

Total No. of Pages:1

Roll No. 17

**FOURTH SEMESTER
[PHYSICS]**

M.Sc.

MID SEMISTER EXAMINATION

MSPH-204 Space & Atmospheric Sciences

Time: 1:00 Hours

Max. Marks: 20

Note: Answer **ALL FOUR** questions
Assume suitable missing data, if any.

1. Describe different layers of atmosphere and the effect of the Sun on different layers. (5 M) (Co 1)
2. Explain variation of temperature and pressure of atmosphere with altitude with justifiable reasons. (5 M) (Co 2)
3. What is an automatic weather station? Explain in detail how it measures different meteorological parameters. (5 M) (Co 1)
4. Explain the scientific needs for the upper air observations. Explain in detailed about the working condition of radio sonde. (5 M) (Co 2)

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Roll No. 17

Fourth SEMESTER

M.Sc (Physics)

MID SEMESTER EXAMINATION

(March.-2024)

MSPH-202 Advanced Semiconductor Devices

Time: 1.5 Hours

Max. Marks: 25

Note : All question are compulsory
All questions carry equal marks.
Assume suitable missing data, if any.

1. Deduce the Maxwell's equations in uniform linear non-conducting isotropic medium and prove the relation for wave equation. [5][CO-1,4]
2. Prove that in rectangular wave guide with height a and width b propagation dominant mode is TE_{10} with cutoff frequency $\omega_{10} = (c\pi)/a$.
5[CO-1,4]
3. (a) Write a short notes on the properties, advantage, disadvantage and application of microwave. [2][CO-1,4,5]
(b) What are the different types of Light emitting diode (LED)? Explain principle, construction details, and provide device diagrams to illustrate their workings? [3][CO-2,4]
4. (a) Explain the principle and working of semiconductor laser in detail. What factors contribute to the preference for double heterostructure semiconductor lasers over other types? [3][CO-2,4,5]
(b) An InGaAsP Fabry-Perot laser operating at a wavelength of $1.33 \mu\text{m}$ has a cavity length of $300 \mu\text{m}$. The index of refraction of InGaAsP is 3.39.
(i) What is the mirror loss expressed in cm^{-1} ?
(ii) If one of the laser facets is coated to produce 90% reflectivity, how much threshold current reduction (as a percentage) can be expected, assuming $\alpha = 10 \text{ cm}^{-1}$? [2][CO-2,4]

4. (a) What are the fundamental characteristics of photodetectors, and could you elaborate on the workings of any photodiode accompanied by diagrams?

[3][CO-2,4,5]

(b) The diameter of the optical receiving area of a Si p-i-n photodiode is 0.06 cm. It is illuminated with an incident optical intensity of 0.2 mW/cm^2 at wavelength 800 nm to generate a photocurrent of $3 \times 10^{-4} \text{ mA}$. What are the responsivity and quantum efficiency of the p-i-n photodiode at 800 nm?

[2][CO-2,4]

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Roll No. 2K22/MSCPHY/07

Fourth SEMESTER

M.Sc (Physics)

MID SEMESTER EXAMINATION

(March.-2024)

MSPH-216 Advanced Function Materials

Time: 1.5 Hours

Max. Marks: 25

Note : All question are compulsory
All questions carry equal marks.
Assume suitable missing data, if any.

1. Considering the general chemical reaction: $aA + bB \leftrightarrow cC$, prove the relation for change in free energy (ΔG). Explain, consequences of supersaturation of reactants and subsaturation of products. [5][CO-1]
2. With suitable example, explain the role of Hydrolysis and Condensation in sol-gel process for the synthesis of oxide nanoparticles. [5][CO-2,5]
3. Explain, the role of electronegativity of metal atoms on the chemical reactivity and size of nanocluster. [5][CO-2]
4. Define, the Seven Crystal Systems, Bravais lattices and proved the condition of forbidden and allowed reflections (h,k,l) for FCC structures. [5][CO-1,3]
5. Differentiate between single crystalline, polycrystalline and amorphous solids. Prove the percentage error formula for estimating the interplaner spacing. [5][CO-1,3]

24221M

MID TERM EXAMINATION

B.Tech (VIII Sem)

March-2024

COURSE CODE: CH416

COURSE TITLE: Industrial Waste Management

Time: 90 min

Max. Marks: 25

Note : All questions are compulsory.
All questions carry equal marks.

- Q.1 ✓ What are the characteristics of Industrial waste water? Discuss in detail. [5][CO1]
- Q.2 ✓ What is Lean manufacturing principle/ technology? What are 8 different wastes of lean manufacturing technology? What is it's drawback? [5][CO1]
- Q.3 ✓ What are effluent treatment plants? Explain in detail with the help of schematic diagram. [5][CO2]
- Q.4 ✓ Suggest ways to reduce waste in manufacturing. What can be done to do volume reduction of waste. [5][CO2]
- Q.5 Write short notes on; [5][CO2]
(i) Effluent standards of any one Industry.
(ii) Ion exchange chromatography.

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END SEMISTER EXAMINATION

MSPH-204 Space and Atmospheric Science

(ELECTIVE COURSE)

Time: 3:00 Hours

Max. Marks: 50

Note: Answer *All the Five* questions
Assume suitable missing data, if any.

Q.1. What is an automatic weather station (AWS)? Describe how it measures various meteorological parameters? What are the advantages of AWS. (10M) (CO-1)

Q.2. What is the necessity of air borne systems for measuring upper air observations? Describe the construction, working conditions and applications of GPS sonde. (10 M) (CO-2)

Q.3. What are trace gases? Explain various natural mechanisms and anthropogenic causes responsible for trace gases production. Explain the adverse effects of trace gases on human beings, animals and agriculture. (10 M) (CO-3)

Q.4. Explain in detailed the mechanism of production of tropospheric Ozone. Write its effect on various things in troposphere. Explain the role of Ozone in stratosphere. Explain depletion of Ozone in stratosphere and discuss its consequences. (10 M) (CO-2)

Q.5. What are aerosols and describe their sources and production mechanisms. Describe their effect on climate and human health. (10 M) (CO-1)

MSPH-202 Advanced Semiconductor Devices

Time: 3 Hours

Max. Marks: 50

Note : Attempt any Five questions.
All questions carry equal marks.
Assume suitable missing data, if any.

1. (a) What are the limitations of 2- cavity, multi-cavity and Reflex klystron in terms of frequency, power and efficiency. [5][CO-1,4,5]

(b) What is the two cavity Klystron? Prove that the relation for the optimum spacing between the two cavities "L" i.e. $L_{optimum} = v_0 \frac{\pi V_0}{\omega \beta_i V_1}$ [5][CO-1,4,5]

2. (a) A two cavity Klystron amplifier has the following parameters: beam voltage $V_0=1000V$, resistance $R_0=40k\Omega$, beam current $I_0 = 25mA$, operating frequency $f=3GHz$, gap in either cavity $d= 1mm$, spacing between the two cavities $L=4cm$, effective shunt impedance $R_{sh}=30k\Omega$. Determine (i) the electron velocity just leaving the cathode (ii) the gap transit angle θ_g (iii) the beam coupling coefficient β_i . [5][CO-1,3,4]

(b) What is Gunn diode? Explain, voltage-controlled and current controlled mode and phenomenon of negative-resistance mode. [5][CO-1,4,5]

3. (a) Explain the principle and working of quantum well (QW) lasers. What are the advantages of QW over heterstructure lasers? [5][CO-2,4,5]

(b) Explain the difference between avalanche and PIN photodiode with suitable diagrams [5][CO-2,4,5]

4. (a) A thin film deposition chamber, with a circular aperture of diameter 10 cm in its wall, contains oxygen molecules at a pressure of 1×10^{-5} torr at 300 K. Calculate (i) mean free path of oxygen molecules; (ii) gas impingement flux; (iii) contamination time for complete monolayer coverage of a surface containing 10^{15} atoms/cm²; and (iv) conductance of the circular aperture.

[5][CO-4,5]

(b) What are the sequential steps involved in the CVD processes of thin film deposition? Explain with the help of a neat diagram. Describe following reaction used in CVD with the help of at least one suitable example in each: (i) pyrolysis; (ii) oxidation; and (iii) compound formation. [5][CO-1,4,5]

5. (a) Define Knudsen number. Write the criteria for distinguishing between molecular, intermediate and viscous flow regimes on the basis of magnitude of Knudsen number. [5][CO-1,4,5]

(b) What are the modes of thin film growth? Describe them with help of suitable diagrams. Obtain Young's condition of surface energy for each mode. [5][CO-1,4,5]

6. (a) Briefly explain working principle of photo multiplier tube (PMT) with suitable diagram. [5][CO-1,2,4,5]

(b) What are electro-optic and magneto-optic effects? [5][CO-1,2,4,5]

7. Write short notes on any two.

[10][CO-1,3,4,5]

(a) Application and working principle of charge couple device (CCD)

(b) Principle and application of optical memories

(c) SAW and integrated devices

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Roll No.

Fourth SEMESTER

M.Sc (Physics)

END SEMESTER EXAMINATION

(May.-2024)

MSPH-216 Advanced Function Materials

Time: 3 Hours

Max. Marks: 50

Note : Attempt any Five questions.
All questions carry equal marks.
Assume suitable missing data, if any.

1. (a) What do you understand by nanomaterials and classified them in terms of their electronic and bonding structures. [5][CO#1,4]

(b) Explain, Clausius-Clapeyron equation and prove the relation between the vapor pressure and temperature. [5][CO#2,4]

2. A metal film is to be deposited by evaporation using the source-substrate geometry as shown in the figure below:



Show that the ratio of thickness of the film at point P (d) to the thickness

at O (d_0) would be $\frac{d}{d_0} = \frac{1}{(1 + \frac{r^2}{d^2})^2}$. What conclusion do you drawn from this equation about the film uniformity of the deposited film? [10][CO#2,3]

3. (a) State the working principle of Scanning electron microscopy and application of EDAX to differentiate elements present in the sample.

(b) State the principle of X-ray photoelectron spectroscopy and differentiate it with Auger electron spectroscopy. [10][CO#1,3,5]

3. (a) With suitable diagram explain the working principle of electrostatic force microscopy/ Kelvin probe microscopy in atomic force microscope. [5][CO#1,3]

(b) What do you mean by critical speed? Define, key properties of grinding media used in Ball Milling Technique. [5][CO#2,4]

4. With suitable example, explain the synthesis of nanomaterial by using either by solid state synthesis or sol-gel process for the synthesis nanoparticles. [10][CO#2,3,5]

6. (a) Explain the mechanism of charge transfer between analyte and nanotube. [5][CO#3,4,5]

(b) Explain, response ($I_{SD}-V_G$ response curve) of CNTFET device with a single semiconducting SWCNT as the conduction channel to NH_3 and NO_2 gas. [5][CO#3,4,5]

7. Write short notes on: [10][CO#1,3,5]

(a) Working principle of transmission electron microscope

(b) Estimation of band using UV-Vis-NIR spectroscopy