Question Paper

Exam Date & Time: 01-Jun-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

Material science for biomedical engineers (BME 4054)

MATERIAL SCIENCE FOR BIOMEDICAL ENGINEERS [BME 4054]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions

1) Compare Bohr and wave-mechanical atom models in terms of electron distribution. (2)

A)

B) "At extrinsic temperature range, the career concentration in p-type semiconductors increases with increase in temperature". (3)

Analyze this statement and decide if this statement is correct or wrong. Justify your decision with detailed explanation

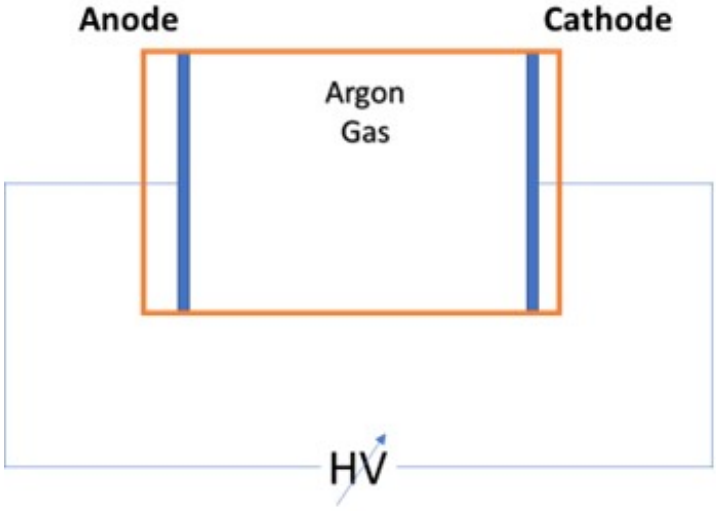
C) A student added 1% silver in gold and 1% pentavalent impurity in an intrinsic semiconductor, silicon. Predict the change in electric conductivity in both the cases. Justify answer with Drude model for conductivity. (5)

2) Discuss field emission mechanism for electric breakdown of vacuum. (2)

A)

B) Deduce the polarizations present in HCl (hydrogen chloride), considering HCl molecules possesses permanent dipole moment. (3)

C) A student prepared an (5)



experiment set up. The set up consists of two metallic electrodes (anode & cathode) placed at specific distance in a closed airtight box. The box is filled with argon gas.

As a part of the experiment procedure, student started increasing the voltage applied to the

electrodes. Propose the dielectric breakdown of air, with Townsends theory.

3)		Describe in detail the magnetic properties of diamagnetic materials.	(2)
	A)		
	B)	Explain in detail the magnetic properties of anti-ferromagnetic materials.	(3)
	C)	The water content of an insulating oil is 1000 ppm at 30oC. Comment on the breakdown strength of the insulating oil and predict and explain in detail any two possible dielectric breakdown mechanisms.	(5)
4)		Distinguish between up-conversion and down-conversion luminescence.	(2)
	A)		
	B)	Explain "Curie's law of paramagnetism" for paramagnetic materials.	(3)
	C)	"The relationship between magnetic flux density (B), magnetic field strength (H) and Magnetization (M) is $B=\mu_0(M+H)$". Validate the above statement using detailed derivation.	(5)
5)		Compare electrostriction and piezoelectricity.	(2)
	A)		
	B)	Explain the change in properties of a ferroelectric material above curie temperature.	(3)
	C)	Recommend a suitable type of material for designing an infrared detector. Plot and explain the design of an infrared imaging system using the above detector.	(5)

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