


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, December 2022			
Course: Computational Physics Program: BSc (H) Physics Course Code: PHYS 2014K		Semester: III Time : 03 hrs. Max. Marks: 100	
Instructions: 1) Each Question will carry 4 Marks 2) Attempt All Questions. You may use either FORTRAN 77 or FORTRAN 90 syntax while writing the code.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q1	Write a short note on the role of shells in Linux OS.	4 marks	CO1
Q2	Differentiate between FORTRAN 90 and FORTRAN 77 programming languages.	4 marks	CO1
Q3	What will be the computational complexities if the computational model of the algorithms are given as: a) $5 + 0.001n^3 + 0.025n$ b) $500n + 100n^{1.5} + 50n \log_{10}n$ c) $n^2 \log_2 n + n(\log_2 n)^2$ d) $2n + n^{0.5} + 0.5n^{1.25}$	4 marks	CO1
Q4	Write a script to plot data from a file named "test.txt", which contains 5 columns and 100 rows; 1 st column represents the independent variable. The graph should be plotted between column 1 and column 3. The graph needs to be saved in a .png file.	4 marks	CO3
Q5	Write following equations in Latex: a) $y = x \tan(\cos x) + \log(\sin x) + 5$ b) $\phi = e^{i\theta} + m \cosh x + \log(\tan \gamma)$	4 marks	CO1
SECTION B (4Qx10M= 40 Marks)			
Q6	Define a data type "basketBallPlayer" with "playerNumber", "numberOfHits" and "Name" as the fields. Use this data type to populate the database of basketball players. Consider at least three players. Based on the number of hits, decide which basketball player is performing better than the others. If the number of hits of a player is less than 8 but greater than or equal to 5, the player is performing "very good". If the number of	10 marks	CO2

	hits is less than 5 but greater than or equal to 3, the player's performance is "average". Otherwise, the player's performance is "bad".																						
Q7	Suppose you are given some data, the graph of which is not smooth. Can you do something to make the data smooth using Gnuplot? If yes, what are various options available? Explain this by considering a data file named "smooth.txt".	10 marks	CO3																				
Q8	<p>(a) What are floating objects in Latex? Write sample Latex scripts to include these floating objects in a document. (5 Marks)</p> <p>(b) Write Latex script to prepare the following table: (5 marks)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Name</th> <th>Age</th> <th>Qualification</th> <th>Employment</th> </tr> </thead> <tbody> <tr> <td>Ram Kumar</td> <td>27</td> <td>MSc</td> <td>Scientist</td> </tr> <tr> <td>Joseph</td> <td>30</td> <td>MTech</td> <td>Engineer</td> </tr> <tr> <td>Abdul</td> <td>39</td> <td>PhD</td> <td>Faculty</td> </tr> <tr> <td>Jasmeet Singh</td> <td>21</td> <td>BTech</td> <td>Engineer</td> </tr> </tbody> </table>	Name	Age	Qualification	Employment	Ram Kumar	27	MSc	Scientist	Joseph	30	MTech	Engineer	Abdul	39	PhD	Faculty	Jasmeet Singh	21	BTech	Engineer	10 marks	CO1
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Q9	Addison High School is holding a fundraiser. The freshmen (1), sophomores (2), juniors (3), and seniors (4) hold a competition to see which class contributes the most money. Write a program that allows you to enter two numbers for each contribution as it comes in—the class of the contributor (1, 2, 3, or 4), and the amount contributed in dollars. For example, perhaps a junior contributes \$20. The user would enter a 3 and a 20. The program continues to accept data until the user types 999 for the contributor's class. At that point, data entry is completed, so display the four class totals as well as the number of the class (1, 2, 3, or 4) that contributed the most.	10 marks	CO2																				
SECTION-C (2Qx20M=40 Marks)																							
<ol style="list-style-type: none"> 1. Each Question carries 20 Marks. 2. Attempt two questions. There is an internal choice for Q11. 																							
Q10	<p>(a) Write a program to create a quiz that contains at least five questions about a hobby, popular music, astronomy, and favourite colour. Each question will be multiple choice (for which valid responses are a, b, c, or d), or true/false (for which valid responses are t and f). If the user responds to a question with an invalid character, display an error message and prompt the user again. If the user answers the question with a valid and correct response, display an appropriate message. If the user responds to a question with a valid but incorrect response, display an appropriate message as well as the correct answer. At the end of the quiz, display the number of correct and incorrect answers. (15 marks).</p> <p>(b) Write a program that accepts a word into a character array. Display a count of the number of letters in the word. Also display a count of the number of vowels and the number of consonants in the word. (5 marks)</p>	20 marks	CO2																				
Q11	(a) Write a program that displays every perfect number from 1 through 1000. A perfect number is one that equals the sum of all the numbers that	20 marks	CO2																				

divide evenly into it. For example, 6 is perfect because 1, 2, and 3 divide evenly into it, and their sum is 6; however, 12 is not a perfect number because 1, 2, 3, 4, and 6 divide evenly into it, and their sum is greater than 12. **(10 marks)**

(b) Create a new data type named *Purchase*. Each *Purchase* contains an invoice number, amount of sale, and amount of sales tax as data field. Create a main() program that declares a *Purchase* object and prompts the user for purchase details. When you prompt for an invoice number, do not let the user proceed until a number between 1000 and 8000 has been entered. When you prompt for a sale amount, do not proceed until the user has entered a non-negative value. Compute the sales tax as 5% of the purchase price. After a valid *Purchase* object has been created, display the object's invoice number, sale amount, and sales tax. **(10 marks)**

OR

(a) Write a program, which prints out the insurance due on an insurance policy. The base premium is USD 75.32. In order to decide the insurance amount, the age of the driver and number of tickets the driver has been issued (for wrong driving) are needed. The insurance due is calculated based on the following:

- I. If the driver is less than 26 years of age, and he has been issued no tickets then USD 50 is added to the base premium.
- II. If the driver is less than 26 years of age, and has obtained one ticket, then USD 75 is added to the base premium. If number of tickets is more than one, USD 150 is added in the base premium.
- III. If the driver is more than 26 years old, and has been issued no tickets, USD 75 is added to the base premium. If the driver gets any tickets, USD 100 is added in the base premium.

Write a program to calculate the premium due for different cases. **(10 marks)**

(b) Create a data type named "Apartment" that contains data fields to hold the number of bedrooms, the number of baths, and the monthly rent for the Apartment. Write a program that creates an Apartment object and prompts the user for number of bedrooms and baths desired. Determine the rent from the following table and set the rent field appropriately. If a requested apartment type is not available, set the rent field to 0. **(10 marks)**

	1 bath	2 baths
1 bedroom	USD 650	Not available
2 bedrooms	USD 829	USD 925
3 bedrooms	Not available	