Reg.No.										

MANIPAL UNIVERSITY

Second Sem. M. Tech (Chem. Engg. & IPC) Degree

End- Semester Examination- May 2016

ELECTIVE III : NANOSCIENCE & TECHNOLOGY (CHE 542)

Time: 3hrs. **Max. Marks: 100**

Note: 1. Answer any FIVE full questions
2. Missing data, if any, may be suitably assumed and the same properly indicated
3. Draw neat diagrams and give synthesis/ reaction equations, wherever required

1A.	Define: Nanoparticle. Classify the nano particles based on physical and chemical properties? What are the various properties of nanomaterials which are of industrial importance?.	**05**
1B.	Compare the applications of the following materials as adsorbents/ catalysts giving reasons and neat figures: (i) micro particle of 1 micron diameter… non porous (ii) micro particle of 1 micron diameter… porous (iii) non porous nano particles produced from (i) …non porous micro particle of 1 micron diameter	**03**
1C.	Fill in the blanks and also explain which one of the following materials is best suited for adsorption/ catalytic applications. Why?. Comment on Ratio of (S/I) wrt no. of unit cells. Give neat figures.	**12**

No. of unit cells in the **BCC**	Surface atoms(S)	Interior atoms (I)	Ratio of (S/I)
1			
8(2*2*2)			
27(3*3*3)			

2.	List the various inorganic nano materials used industries. Industrial. Explain the synthesis procedures for (i) nano Palladium and (ii) a nano TiO2 with neat flow diagrams , reaction equations and the various characterisation methods used.	**20**
3A.	What are the various carbon nano materials that you have studied? Explain with neat diagram. Discuss their special properties and applications.	**08**
3B.	What are the various types of micro /nano emulsions used for nano material synthesis? Compare them. What is the special feature of these emulsions? Which emulsion is preferred and why? Explain the synthesis of nano CuO using a suitable micro emulsion from a zinc precursor. Give neat figures.	**12**
4A.	Determine the % surface atoms in case of cubic (FCC) gold particles of : (i) 1cc size (ii) 1nm size Take the unit cell length of gold as 0.4nm. Give neat figures.	**08**
4B.	What is a nano fluid? What are its applications?. Explain the various methods of synthesis of CuO nano fluid with neat flow sheet and equations.	**12**
5.	Write briefly on: (i) Synthesis of magnetic nanomaterials and their applications (ii) Synthesis of nano composites and applications (iii) Applications of ultrasound sound energy in water-splitting and synthesis of nano materials (iv) Challenges and opportunities in the field of nanotechnology	**20**
6A	What is *zeta potential*? Explain with a neat diagram. Discuss the various methods used for making the nanoparticles / nano fluids stable.	**08**
6B.	Investigate the following instrument output (Fig. 1 – Fig. 4) and give your interpretation regarding: a. The equipment used and the principle of operation of the equipment b. The physical properties of the material that could be inferred c. The chemical properties of the materials that could be inferred	**12**

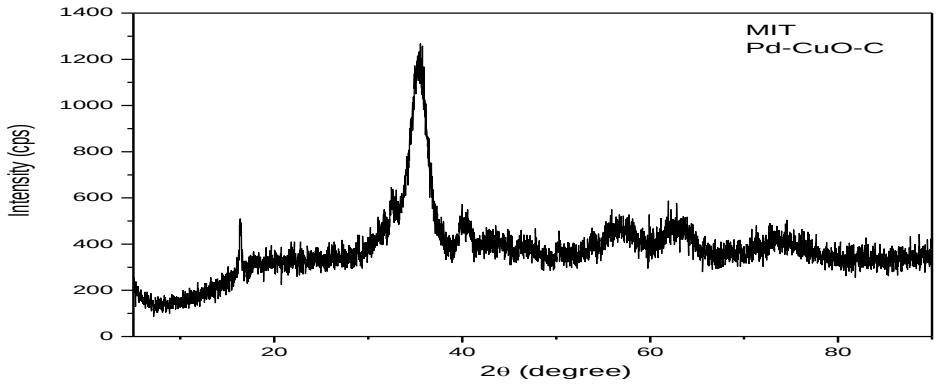
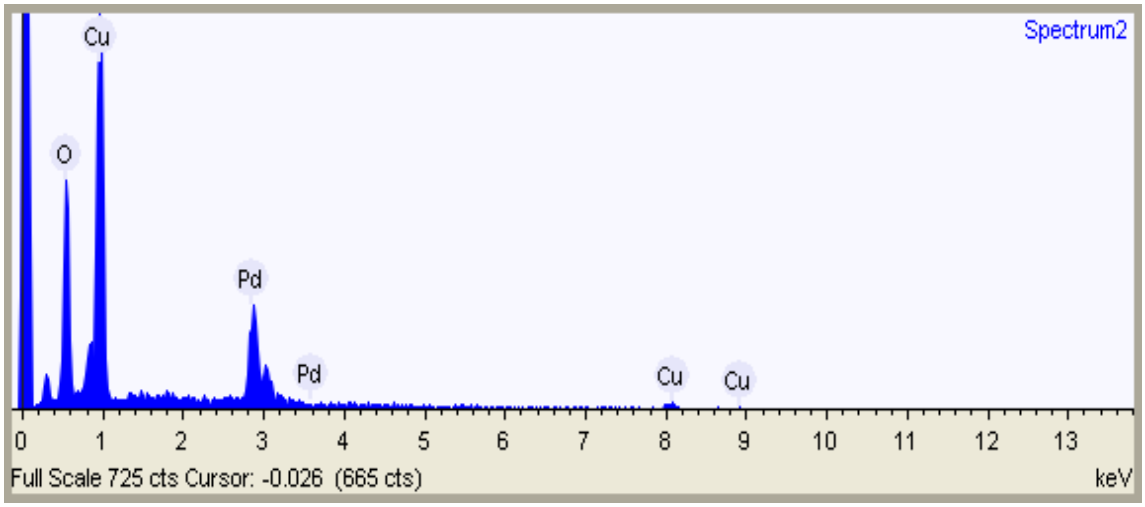


Fig.1



Element	Weight %	Atomic %
Oxygen	20.751	54.663
Copper	52.202	34.624
Palladium	27.047	10.713

Fig.2

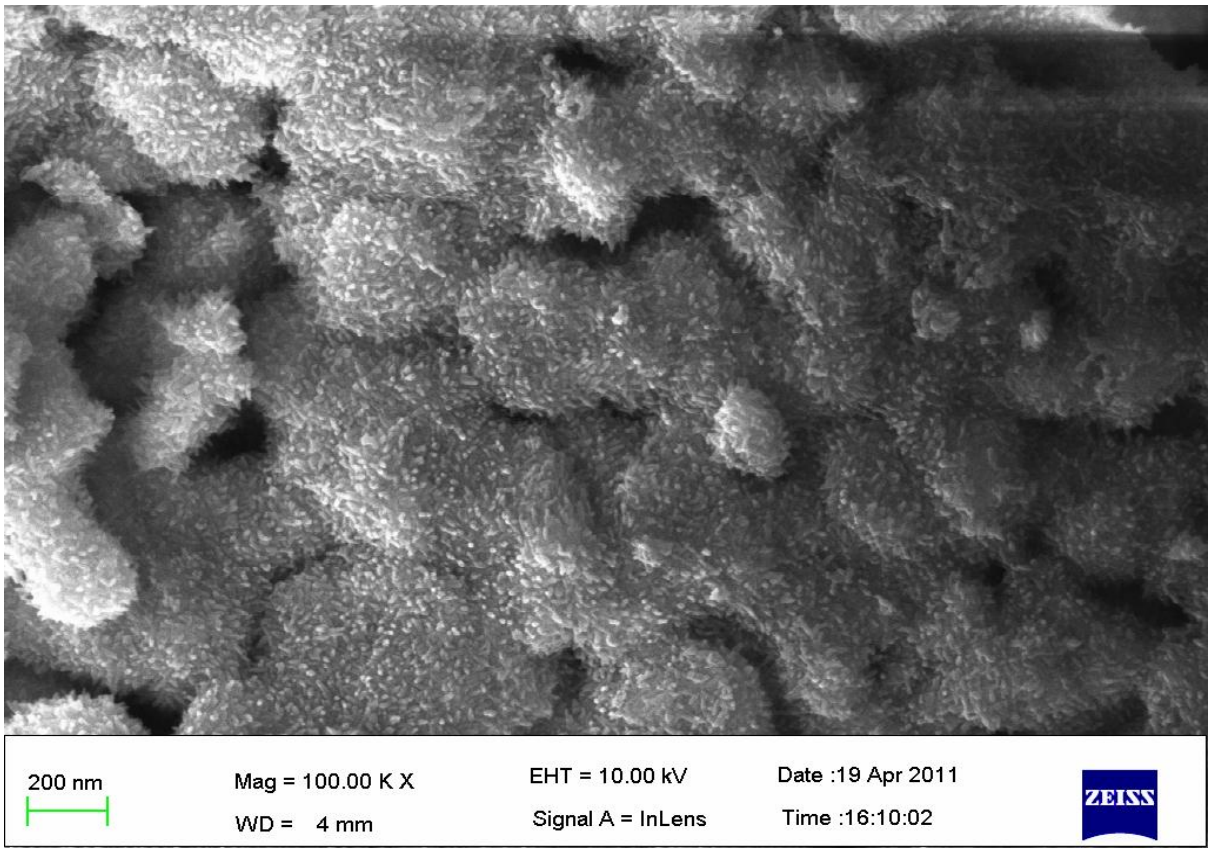

200 nm
Mag = 100.00 K X
WD = 4 mm
EHT = 10.00 kV
Signal A = InLens
Date :19 Apr 2011
Time :16:10:02
ZEISS

Fig. 3

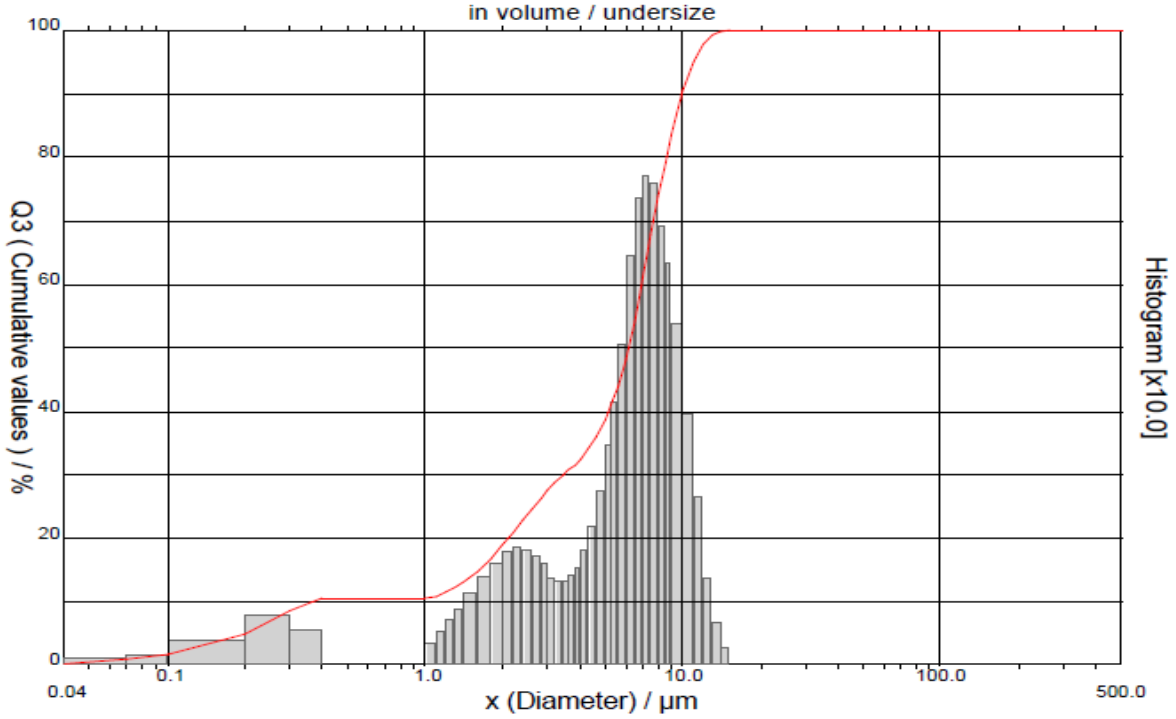

in volume / undersize
Q3 (Cumulative values) / %
Histogram [x10.0]
x (Diameter) / µm
0.04
0.1
1.0
10.0
100.0
500.0
0
20
40
60
80
100

Fig. 4