RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. THIRD SEMESTER EXAMINATION, DECEMBER 2014

SECOND YEAR

Date : 17/12/2014 INDUSTRIAL CHEMISTRY (Honours)

Time : 11 am – 3 pm

Paper : III

Full Marks: 75

[5×2]

[Use a separate Answer Book for each group]

<u>Group – A</u>

- 1. Answer <u>any five</u> questions :
 - a) Classify the different types of materials according to the way the atoms are bound together.
 - b) What is the difference between Crystalline Solids and Amorphous Solids?
 - c) What is meant by the term Crystal lattice? Name four types of Crystal lattice. Define unit cell. [1+1]
 - d) What is meant by the term doping? What types of semiconductors are obtained (i) by doping germanium with antimony and (ii) by doping silicon with boron?
 - e) What are alloy steels? Compare the crystalline state in metals and polymers. [1+1]
 - f) Define microcrystalline and nanocrystalline materials.
 - g) Write down the general expression of melting point of a nanomaterial.
 - h) A continuous and aligned carbon fiber reinforced composite is made up of 30 vol% carbon fiber having a modulus of elasticity of 300 gigapascal dispersed in a polymer matrix which on hardening has a modulus of elasticity of 4 gigapascal. What will be the modulus of elasticity of the composite in longitudinal directions of the carbon fiber?

2.	Answer any three of the following :	[3×5]
	a) Answer <u>any five</u> of the following :	[5×1]
	i) What is refractoriness?	

- ii) What is the chemical composition of clay?
- iii) What is meant by the term crystallography?
- iv) What are liquid crystals?
- v) What are the disadvantages of high silica cement?
- vi) Write at least two uses of liquid crystal.
- b) i) What are the raw materials used for Portland cement manufacture?
 - ii) Outline the various steps involved in the manufacture of Portland cement by rotary Dry Klin methodology. Give a rough flow sheet of process.
 - iii) Write the chemical reactions involved in the process.
- c) i) Give the formula (as per I.S 269 1975) for determining the chemical composition of cement and its guide lines.
 - ii) What is the chemical composition of cement (Portland) and characteristics of constituents? Why is it called Portland Cement? [2+(2+1)]
- d) i) How are refractories classified on constitution basis? Give one example of each class.
 ii) Explain the differences between acidic and basic refractories with suitable examples. [2+3]
- e) Define glass from physical and chemical view points. Name three important raw materials for making window glass. What is annealing of glass? Write what you know about optical glass or opthalmic glass.
 [2+1+2]

3.	Answer any three of the following :	[3×5]
	a) i) How are ceramics for domestic uses classified?	

- ii) Define enamelling & glazing.
- b) i) What is polysilazane?
 - ii) Give in brief, method of making polysilazane.
 - iii) Mention its uses (at least two).

[1+3+1]

[2+3]

[1+3+1]

	c)	 Explain briefly the following materials : i) Plaster of Paris ii) Pozzalana Cement iii) Slag Cement iv) Reinforced Concrete and its material contents 	[1+1+11/2+11/2]		
	d)	i) Describe with sketch the operation of Pot furnace (Regenerative type) for t	nanufacture of		
	(1)	optical glass.			
		ii) Describe in brief Forcault and Colbum technology in shaping sheet glass.	$[2\frac{1}{2}+2\frac{1}{2}]$		
	e)	Write short notes on:			
		i) Setting and hardening of Portland Cement			
		ii) Thermal Spalling			
		iii) Pyrometric cone equivalent			
		iv) Water Proof Cement	[2+1+1+1]		
		<u>Group – B</u>			
4.	An	swer <u>any four</u> questions :	[4×5]		
	a)	Write a short note on crystal structure of Fe (ferrous) at various temperature	es (also show		
		coordination number and packing factor of the structure)	[5]		
	b)	Write short note— (i) Gibb's phase rule (ii) S.G Steel	[2.5+2.5]		
	c)	Briefly explain Bessemer process. What is killed steel?	[4+1]		
	d)	Write a note on L-D process. Write the important advantages of the process.	[3+2]		
	e)	Briefly explain production of iron in blast furnace with furnace diagram.	[5]		
	f)	Briefly explain extraction principle of Aluminium.	[5]		
	g)	Explain in brief extraction of copper from copper pyrites.	[5]		
		<u>Group – C</u>			
5.	An	swer <u>any three</u> questions :	[3×5]		
	a)	A sample of anthracite coal was analysed with following results : $C = 95$, $H = 2$, $O = 3$			
	Calculate its calorific value in KJ/Kg, given Heat of combustion of carbon = 8137 cal/g and H = 34500 cal/g respectively.				
		Write composition, occurrence C.V, and use of Peat or Lignite.	[2½×2]		
	b)	b) Write with a neat sketch of plant the Lurgi-Spül, LTC process mentioning various products obtained therefrom.			
		Convert 2000 BTU into Kilo-Joule	[4+1]		
	c)	Narrate briefly the process of manufacture of Producer gas mentioning important r is CV of Producer gas? Why it is Lower than other gases derived from coal? Give re	eactions. What eason.		

Calculate % of CO in air blown producer gas which is but a mixture of mainly N_2 and CO [3+2]

d) Calculate theoretical air requirement in NM^3/NM^3 for complete combustion of pure and dry propane. A XV seam Asansol coal has proxymate analysis as below : Moisture = 1.6 Pc, Ash = 15.7 Pc, volatile matter - 27.8 Pc.

Calculate its ash context on dry basis, and volatile matter on dry-ash free (daf) basis and fixed carbon on dry-mineral matter-free (dmmf) basis [2+3]

e) Write short notes on (<u>any two</u>): [2×2·5] i) Natural Gas ii) Bottled (LP) Gas iii) Biogas iv) CNG ______X_____