for water is 1.33, calculate the Brewster's angle. ***02***

8 Discuss **any two** of the following phenomena : ***2*7***

(i) Group and phase velocity and their relationship
(ii) Theory and principle of working of a synchrocyclotron
(iii) Einstein's Coefficient
(iv) Seven crystal systems.

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FIRST SEMESTER EXAMINATION JUNE-2025

(Branch : Computer Science & Engineering)

MA-1402 / MA-1302 MATHEMATICS - I

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) (i) Express the integral $\int_0^1 x^m (1-x^n)^p dx$ in terms of gamma function and henceevaluate $\int_0^1 x^{\frac{3}{2}} (1-x^{\frac{1}{2}})^{\frac{1}{2}} dx$. ***3½***

(ii) Prove that $\Gamma(n) = \int_0^\infty e^{-x^2} x^{2n-1}\, dx$ ***3½***

(b) (i) $\iint (x^2+y^2)\, dxdy$ over the region in the positive quadrant for which $x + y \leq 1$. ***3½***

(ii) Find the volume of the solid generated by revolving the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about x axis. ***3½***

2(a) (i) Verify the Rolle's theorem for $f(x) = x(x+3)e^{-x/2}$ in the interval (-3, 0). ***3½***

(ii) Expand sinx in powers of $(x - \pi/2)$. Hence find $\sin 91^o$. ***3½***

(b) (i) Evaluate $\lim_{x\to 0}(\frac{1}{x} - \frac{1}{e^x-1})$ ***3½***

(ii) Find the maxima and minima of the function $u = \sin x \sin y \sin(x+y)$. ***3½***

3(a) (i) Find the adjoint and inverse of matrix $A = \begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$ ***3½***

(ii) Find the inverse of A by Gauss-jordan method $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$ ***3½***

(b) (i) Sove by Cramer's rule $x + y + z = 11$, $2x - 6y - z = 0$, $3x + 4y + 2z = 0$ ***3½***

(ii) Determine b such that the system of homogeneous equations ***3½***

$2x + y + 2z = 0$, $x + y + 3z = 0$, $4x + 3y + bz = 0$ has Trivial solution and non trivial solution. Find the non trivial solution.

4(a) (i) A non empty sub set W of a vector space V(F) is a subspace of V if and only if a, $b \in F$, $\alpha, \beta \in W \Rightarrow a\alpha + b\beta \in W$. ***3½***

(ii) Find whether the set of vectors $v_1 = (1,2,1)$ $v_2 = (3,1,5)$ $v_3 = (3,-4,7)$ is linearly independent or dependent ***3½***

(b) (i) Show that the function $T: V_2 \to V_2$ defined by $T(x,y) = (2x + 3y, 3x - 4y)$ is a linear mapping. ***3½***

(ii) Show that the following set is a basis of ***3½***

$V_4(R)$ S = { (1,0,0,0) (1,1,0,0) (1,1,1,0) (1,1,1,1)}

P.T.O.

5(a) Find the Eigen value and Eigen vector of A = $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ ***07***

(b) Show that the matrix A == $\begin{bmatrix} 3 & 2 & 4 \\ 2 & 0 & 2 \\ 4 & 2 & 3 \end{bmatrix}$ is diagonalizable. ***07***

6(a) Find the first four terms in the expansion of log(1 + tanx) by Maclaurians theorem. ***07***

(b) Reduce the following matrix to row-echelon form A == $\begin{bmatrix} 4 & 3 & 7 \\ 1 & 1 & 5 \\ 4 & 5 & 7 \end{bmatrix}$ ***07***

7(a) Show that the vectors (2, 1, 4), (1, -1, 2), (3, 1, -2) form a basis of R^3. ***07***

(b) Let W = $\{(a_1, a_2, a_3) : a_1, a_2, a_3 \in F$ and $a_1 + a_2 + a_3 = 0\}$. Show that W is a subspace of $V_3(F)$. ***07***

8(a) Find that for what value of A and B the equations ***07***

x + y + z = 6, x + 2y + 3z =10, x + 2y +Az = B have

(i) no solution (ii) a unique solution (iii) infinite many solutions.

(b) Find the rank of the matrices A, B, AB where ***07***

A = $\begin{bmatrix} 1 & 1 & -1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix}$, B = $\begin{bmatrix} -1 & -2 & -1 \\ 6 & 12 & 6 \\ 5 & 10 & 5 \end{bmatrix}$

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FIRST/SECOND SEMESTER EXAMINATION JUNE-2025

(for NEP-2020 CM/ME/CS/EC/EE & for AICTE all branches)

CE-1401 / CE-1301 BASIC CIVIL ENGG. & ENGG. MECHANICS

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Describe the engineering properties of stones. ***07***

(b) Describe any one test of each to assess quality of the following materials : ***07***

(i) Brick (ii) Cement

2(a) Differentiate between stones masonry and brick masonry. ***07***

(b) Describe various types of deep foundations. ***07***

3(a) Define the following : (i) Survey stations (ii) Survey lines (iii) Forward bearing (iv) Change point ***07***

(b) Describe uses and characteristics of Contours. ***07***

4(a) Describe any two of the following : ***07***

(i) Rise and fall method (ii) Theodolite and its use (iii) Plane table survey.

(b) The following successive readings were taken with a dumpy level along a chain line at common intervals of 20 m. The R. L. of first station was 120.50 m. The dumpy level was shifted after third, sixth and eighth reading. Calculate R. L. of each station and also find gradient of the line joining first and last station. The readings are : ***07***

0.945 m, 1.270 m, 1.890 m, 0.655 m, 1.355 m, 1.980 m,
0.730 m, 1.675 m, 0.985 m, 1.805 m, 2.150 m, 3.010 m.

5(a) Perpendicular offsets at 50 m intervals to a hedge are 10.6 m, 15.4 m, 20.0 m, 15.0 m, 16.0 m, 16.75, 20.4 m, 25.8 m, 30.5 m, 20.8 m & 17.0 m. Calculate the area between the chain line and hedge by : (i) Average ordinate rule (ii) Trapezoidal rule. ***07***

(b) Describe Remote sensing and its application. ***07***

6(a) Explain the term free body diagram. Draw the free body diagram of a ball of weight W placed on a horizontal surface. ***04***

(b) A ball of weight 120 N rests in a right angle groove. The sides of the grooves are inclined at an angle of 30° and 60° to the horizontal. If all surfaces are smooth, determine the reactions at points of contact. ***10***

7(a) Define the term moment of inertia and radius of gyration. ***04***

(b) Find the moment of inertia of the I section shown in ***fig.1*** about the centroidal axis. ***10***

P.T.O.

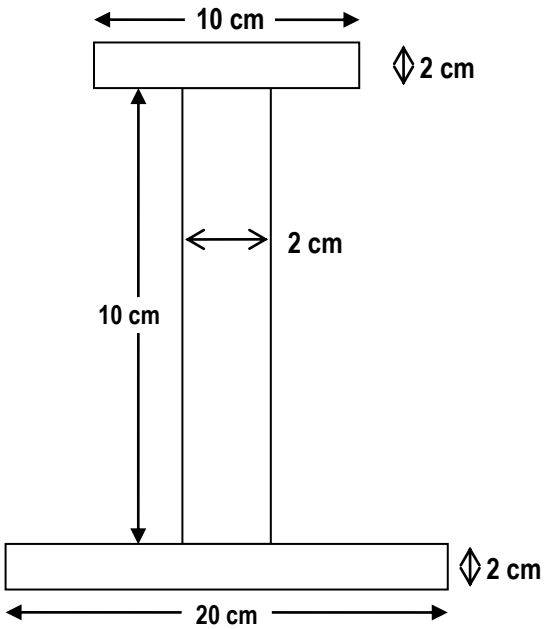

Fig.1

8(a) What are the different types of beams? ***04***

(b) Draw the SFD and BMD for simply supported beam loaded as shown in ***fig.2***. ***10***

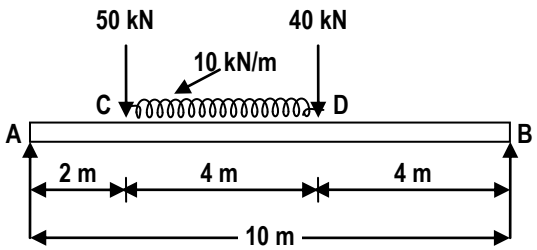

Fig.2

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FIRST/SECOND SEMESTER EXAMINATION JUNE-2025

(Common for All Branches)

CS-1401 C/C++ PROGRAMMING FOR PROBLEM SOLVING

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Write an algorithm, flowchart and C program to find the sum of numbers from 1 to 10. ***07***

(b) Explain string manipulation library functions with their syntax's. Write a program to check whether a string is palindrome or not. ***07***

2(a) Write a program in C using functions to swap two numbers using global variables concept and call by reference concept. ***07***

(b) What do you mean by nesting of classes? ***07***

3(a) What is an array? How a single dimension and two dimension arrays are declared and initialized? ***07***

(b) Differentiate between syntax errors and logical errors in the context of program compilation. ***07***

4(a) Write a C^{++} program that reads from the user an arithmetic operator and two operands, perform the corresponding arithmetic operation on the operands using switch statement. ***07***

(b) Give the scope and life time of the following : ***07***

(i) External variable (ii) Static variable
(iii) Automatic variable (iv) Register variable

5(a) What is function? Explain different classification of user defined functions based on parameter passing and return type with examples ***07***

(b) Explain OOP (Object Oriented Programming) paradigm and the features of OOP. ***07***

6(a) What do you mean by abstraction? Construct Data abstraction program in C^{++}. ***07***

(b) Briefly explain Dynamic Binding through virtual function with an example. ***07***

7(a) With example, explain friend function and friend class. ***07***

(b) Classify different forms of inheritance and clearly explain them. ***07***

8(a) Differentiate between operator overloading and operator overriding. ***07***

(b) What do you mean by Polymorphism? Explain with the help of example how polymorphism is achieved at : (i) Compile time (ii) Run time. ***07***

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FIRST/SECOND SEMESTER EXAMINATION JUNE-2025

(Common for All branches)

ME-1401 / ME-1302 BASIC MECHANICAL ENGINEERING

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Define the thermodynamic system. Differentiate between open system, closed system and an isolated system. ***07***

(b) A system undergoes a cycle comprising for process. The heat transfers in each process are: ***07***

Q_{ab} = 725 kJ; Q_{bc} = - 80 kJ; Q_{cd} = 35 kJ and Q_{da} = - 640 kJ

The respective work transfers are :

W_{ab} = - 95 kJ; W_{bc} = - 45 kJ and W_{cd} = 130 kJ

Determine the work interaction during the process d-a.

2(a) Explain the Kelvin-Plank and Clausius statement of the second law of thermodynamics. ***07***

(b) A reversible heat engine delivers 1.2 kW power and rejects heat energy to a reservoir at 300 K at the rate of 0.8 kW. Make calculations for the engine efficiency and temperature of the thermal reservoir. ***07***

3(a) What are the major differences between mountings and accessories? Give the examples of each. ***07***

(b) What is boiler draught? Compare forced and induction draught. ***07***

4(a) Explain construction and working of Locomotive boiler. ***07***

(b) Define : (i) Quality of steam (ii) Boiler efficiency (iii) Equivalent evaporation. ***07***

5(a) Explain the working of 4-stroke diesel engine with neat sketch. ***07***

(b) Explain Otto cycle with the help of p-v diagram. Derive an expression for air standard efficiency of Otto cycle. ***07***

6(a) Classify engineering materials and define the following mechanical properties of materials: ***07***

(i) Ductility (ii) Toughness (iii) Hardness and (iv) Malleability.

(b) Draw and explain the stress-strain diagram for a ductile material under tensile loading. ***07***

7(a) Explain briefly : (i) Pattern allowances (ii) Properties of moulding sand. ***07***

(b) Explain the function of a pattern in casting process. Explain with the help of sketcher different types of pattern. ***07***

8(a) Classify the various welding processes. ***07***

(b) Explain the principle of operation of gas welding. ***07***

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