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2B6M19293 (Pages : 3) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, March /April 2019

PH6B13(E1) – Computational Physics

(2016 Admission onwards)

Time: 3 hours Max. Marks: 80

SECTION A

(Answer all questions, each question carries one mark)

1. Extracting a part from the string is known as
2. When step size increases, truncation error .....
3. First order R K method is known as
4. Number of elements in a list can be extracted by the function

   a)length() b) len() c) size() d) range()
5. Which of the following is a compound data type

   a) float b)integer c) complex d) list
6. Which of the following is a valid statement in python program

   a) include math b)import math c) insert math d) call math
7. In python result of 3/2 is
8. In python >>> is known as
9. If we run the following python code:

```
x=1
while x<=5:
    print x*4
    x=x+1
```

   The output will not contain the number

   a) 4 b) 5 c) 8 d) 12
10. What will be the output of python statement >>>print type(5+8j)

(10 x1=10 marks)

SECTION B

(Answer all questions, each question carries two marks)

11. Write syntaxes for importing module and sub module from Python library
12. How step size effects on round off error
13. Write a program which accept the radius of a circle from the user and compute the area of that circle
14. Write the syntax of a user defined function
15. What is the difference between **from math import sin** and **from math import ***
16. Write a python program to remove 4 from the list [2,4,7,8]and to print it
17. What is a dictionary in Python? Give example

(7 x 2=14 marks)

SECTION C

(Answer any five questions, each question carries 4 marks)

18. How can you create a list in python? Generate a list of number of your choice and show how to add another number to the list. Find the total number of elements in a list and replace one number in the list by another number
19. List the advantages of numerical methods over analytical methods
20. Illustrate how break and continue statement used in python with suitable example
21. The observed data in an experiment can be tabulated as follows. Estimate the first order equation to satisfy the general behavior of data

X	-2	-1	0	1	2
Y	-7.3	-2.5	2.	7.	1

22. Find the velocity(v) at x=0.2 by Newton's forward interpolation formula

x	0.1	0.3	0.5	0.7
v	0.72	1.81	2.73	3.47

23. Find the Numerical approximate value of $\int_0^2 x^{1/3}dx$ using the trapezoidal rule with four increments
24. Solve the differential equation dy/dx =x+y at y(0.5) using Euler method Initial condition y=1 at x=0 . Take the step size as 0.1

(5 x4=20 marks)

SECTION D

(Answer any four questions, each question carries 4 marks)

25. Write a program to convert temperature in Fahrenheit to Celsius
26. Write a python program to solve quadratic equation
27. Write a python program to check whether the given number is odd or even
28. Write a python program solving the equation $x^3+2x^2+10x-20=0$ by Newton Raphson method
29. Write a python program to integrate $f(x)=x^3$ using Simpson's rule
30. Write a python program to find Maximum height. Time of travel and Horizontal range obtained by a projectile by giving velocity and angle of projection as inputs
31. Write a python program to print the multiplication table of required number, where the required number is given as input

(4 x 4=16 marks)

SECTION E

(Answer any two questions, each question carries 10 marks)

32. Explain different flow of control in python with syntax and examples
33. Explain the Taylor series expansion of sin x and cos x. Develop a python program for it
34. Write a Python program to obtain numerical solution for a two body problem in central force field. Use Euler method
35. Write a program to obtain numerical solution for the body falling in viscous medium

(2 x10=20 marks)

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Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, March /April 2019

PH6B10 – Thermal & Statistical Physics

(2016 Admission onwards)

Time: 3 hours Max. Marks: 80

SECTION A (Answer all questions. One mark each)
Answer all questions in a sentence.

1. What are intensive variables?
2. What are Fermions?
3. Give an example of adiabatic process.
4. Draw the indicator diagram of an isochoric process.
5. Entropy of the universe increases. Comment on the statement.
6. State the third law of thermodynamics.
7. Draw the T-S diagram of a Carnot's cycle.
8. What is a white dwarf?
9. Give one of the physical significance of Fermi energy.
10. What do you mean by most probable state of a system?

(10 x 1 = 10 Marks)

Section B
(Answer all questions in two or three sentences.2 marks each)

11. What is Kelvins statement of the second law of thermodynamics?
12. What is phase space?
13. Enthalpy of a system remains constant always. Comment on the statement.
14. State and explain Plancks law of radiation.
15. In nature all process are irreversible. Justify your answer.
16. Give the limitations of the first law of thermodynamics.
17. What is a quasi static process?

(7 x 2 = 14 Marks)

Section C
(Write in a paragraph about half a page. Answer any five .Each question carries 4 marks)

18. Derive the relation for the work done in an adiabatic process.
19. State and prove Carnot's theorem.
20. What is available energy?
21. Derive Claussius- Clayperon equation from Maxwell's equations.
22. Derive expressions for the r.m.s speed and the most probable speed.
23. Derive the relation between Cp and Cv from First law of thermodynamics
24. What is Fermi energy?

(5 x 4 = 20 Marks)

Section D
(Answer any 4 questions .Each carries 4 marks)

25. A quantity of air is at 300K is compressed to half of its volume. Determine the change in temperature. r=1.4
26. A Carnot's engine working between a source at 400K and a sink and has an efficiency 40%. If the temperature of source and sink are increased by 100K, what is its efficiency?
27. Find the r m s velocity of Oxygen molecules at 37^0C.Molar mass 0.032kg and R=8.13J/mol/K
28. The Fermi energy of a system is 10.4J Calculate the average ground state zero point energy.
29. Water boils at a temperature of 101^0C at a pressure of 78.6cm of mercury. One gm of water occupies a volume 1598cm^3 on evaporation. Calculate the latent heat of vapourisation.
30. A metallic sphere of diameter 8cm has emissivity 0.32 and is heated to a temperature of 1000K.Calculate the rate of radiation from the sphere.
31. Calculate the change in entropy when 10 gms of water at 0^0C is heated and boiled at 100^0C.

(4 x 4 = 16 Marks)

Section E
(Answer any 2 in two pages. Each question carries 10 marks)

32. Discuss the theory and working of Otto engine. Derive the expression for efficieney.
33. Obtain Maxwell's thermodynamic relations from thermodynamic potentials.
34. What is Fermi-Dirac statistics? Derive an expression for its distribution law of electrons.
35. What is Entropy? Derive expressions for the change in entropy of a perfect gas in T and V,T and P and in P and V

(2 x 10 = 20 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, March /April 2019

PH6B11 – Solid State Physics, Spectroscopy & laser Physics

(2016 Admission onwards)

3 hours Max. Marks: 80

SECTION A
(Answer all in a sentence, each question carries one mark)

Mention two industrial application of laser.

What is Bragg's law of X-ray diffraction in crystals?

Distinguish between symmetric top and spherical top molecules.

What are stoke lines and antistoke lines? Compare their intensities.

Symmetric stretching vibration of CO_2 molecule is IR active why

Why soft super conductors show meissner effect

What is atomic packing factor?

What is noise of a signal?

What is basis of formulation of B C S theory?

Explain collision broadening

(10×1=10 Marks)

SECTION B
(Answer in two or three sentences)
Answer all questions, Each question carries 2 Marks

With diagram explain the relation between slit width and resolving power

Outline the effect of isotopic substitution on the rotational spectrum of molecule

Explain superconductivity

Write a note on symmetric top molecule

Discuss type I and Type II Superconductor

What are hot bands in vibrating diatomic molecule?

What is meant by induced absorption?

(7×2=14 Marks)

SECTION C

(Answer in a paragraph of about half a page to one page)
Answer any five questions each question carries 4 mark

18 What is meant by coordination number what is its significance.

19 Explain powder crystal method

20 Explain a.c Josephson Effect.

21 Classify the spectroscopy in accordance with electromagnetic spectrum.

22 Discuss rotational Raman spectra for linear molecules.

23 How does the elasticity of bond length influence the rotational constant?

24 What are cooper pairs? How does it form?

(5×4=20 Ma

SECTION D

(Problems-write relevant formulas, all important steps carry separate marks)
Answer any four questions each question carries 4 mark

25 Determine the coefficient of stimulated emission of radiation whose wavelength is 610nm and the coefficient of spontaneous emission is 10^6 per second

26 The first line in the rotational spectrum of CO has afrequency 3.84240cm^{-1}. Calculate and hence bond length in CO molecule. Given Avogardo number is 6.022×10^{23}.

27 The fundamental vibration frequency of HCL is 2989cm^{-1}. Find the force constant of HCL bond.

28 The average spacing between successive rotational lines of carbon monoxide is 3.8626cm^{-1}. Determine the transition which gives the most intense spectral line at 300

29 What is the change in rotational constant B when Hydrogen is replaced by deuterium hydrogen molecule?

30 The critical temperature of a super conductor at zero magnetic field is T_c Determine t temperature at which the critical field becomes half of its at 0K.

31 Calculate the distance between two atoms of a basis of the diamond structure. If the lattice constant of the structure is 5 Å

(4×4=16 Ma

SECTION E

(Essay-answer in about two pages)
Answer any two questions; each question carries 10 marks

32 Derive Bragg's law for X-ray diffraction. How is it verified? Describe and explain rotating crystal method of crystal structure analysis

33 What is grating spectrometer? Explain the recording of a spectrum with diagram.

34 Discuss the theory of rotation- vibration spectrum of a diatomic molecule.

35 Obtain an expression for the rotational energy levels of a diatomic molecule taking it rigid rotator

(2×10=20 Ma

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, March /April 2019
PH6B12 – Nuclear Physics, Particle Physics & Astrophysics
(2016 Admission onwards)

me: 3 hours Max. Marks: 80

SECTION A

Answer all in a sentence; each question carries one mark

What is meant by mean free path?

Give the energy equivalent of one atomic mass unit

Give the relationship between decay constant and mean life time of a radioactive nucleus.

What is the roll of moderator in nuclear reactor?

What are the coordinates in the azimuth coordinate system?

Name any two leptons

What is the isospin quantum number of proton

Which is the missing element in the following reaction?

$^9_4Be + {}^4_2He \Rightarrow 3\ {}^4_2He + \_\_\_$

The energy of cosmic rays is in the order of _____

0. What is radiocarbon?

(10 x1=10 Marks)

SECTION B

Answer all questions; Each question carries 2 mark

1. What is meant by radioactive equilibrium?

2. Write a short note on the stability of nucleus

3. Identify the unknown particle in the reaction using conservation laws

$$\mu^- + p \rightarrow n^1 + \_\_\_\_\_$$

4. Briefly explain cosmic ray showers

5. Which are the confinement methods used in the fusion reactors?

6. What are the basic notions of Gamov theory of alpha decay?

7. What is the betatron condition?

(7 x 2=14 Marks)

SECTION C

Answer any five questions; Each question carries 4 marks

18. Explain the law of radioactive disintegration and obtain the expression for half life
19. Explain radiometric dating
20. Explain compound nuclear reactions
21. Explain how Pauli proposed a desperate remedy to explain the energy spectrum of beta decay.
22. By how much must the atomic mass of a parent nucleus exceeds the atomic mass number of the daughter nucleus when (a) an electron is emitted, (b) a positron is emitted, (c) an electron is captured?
23. Write a short note on stellar constellations
24. Explain the working of ionization counter

(5 x 4=20 Marks)

SECTION D

Answer any four questions; Each question carries 4 marks

25. Calculate the binding energy of Zn^{64} (in MeV). Given that m(Zn^{64})=63.929u, m(n)=1.00866 u, m(p)=1.00728 u.
26. The half life of Po^{210} is 138 days . What mass of Po^{210} is needed for a 10 mCi source?
27. A rock sample contains 1.00 mg of $Pb^{206}$and 4.00 mg of U^{238} , whose half life is 4.47×10^9 yr. How long ago was the rock formed?
28. In a cyclotron the strength of the magnetic field is 0.954 Wb/m^2 and the dees are dimensioned so that the accelerated protons emerge tangentially at a distance of 0.15m from the centre. What would be the frequency of the oscillator and the energy in MeV of the emerging protons?
29. A slab of absorber is exactly one mean free path thick for a beam of certain incident particles. What percentage of the particle will emerge from the slab?
30. Check the possibility of the following reactions. State the conservation principles obeyed in each case

    a) $\gamma + n \rightarrow p + \pi^-$ b) $\pi^+ + p \rightarrow \Lambda^0 + \pi^0$

    c) $p + p \rightarrow n + p + \pi^+$ d) $p + \bar{e} \rightarrow n + \mu^+$

31. The apparent magnitude of a star is +3.3 and its parallax is 0".025. Find the absolute magnitude of the star.

(4 x 4=16 Marks)

SECTION D

Answer any two questions; Each question carries 10 marks

Explain the semi empirical formula for binding energy? What are the corrections to the formula and explain mass parabola.

Explain nuclear fusion. Discuss the different fusion cycles for the origin of stellar energy.

Explain the different geomagnetic effects of cosmic rays

Explain the construction and working of a linear accelerator. What are its limitations?

(2 x 10=20 Marks)