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1M4M21542 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester M.Sc Degree Examination, March/April 2021

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. What is the Lande's interval rule in the separation of fine structure lines.
2. Distinguish between Zeeman effect and Paschen back effect.
3. Briefly explain the Born-Oppenheimer approximation?
4. Write a note on stimulated Raman effect.
5. What is Fortrat diagram?
6. Explain how the chemical isomer shift is used in understanding the structure of molecules.
7. What are the Bloch equations?
8. Briefly outline the principle of Mossbauer spectroscopy.

(8x1=8 weightage)

SECTION B

Answer any two questions

Each question has a weightage of 5

9. With principle, explain Fourier Transform Infrared (FTIR) spectroscopy.
10. Explain the Rotational Raman spectrum of symmetric top molecules.
11. Give an outline on the vibrational analysis of the band systems in electronic spectra of molecules using Deslander's table.
12. Briefly analyze the working principle of electron spin resonance (ESR) spectroscopy. Explain the working of an ESR spectrometer.

(2x5=10 weightage)

SECTION C

Answer any four questions

Each question has a weightage of 3

13. Write all the possible spectroscopic terms that 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 D-lines of Sodium ($3p\ ^2P_{1/2,3/2} \rightarrow 3\ s\ ^2S_{1/2}$), including the g values, and from this deduce the pattern for the spectral lines.

15. Assume that H_2 molecule has a force constant of 573 N/m. Find the vibrational quantum number corresponding to 3.5 eV dissociation energy. Given mass of H atom = 1.68×10^{-27}kg, h =6.63×10^{-34} J s

16. The first rotational Raman line of H_2 appears at 346 cm^{-1} from the exciting line. Calculate the bond length of H_2 molecule. $m(^1H) = 1.673 \times 10^{-27}$kg.

17. The rotational lines of a band system of electronic vibration spectra of a molecule is given by $\bar{\nu}=24762 + 25m - 2.1\ m^2\ cm^{-1}$
Deduce the position of the head band, values of B' and B'' and the degradation of the band.

18. Calculate the difference in energies of protons oriented with and against a magnetic field of 3.5 T. What is the frequency of photons that has radiations with this energy? (g_N=5.5857)

19. For ^{11}B nucleus with nuclear spin I= 3/2 and g_I = 1.7923, 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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M21543 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester M.Sc Degree Examination, March/April 2021

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 the techniques used in lasers to generate pulses in nano and femto second regime?
2. What is second Harmonic Generation of light? Write phase matching condition for this process.
3. Discuss the laser energy requirements of a laser fusion.
4. What are the different attenuation measurement techniques for fibres?
5. Describe the advantages of cladding in optical fibres?
6. What are the applications of Holography?
7. What is 'V' parameter of an optical fibre?
8. What is meant by Q factor of a laser cavity?

(8 x 1 =8 weightage)

Section B

(Answer ANY TWO questions, each carries weightage 5)

9. Explain working principle and energy level diagrams of
   (a) He-Ne laser (b) Semiconductor Laser
10. Describe Optical Time Domain Reflectometer (OTDR) and explain how fibre attenuation can be measured.
11. Analyse light propagation through optical fibers using Maxwell's equations.
12. Analyse the optical resonators using geometrical optics and hence obtain the condition to be satisfied for a stable resonator.

(2 x 5 =10weghtage)

Section C

(Answer any FOUR questions, each carries weightage 3)

13. Find the longitudinal mode spacing of a laser resonator of cavity length d=90 cm. Assume cavity is filled with free space.
14. Get an expression for threshold pump power for laser oscillations in three level laser systems.
15. Calculate the numerical aperture and acceptance angle of an optical fibre cable with a clad index of 1.478 and a core index of 1.546.
16. A fibre has 100 m length and is fed with an optical power of 10 μW. The output power is found to be 8 μW. Calculate the loss in dB/km.
17. A Laser produces 15mW beam of light at 632.8 nm. Find the number of photons emitted by the laser in each second.
18. Describe the scalar wave equation of a fibre.
19. Find the laser fusion energy released from a deuterium pellet with a factional burn up of the fuel f = 0.01.(Mass of the deuteron is $2 \times 1.66 \times 10^{-23}$ g).

(4 x 3 = 12 weightage)

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14M21544 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester M.Sc Degree Examination, March/April 2021

MPH4E20 – Microprocessors, Microcontrollers and Applications

(2019 Admission onwards)

Time: 3 hours Max. weightage : 30

Section A

Answer All Questions, each carry 1 weightage

1. Enlist the codes for registers and register pairs in 8085. Why two bit codes are used for register pairs whereas three bit codes for registers?
2. Describe the purpose of the following pins in 8085;

   i) ALE ii)HOLD
3. With one example describe the generation of control signals for Memory and I/O device interfacing from standard signals of processor.
4. How Machine cycle are different from Instruction cycle?
5. What is DMA? What are the requirements of a DMA controller? How these are met in Intel 8257?
6. What is *scratch pad* in AVR? Give the description of each of the instructions in the following ALP and hence find the content of the data memory 0x120;

```
LDI   R20,  2
LDI   R21,  3
ADD   R20,  R21
ADD   R21,  R20
STS   0x    120
```

7. What are STACK? Describe the handling of STACK in AVR.
8. Give the limit of Unsigned Int. data type in AVR C compiler. How the following data type are handled / distinguished by an AVR C compiler

   i) Unsigned Char and Signed Char

   ii) Unsigned Int and Signed Int **(8x1=8 weightage)**

Section B

Answer Any Two Questions, each carry 5 weightage

9. Explain the instruction format and the classification of instructions based on their word length in 8085. Discuss the addressing modes of instructions in 8085.
10. Describe the architecture of Intel 8255. How the control word register of 8255 is programmed? Discuss the various operating modes of 8255.

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). Identify the content of the C, H and Z flags after the execution of the following programme;

```
LDI     R20, 0x88
LDI     R21, 0x2F
ADD     R20, R21
```

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 50% 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 largest among a set of numbers stored from the memory with address 8501onwards. Number of numbers in the series is stored at 8500. Store the result in the location 8700.
14. Given the content of the memory locations with address A500 and A501 are respectively7F H and 98 H. Identify the content of PSW in 8085 after the execution of the following program;

```
LXI H     A500
MOV       A, M
INX       H
ADD       M
STA       A600
HLT
```

15. Draw the complete timing of the instruction MOV A, M
16. Write an ALP to display the number '8' using the 7 segment LED display. Draw the necessary interfacing to 8085 through proper decoder cum driver.
17. Write an ALP to be executed in AVR that will perform division of a byte by another. Comment on the location on the quotient and reminder.
18. Write an AVR C programme to send values 00-FF to Port C.
19. Write an AVR C programme to monitor bit 7 of Port B. If it is one, make bit 4 of Port B input; otherwise change pin 4 of Port B to output.

(4 x 3 = 12 weightage)