# GROUP C

## MODEL QUESTION PAPER

# SEMESTER 1

# MODEL QUESTION PAPER

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

**FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH AND YEAR**

**Course Code: GYMAT101**

**Course Name: MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE - 1**

Max. Marks: 60 | Duration: 2 hours 30 minutes

## PART A

| | | *Answer all questions. Each question carries 3 marks* | CO | Marks |
|---|---|---|---|---|
| 1 | | Find the rank of the matrix $\begin{bmatrix} -1 & 0 & 6 \\ 3 & 6 & 1 \\ -5 & 1 & 3 \end{bmatrix}$ | CO1 | (3) |
| 2 | | If **2** is an Eigen value of the matrix $\begin{bmatrix} 2 & 1 & 0 \\ 0 & 1 & -1 \\ 0 & 2 & 4 \end{bmatrix}$ then find the other Eigen values without using its characteristic equation | CO1 | (3) |
| 3 | | Solve $y'' + y' - 6y = 0$ | CO2 | (3) |
| 4 | | Find the Wronskian corresponding to the solution of $y'' + 3y' + 2y = 0$ . | CO2 | (3) |
| 5 | | Find $L(sin^2 3t)$ | CO3 | (3) |
| 6 | | Find $L(e^{-2t} \cosh 4t)$ | CO3 | (3) |
| 7 | | Find the Taylor series for $f(x) = \frac{1}{x}$ about $x = -1$ | CO4 | (3) |
| 8 | | Find the Fourier coefficient $b_n$ for $f(x) = x \; in - \pi < x < \pi$ | CO4 | (3) |

## PART B

***Answer any one full question from each module. Each question carries 9 marks***

### Module 1

| | | | | |
|---|---|---|---|---|
| 9 | a) | Solve the system of equations $2x - y + z = 7, \;\; 3x + y - 5z = 13, \;\; x + y + z = 5$ | CO1 | (4) |
| | b) | Find the Eigen values and Eigen vectors of the following matrix $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$ | CO1 | (5) |
| 10 | a) | Find the values of $\lambda, \mu$ for which the system of equations $2x + 3y + 5z = 9, \quad 7x + 3y - 2z = 8, 2x + 3y + \lambda z = \mu$ has (i) no solution ((ii) infinite number of solutions (iii) unique solution | CO1 | (4) |

| | | | | |
|---|---|---|---|---|
| | b) | Diagonalise $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ | CO1 | (5) |
| | | **Module 2** | | |
| 11 | a) | Solve $y'' + y = secx$ by the method of variation of parameters. | CO2 | (5) |
| | b) | Solve $(D^2 - 16I)y = 3.2e^{4x} + 15e^{x}$ | CO2 | (4) |
| 12 | a) | Solve $(D^2 - 16)y = 15e^{x} + x^2$ | CO2 | (6) |
| | b) | Solve $y''' + y' = 0$ | CO2 | (3) |
| | | **Module 3** | | |
| 13 | a) | Solve by using Laplace transform, $y'' + 4y' + 3y = e^{-t}, y(0) = 1, y'(0) = 1$ | CO3 | (5) |
| | b) | Find $L^{-1}\left(\frac{3s+2}{(s-1)(s^2+1)}\right)$ | CO3 | (4) |
| 14 | a) | Using convolution theorem, find the inverse Laplace transform of $\frac{18s}{(s^2+36)^2}$ | CO3 | (5) |
| | b) | Find $L^{-1}\left(\frac{s+1}{s^2+s+1}\right)$ | CO3 | (4) |
| | | **Module 4** | | |
| 15 | a) | Find a Fourier series representation of $f(x) = \begin{cases} -x & ; \quad -1 < x < 0 \\ x & ; \quad 0 < x < 1 \end{cases}$. | CO4 | (5) |
| | b) | Find the Half range cosine series of the function $e^{-x}$, $0 < x < 1$ | CO4 | (4) |
| 16 | a) | Find a Fourier series representation of $f(x) = \begin{cases} -x & ; \quad -1 < x < 0 \\ x & ; \quad 0 < x < 1 \end{cases}$. | CO4 | (4) |
| | b) | Find a Fourier series representation of $f(x) = x^2, -\pi \le x \le \pi$ .Hence show that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots\ldots\ldots = \frac{\pi^2}{6}$ | CO4 | (5) |
| | | ***** | | |

# MODEL QUESTION PAPER

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

**FIRST/SECOND SEMESTER B. TECH DEGREE EXAMINATION, MONTH AND YEAR**

**Course Code: GZPHT121**

**Course Name: Physics for Physical Science and Life Science**

*(Common to C & D)*

Max. Marks: 60 | Duration: 2 hours 30 minutes

**PART A**

| | | *Answer all questions. Each question carries 3 marks* | CO | Marks |
|---|---|---|---|---|
| 1 | | Compare stimulated demission and spontaneous emission. | 1 | (3) |
| 2 | | With a block diagram briefly explain fiber optic communication system. | 1 | (3) |
| 3 | | Compare interference and diffraction of light. | 2 | (3) |
| 4 | | Define resolving power and dispersive power of a grating. | 2 | (3) |
| 5 | | What are the properties of wave function of a particle? | 3 | (3) |
| 6 | | What is Quantum Mechanical Tunnelling? Give two examples. | 3 | (3) |
| 7 | | Compare transverse and longitudinal waves. | 4 | (3) |
| 8 | | Compare echo and reverberation. | 4 | (3) |

**PART B**

***Answer any one full question from each module. Each question carries 9 marks***

**Module 1**

| | | | | |
|---|---|---|---|---|
| 9 | a) | Explain the construction and working of CO2 laser. | 1 | (6) |
| | b) | Write any six applications of laser. | 1 | (3) |
| 10 | a) | Derive the numerical aperture of optic fiber | 1 | (6) |
| | b) | Refractive index of core and cladding of a step index fiber are 1.485 and 1.475 respectively. Calculate its NA and acceptance angle. | 1 | (3) |

**Module 2**

| | | | | |
|---|---|---|---|---|
| 11 | a) | Derive Cosine law of interference in case of thin films. | 2 | (6) |
| | b) | In a Newton's rings arrangement, diameter of the $10^{th}$ and $15^{th}$ dark rings are 0.55cm and 0.64cm respectively. Find the radius of curvature of lens if the light used is of wavelength 632nm. | 2 | (3) |
| 12 | a) | Derive the grating equation. | 2 | (6) |
| | b) | For a grating with 5000lines/cm kept at normal incidence, find the angle of diffraction for light of wavelength 556nm in the second order. | 2 | (3) |

**Module 3**

| | | | | |
|---|---|---|---|---|
| 13 | a) | Derive time dependent Schrodinger equation | 3 | (5) |
| | b) | For an electron confined in one dimensional box of width $2A^0$, calculate the first three energy values. | 3 | (4) |
| 14 | a) | Derive of energy eigenvalues and normalized wave function for a particle confined in an infinite square well potential. | 3 | (6) |
| | b) | Calculate the wavelength of an electron accelerated through a potential 1000 volts. | 3 | (3) |
| **Module 4** | | | | |
| 15 | a) | Derive the frequency of fundamental mode of transverse vibrations in a stretched string. | 4 | (6) |
| | b) | The volume of a hall is 3000 $m^3$. It has a total absorption 100 $m^2$sabine. If the hall is filled with an audience who add another 50 $m^2$sabine, then find the difference in reverberation time. | 4 | (3) |
| 16 | a) | Explain the construction and working of Piezoelectric oscillator. | 4 | (3) |
| | b) | Explain the construction and working of Ultrasonic diffractometer, | 4 | (3) |
| | c) | What is Pulse echo method in NDT? | 4 | (3) |
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# MODEL QUESTION PAPER

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

**FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH AND YEAR**

**Course Code: GCCYT122**

**Course Name: Chemistry for Physical Science**

Max. Marks: 60 | Duration: 2 hours 30 minutes

**PART A**

| | | *Answer all questions. Each question carries 3 marks* | CO | Marks |
|---|---|---|---|---|
| 1 | | Explain the following i) Aniline point ii) Flash point? | 1 | (3) |
| 2 | | Give any three applications of carbon nanotubes. | 1 | (3) |
| 3 | | Represent the electrode reactions at different electrodes of a Li–ion cell during discharging. | 2 | (3) |
| 4 | | Calculate the emf of the following cell, $Zn(s)/Zn^{2+}(0.3M)//Ag^{+}(0.04\ M)/Ag(s)$ at 25ºC. Write the cell reaction. The $E^0$ cell is 1.56 V at 25ºC. | 2 | (3) |
| 5 | | Sketch the TGA and DTA profile of $CaC_2O_4.H_2O$. | 3 | (3) |
| 6 | | State Beer Lambert's Law. Write its differential form. | 3 | (3) |
| 7 | | Calculate the hardness of 0.05M $CaCl_2$ solution. | 4 | (3) |
| 8 | | Explain ozone layer depletion? | 4 | (3) |

**PART B**

***Answer any one full question from each module. Each question carries 9 marks***

**Module 1**

| | | | | |
|---|---|---|---|---|
| 9 | a) | Describe the various steps involved in the manufacture of Portland cement. | 1 | (5) |
| | b) | Explain the classification of conducting polymers? | 1 | (4) |
| 10 | a) | Explain the working of a Bomb calorimeter for determining the calorific value of a solid fuel with the help of a neat diagram. | 1 | (5) |
| | b) | Briefly outline the following properties of lubricants a) viscosity index b) flash and fire points. | 1 | (4) |

**Module 2**

| | | | | |
|---|---|---|---|---|
| 11 | a) | Explain the construction and working of $H_2$-$O_2$ fuel cells. List any two application?. | 2 | (5) |
| | b) | Explain the principle of electroless plating. Write the reactions involved in the eletroless plating of copper? | 2 | (4) |

| | | | | |
|---|---|---|---|---|
| 12 | a) | Explain the construction and working of a calomel electrode as a reference electrode? What is the variation in the potential of a calomel electrode with change in chloride ion concentration? | 2 | (5) |
| | b) | Explain the mechanism of electrochemical corrosion of iron in oxygen rich acidic environment | 2 | (4) |
| **Module 3** | | | | |
| 13 | a) | Explain the principle, instrumentation and application of GC. | 3 | (5) |
| | b) | Explain the various modes of vibrations possible in $H_2O$ molecule. Which of them are IR active? Give reasons. | 3 | (4) |
| 14 | a) | Briefly explain the principle and instrumentation of SEM | 3 | (5) |
| | b) | UV-Visible spectroscopy is also known as 'Electronic Spectroscopy'. Justify the comment. | 3 | (4) |
| **Module 4** | | | | |
| 15 | a) | Explain Trickling Filter process | 4 | (5) |
| | b) | Describe various disinfection methods | 4 | (4) |
| 16 | a) | Describe the methods for Solid waste disposal? | 4 | (5) |
| | b) | What are the various sources of air pollution and how can this be controlled? | 4 | (4) |
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# MODEL QUESTION PAPER

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**
**FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH AND YEAR**

**Course Code: GCEST103**

**Course Name: Engineering Mechanics**

Max. Marks: 60 | Duration: 2 hours 30 minutes

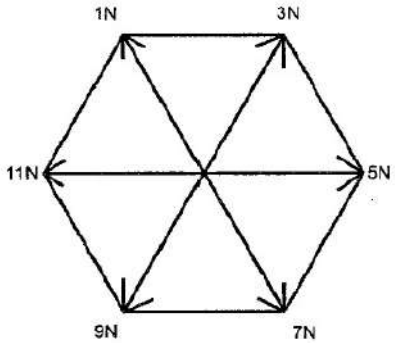
**PART A**

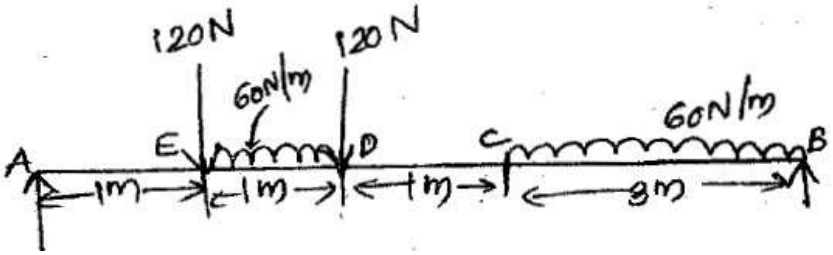
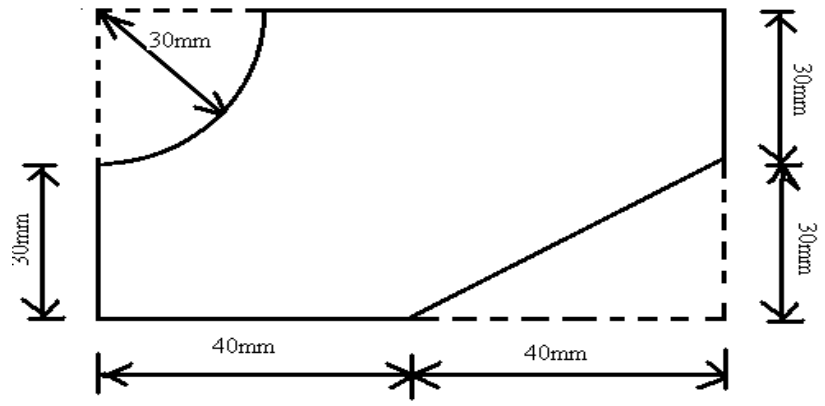
| | | *Answer all questions. Each question carries 3 marks* | CO | Marks |
|---|---|---|---|---|
| 1 | | A force of magnitude 60 N is applied at the origin of x-y-z axes and through the point A(1,1.5,2.25), Determine the components of force along x-y-z axes. | CO1 | (3) |
| 2 | | Explain free body diagram with an example. | CO2 | (3) |
| 3 | | Distinguish between angle of friction and angle of repose. | CO2 | (3) |
| 4 | | Define the terms moment of inertia and polar moment of inertia. | CO2 | (3) |
| 5 | | State and explain D'Alembert's principle. | CO5 | (3) |
| 6 | | The equations of motion of a particle moving in a straight line is given by $s = 20t+5t^2 -3t^3$ where s is in metres and t in seconds. Find the velocity and acceleration at the start. | CO5 | (3) |
| 7 | | Differentiate between curvilinear motion and projectile motion. | CO5 | (3) |
| 8 | | A body is projected at an angle such that its horizontal displacement is 3 times that of maximum height. Find the angle of projection. | CO5 | (3) |

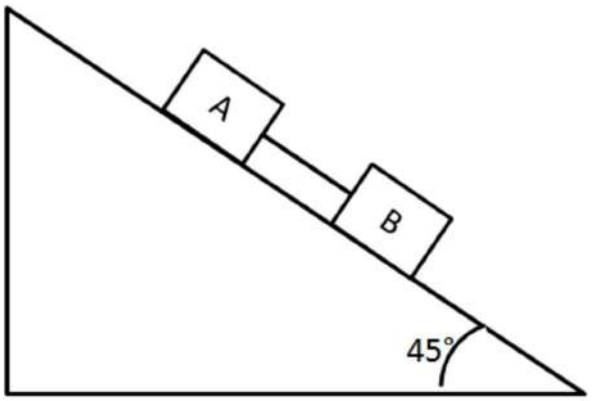
**PART B**

***Answer any one full question from each module. Each question carries 8 marks***

**Module 1**

| | | | | |
|---|---|---|---|---|
| 9 | a) | Concurrent forces 1, 3, 5, 7, 9 and 11 N are applied at the center of regular hexagon acting towards its vertices as shown in Figure 3 . Determine the magnitude and direction of the resultant.   | CO3 | (9) |

| | | | | |
|---|---|---|---|---|
| 10 | a) | Determine the reactions at the supports A and B of the beam loaded as shown in figure.<br>  | CO3 | (9) |
| | | **Module 2** | | |
| 11 | a) | A uniform ladder 4m length rest against a vertical wall with which it makes angle of 45°. The coefficient of friction between the ladder and wall is 0.4 that between the ladder and floor is 0.5. If a man whose weight is one half the weights of ladder ascents it, how high will be he when the ladder slips. | CO4 | (9) |
| 12 | a) | Calculate the centroid of the composite area shown in figure.<br>  | CO4 | (9) |
| | | **Module 3** | | |
| 13 | a) | An elevator weights 2500 N and is moving vertically downwards with constant acceleration. Write the equation for the elevator cable tension. Starting from rest it travels a distance of 35 metres during an interval of 10 seconds. Find the cable tension during this time. Neglect all other resistances to motion. What are the limits of cable? | CO5 | (9) |
| 14 | a) | Two masses MA = 20 kg and MB = 10 kg are connected by a bar of negligible mass. Find the acceleration of the system when it slides down an inclined plane of inclination 45° as shown in figure. Also find the force in | CO5 | (9) |

| | | | | |
|---|---|---|---|---|
| | | bar. Assume μA= 0.2 and μB=0.4.<br>  <br> | | |
| **Module 4** | | | | |
| 15 | a) | A car starts from rest on a curved road of radius 250 m and attains a speed of 18 km/hour at the end of 60 seconds while travelling with a uniform acceleration. Find the tangential and normal accelerations of the car 30 seconds after it started. | CO5 | (9) |
| 16 | a) | A flywheel rotates for 5s with a constant angular acceleration and describes during that time 100 rad. Then it rotates with constant angular velocity and angular acceleration. | CO5 | (9) |
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# MODEL QUESTION PAPER

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

**FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH AND YEAR**

**Course Code: GCEST104**

**Course Name: Introduction to Mechanical and Civil Engineering**

Max. Marks: 60 | Duration: 2 hours 30 minutes

**PART A**

| | | *Answer all questions. Each question carries 3 marks* | CO | Marks |
|---|---|---|---|---|
| 1 | | Draw the P-v and T-s diagram of Otto cycle and list out the processes involved. | 1 | (3) |
| 2 | | Define the following terms: a) COP b) Dew point temperature c) Specific humidity | 2 | (3) |
| 3 | | List out the different types of welding used. | 3 | (3) |
| 4 | | How turbines are classified and give examples. | 2 | (3) |
| 5 | | Define: a)Plinth area b)Carpet area c)Floor area ratio | | (3) |
| 6 | | Discuss the role of a civil engineer in the infra structural development of a country. | 4 | (3) |
| 7 | | List the characteristics of good stone that is used for the construction. | 6 | (3) |
| 8 | | What is weathering, and how does it contribute to the rock cycle? | 6 | (3) |

**PART B**

***Answer any one full question from each module. Each question carries 8 marks***

**Module 1**

| | | | | |
|---|---|---|---|---|
| 9 | a) | Derive the efficiency of Carnot's cycle. | 1 | (5) |
| | b) | A Carnot's engine between 500ºC and 95ºC. Find out the efficiency of the engine. Also calculate the work developed, if it takes 1200 kJ of heat from the high temperature reservoir. | 1 | (4) |
| 10 | a) | Explain the working of a 2-stroke diesel engine with neat diagram. | 2 | (9) |

**Module 2**

| | | | | |
|---|---|---|---|---|
| 11 | a) | With the help of neat diagram explain the working of a centrifugal pump | 2 | (6) |
| | b) | What do you mean by priming? Why is it required in a centrifugal pump? | 2 | (3) |
| 12 | a) | What are the steps involved in a sand-casting process. Explain in detail with neat sketch. | 3 | (9) |

**Module 3**

| | | | | |
|---|---|---|---|---|
| 13 | a) | List out the major disciplines of civil engineering and explain their role in the infrastructural framework. | 4 | (9) |
| 14 | a) | Mention the factors to be considered while selecting the site for a building. | 5 | (4) |
| | b) | Draw a neat sketch showing important parts of a residential building. | 5 | (5) |
| **Module 4** | | | | |
| 15 | a) | Elaborate the tests on bricks to identify its qualities. | 6 | (9) |
| 16 | a) | Explain the types of steel sections and steel reinforcement that are available. | 6 | (5) |
| | b) | Describe the process to check workability of concrete. | 6 | (4) |
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# MODEL QUESTION PAPER

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

**FIRST SEMESTER B. TECH DEGREE EXAMINATION, DECEMBER 2024**

**Course Code: UCEST105**

**Course Name: Algorithmic Thinking with Python**

Max. Marks: 60 | Duration: 2 hours 30 minutes

**PART A**

| | | *Answer all questions. Each question carries 3 marks* | CO | Marks |
|---|---|---|---|---|
| 1 | | How do you use a decomposition strategy to design a menu-driven calculator that supports four basic arithmetic operators - addition, subtraction, multiplication, and division? | 1 | (3) |
| 2 | | A mad scientist wishes to make a chain out of plutonium and lead pieces. There is a problem, however. If the scientist places two pieces of plutonium next to each other, BOOM! The question is, in how many ways can the scientist safely construct a chain of length ***n***? | 4 | (3) |
| 3 | | Write a **case** statement that will examine the value of ***flag*** and print one of the following messages, based on its value.<br><br>**Flag value** \| **Message**<br>1 \| Hot<br>2 \| Luke warm<br>3 \| Cold<br>Any other value \| Out of range | 3 | (3) |
| 4 | | Draw a flowchart to print the numbers that are divisible by 4 but not by 3 in a list of ***n*** positive numbers. | 3 | (3) |
| 5 | | Identify and rectify the problem with the following recursive definition to find the greatest common divisor of two positive integers.<br>**ABC ( n , m )**<br>if **n == 2** return **m**<br>else return **ABC(m , n mod m)** | 4 | (3) |
| 6 | | Write a recursive procedure to search for a ***key*** in a list of ***n*** integers. | 4 | (3) |
| 7 | | Compare and contrast greedy and dynamic programming strategies. | 3 | (3) |

| | | | | |
|---|---|---|---|---|
| 8 | | Give the pseudocode for brute force technique to find the mode of elements in an array. Mode is the value that appears most frequently in the array. | 3 | (3) |
| **PART B** | | | | |
| ***Answer any one full question from each module. Each question carries 9 marks*** | | | | |
| **Module 1** | | | | |
| 9 | | Walk through the six problem-solving steps to find the largest number out of three numbers. | 1 | (9) |
| 10 | a) | Your professor has given you an assignment on "Algorithmic thinking" to be submitted by this Wednesday. How do you employ means-end analysis to devise a strategy for completing your assignment before the deadline? | 2 | (5) |
| | b) | Name two current problems in your life that might be solved through a heuristic approach. Explain why each of these problems can be solved using heuristics. | 1 | (4) |
| **Module 2** | | | | |
| 11 | a) | Mr. Shyam, a history professor, would like to know the percentage increase in the population of our country per decade given the first decade and the last decade. Other given data include the population at the beginning of each decade. Draw a flowchart for determining the percentage increase in the population. | 3 | (6) |
| | b) | Draw a flowchart to find the average mileage of a car in kilometers per litre after six fill-ups at petrol pumps. Input data include the number of litres of diesel, the starting odometer reading, and the odometer reading at each fillup. | 3 | (3) |
| 12 | a) | A standard science experiment is to drop a ball and see how high it bounces. Once the "bounciness" of the ball has been determined, the ratio gives a bounciness index. For example, if a ball dropped from a height of 10 feet bounces 6 feet high, the index is 0.6, and the total distance traveled by the ball is 16 feet after one bounce. If the ball were to continue bouncing, the distance after two bounces would be 10 ft + 6 ft + 6 ft + 3.6 ft = 25.6 ft. Note that the distance traveled for each successive bounce is the distance to the floor plus 0.6 of that distance as the ball comes back up. Write an algorithm that lets the user enter the initial height of the ball, bounciness index and the number of times the ball is allowed to continue bouncing. Output should be the total distance traveled by the ball. | 3 | (6) |

<table>
<tr><td></td><td>b)</td><td>Light travels at $3 \times 10^8$ meters per second. A light-year is the distance a light beam travels in one year. Write an algorithm that inputs a large distance value (in meters) and displays it in light-years.</td><td>3</td><td>(3)</td></tr>
<tr><td colspan="5">Module 3</td></tr>
<tr><td rowspan="2">13</td><td>a)</td><td>Write a recursive function to find an array's minimum and maximum elements. Your method should return a tuple (a, b), where a is the minimum element and b is the maximum.</td><td>4</td><td>(5)</td></tr>
<tr><td>b)</td><td>Write a program to input a matrix and determine its type: lower triangular, upper triangular, or diagonal.</td><td>4</td><td>(4)</td></tr>
<tr><td rowspan="2">14</td><td>a)</td><td>Write a program to read N words and display them in the increasing order of their lengths. The length of each word is also to be displayed.</td><td>4</td><td>(6)</td></tr>
<tr><td>b)</td><td>There are 500 light bulbs (numbered 1 to 500) arranged in a row. Initially, they are all OFF. Starting with bulb 2, all even numbered bulbs are turned ON. Next, starting with bulb 3, and visiting every third bulb, it is turned ON if it is OFF, and it is turned OFF if it is ON. This procedure is repeated for every fourth bulb, then every fifth bulb, and so on up to the 500th bulb. Devise an algorithm to determine which bulbs glow at the end of the above exercise.</td><td>4</td><td>(3)</td></tr>
<tr><td colspan="5">Module 4</td></tr>
<tr><td>15</td><td>a)</td><td>Studies show that the capacity of an empty human stomach is 1.5 litres on average. Give a greedy algorithm to output an efficient lunch menu maximizing the total nutritional value. The available items along with their nutritional values are tabulated below:
<table>
<tr><th>Recipe</th><th>Available quantity</th><th>Nutritional value</th></tr>
<tr><td>Cooked rice</td><td>2.5 cups</td><td>800 calories</td></tr>
<tr><td>Sambar</td><td>1.5 cups</td><td>140 calories</td></tr>
<tr><td>Potato curry</td><td>0.5 cup</td><td>50 calories</td></tr>
</table></td><td>3</td><td>(6)</td></tr>
</table>

| | | | | |
|---|---|---|---|---|
| | | <table><tr><td>Fish fry</td><td>0.5 cup</td><td>200 calories</td></tr><tr><td>Buttermilk</td><td>1 cup</td><td>98 calories</td></tr><tr><td>Payasam</td><td>2 cups</td><td>300 calories</td></tr></table> You may assume that 1 cup is equivalent to 250ml. | | |
| | b) | How are recursion and dynamic programming (DP) related? Is it possible to construct a DP version for all recursive solutions? | 2 | (3) |
| 16 | a) | Write a Python program for a random walk simulation in a 2D grid starting from the origin **(0, 0)**. At each step, randomly move up, down, left, or right. Print the final position after 10 steps. | 3 | (4) |
| | b) | Use divide and conquer to find the majority element in an array, where the majority element appears more than n/2 times. Divide the array into two halves, find the majority element in each half, and combine the results to identify if there is a majority element in the entire array. | 2 | (5) |
| ***** | | | | |