2M4A22542 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester M.Sc Degree Examination, April 2022

MPH4C12 – Atomic and Molecular Spectroscopy

(2019 Admission onwards)

Time: 3 hours Max. weightage : 30

SECTION A

Answer all questions,
Each question has a weightage of 1

1. Briefly explain the Paschen back effect.
2. Outline the importance of stark effect in microwave spectroscopy.
3. What is the effect of the breakdown of Born-Oppenheimer approximation?
4. What are the normal modes and vibrations of a water molecule?
5. Write a short note on hyper Raman effect.
6. State and explain Franck Condon principle.
7. Explain chemical shift with an example.
8. Briefly explain electron spin resonance (ESR) spectroscopy.

(8x1=8 weightage)

SECTION B

Answer any two questions
Each question has a weightage of 5

9. (a)Discuss in detail the rotational spectra of a non rigid diatomic molecule.
   (b)Give an outline on the analysis of rotational spectra of linear polyatomic molecules.
10. Explain the instrumentation for Raman spectroscopy with the help of a schematic diagram.
11. Give the vibrational analysis of band systems using Deslandres table in electronic spectra of molecules.
12. What are the different relaxations processes in nuclei? Derive the Bloch equations.

(2x5=10 weightage)

SECTION C

Answer any four questions

Each question has a weightage of 3

13. Write all the possible spectroscopic terms which arise when an electron in a p orbit and another in a d orbit couple together in LS coupling and JJ coupling schemes

14. Work out the Zeeman patterns for the following transition ${}^2D_{5/2} \rightarrow {}^2P_{3/2}$.

15. The molecules of HCl show a strong absorption line of wavelength 3.456 microns. Assuming the origin of the line is due to vibration, calculate the force constant for HCl bond .$m_H = 1.0087$, $m_{Cl} = 35.453$, in a.m.u

16. The bond length of N_2 molecule is 1.097×10^{-10} m. What would be the positions of the first three rotational Raman lines of N_2? $m(^{14}N) = 23.25 \times 10^{-27}$ kg.

17 The zero point energy of the ground state of a molecule is 1176 cm^{-1}, and that of its lowest excited state is 727 cm^{-1}. The energy difference between the minima of the potential energy curves is 50,206 cm^{-1}. What is the wave number of the (0,0) band? What is the corresponding wavelength?

18. Calculate the NMR frequency of the ^{31}P nucleus when it is placed in the magnetic field of 1.5 T. Given that $g_I = 2.2632$ and $\mu_N = 5.0504 \times 10^{-27}$ J/T. Also, calculate the relative populations in these spin states.

19. For ^{37}Cl nucleus with nuclear spin I= 3/2 and g_I= 0.4561, draw all the possible energy levels in a magnetic field. Calculate the transition frequency from one of these orientations to an adjacent one in a magnetic field of 0.1 T.

(4x3=12 weightage)

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2M4A22543

(Pages : 2)

Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semesters M.Sc Degree Examination, April 2022

MPH4E13– Lasers and Fibre Optics

(2019 Admission onwards)

Time: 3 hours

Max. weightage : 30

Section A

(Answer ALL questions, each carries weightage 1)

1. What are resonators? Why they are needed in Laser systems.
2. Discuss Second Harmonic Generation of Light.
3. What is nonlinear polarization?
4. What are the different attenuation measurement techniques for fibers?
5. Discuss about leaky modes.
6. What is the idea of spatial frequency filtering?
7. Distinguish between mono mode and multimode fiber.
8. What is quality factor of a laser cavity? Explain Q switching.

(8 x 1 =8 weightage)

Section B

Answer ANY TWO questions, each carries weightage 5

9. What is a line broadening mechanism? Discuss about the different line broadening mechanisms.
10. Analyse the optical resonators using geometrical optics and hence obtain the condition to be satisfied for a stable resonator.
11. Discuss quantum theory for the evaluation of transition rates and hence derive the equations.
12. Derive the wave equations for step index fibres.

(2 x 5=10 weightage)

Section C

Answer any FOUR questions, each carries weightage 3

13. Find the acceptance angle and numerical aperture of an optical fiber with a clad index of 1.378 and a core index of 1.546
14. What is laser induced fusion? Discuss the laser energy requirements of a fusion reaction.
15. Find the longitudinal mode spacing of a laser resonator of cavity length d=100 cm. Assume cavity is filled with free space.
16. Calculate the percent of power lost when light moves from air to glass when the angle of incidence is 0°.
17. A continuous 10 km long fiber link has a loss of 1.2dB/km. What is the required input power if the fiber has a loss of 2.0 dB/km ?
18. Calculate the fractional burn up of fuel in a laser induced fusion reaction where the density of the fuel is $200 kg/m^3$ and the fuel radius is 0.15m.
19. Find the ratio of populations in the two states in He-Ne laser that produces light of wavelength $6328 A^0$ at $27\ ^0C$.

(4 x3 = 12 weightage)

2M4A22544 (Pages : 2)

Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester M.Sc Degree Examination, April 2022

MPH4E20 – Microprocessors, Microcontrollers and Applications

(2019 Admission onwards)

Time: 3 hours Max. weightage : 30

Section A

Answer All Questions, each carry 1 weightage

1. What is address data multiplexing? How it is achieved in 8085?
2. How does the following instructions differ?
   i)JP 8500 ii) JPO 8500
3. Describe the addressing schemes for I/O devices? Which out of them are more advantageous? Why?
4. What are T – states? How MR machine cycle is different from Fetch cycle?
5. What is ISS? Enlist the interrupts in 8085 in their precedence order? How they are classified as Vectored / No-vectored and Maskable / Non- Maskable interrupt?
6. What are Assembler Directives? Describe the following directives in AVR;
   i)EQU ii)SET iii)ORG iv) INCLUDE
7. Write a brief note on the instruction cycle time for the AVR. What is *branch penalty*?
8. What is the advantage of bit – addressability for AVR Ports? Enlist the four bit – oriented instructions for AVR and give their functions.

(8x1=8 weightage)

Section B

Answer Any Two Questions, each carry 5 weightage

9. Explain the internal architecture of Intel 8085 microprocessor, with the help of a block diagram.
10. How the CWR of Intel 8253 is programmed for various real time applications? Discuss the various operating modes of 8253.
11. i). With the help of a simplified block diagram, discuss the internal architecture of AVR microcontroller. Describe the GPR organization, data Memory and the purpose of statue register in AVR.

    ii). Find the C, Z and H flsg bits for the following codes

    LDI R17, 0x82

    LDI R23, 0x22

    ADD R17, R23

12. i). Describe the organization of the various I/O ports of 40 – PIN AVR taking the case of ATmega32. With suitable illustration, discuss their programming and the dual role of various ports.

ii). Write an ALP to create a square wave of 66% duty cycle on bit 0 of Port C. Show the necessary CRO interface.

(2x5=10 weightage)

Section C

Answer Any Four Questions, each carry 3 weightage

13. Write an ALP executable in 8085 to find the 2's complement of a two byte number.
14. Identify the content of PSW in 8085 after the execution of the following program;

SUB A

HLT

15. Draw the complete timing of the instruction ADD M
16. Draw the schematic of the CWR of Intel 8255. Programme the register such that;
    i) Port C lower is a simple input port
    ii) Port C Upper is a simple output port
    ii) Port B is a strobed input port and
    iv) Port A is an Output port in Mode 0.
17. Show how the AVR would represent -34H.
18. Write an AVR ALP to find largest among a set of numbers and place it in R20.
19. Write an AVR C programme to toggle all bits of Port B 200 times.

(4 x 3 = 12 weightage)