

B.Tech. – 8th (MME)

Materials for Advanced Applications

Full Marks: 70

Time: 3 hours

Answer any Six questions, including Q. No. 1 which is compulsory
The figures in the right hand margin indicate marks. *Symbols carry usual meaning*

1. Answer all questions : 2X10
- (a) Explain why at nano scale properties are size dependent?
 - (b) How organic polymers behave differently from inorganic polymers?
 - (c) Draw micelles and inverse micelles structure showing hydrophobic and lyophilic part?
 - (d) What is Timetal LCB? In this case what is the master alloy used for casting?
 - (e) Topologically close-packed (TCP) phases are seen in which superalloy and at what condition they form?
 - (f) What are the different types of carbide present in Ni-based super alloy and which alloying element is added to increase the creep resistance of superalloys?
 - (g) What is a rapid solidifications process and how many different types of rapid solidification processes are there?
 - (h) Mention any two ceramic cutting tools?
 - (i) How Li reduces structural mass when it is added to Al?
 - (j) What is ultra low temperature isotropic carbon (ULTI) and write down the factors which affect the anisotropy of carbon structure?
- 2.(a) Define classification of porous material depending on pore size and also explain different synthesis process for mesoporous material with a neat sketch? 5
- (b) How one dimensional nanostructure is different from two dimensional nanostructure? With the help of neat sketch show the difference between tip growth model (for synthesis of carbon nano tube) and root growth model? 5
- 3.(a) With a neat sketch explain sol-gel synthesis process? 5
- (b) Explain the mechanism of formation of nano particles in (water in oil) W/O microemulsion system? 5
4. (a) State different ways to activate shape memory polymer? 5
- (b) What are shape memory alloys? Explain one way and two way memory effects? 5

5. (a) What are the different types of phases present in Ni-base high performance alloys? Explain any three phases? 5
- (b) Why are nickel base single crystal super alloys the most preferred material for gas turbine blades? 5
6. (a) What do you mean by poling and write down the synthesis process for piezoceramic actuators? 5
- (b) What are fuel cells and explain the working principle of fuel cells? 5
7. (a) Classify four major categories of polymer metal hybrid technology? State one category of polymer metal hybrid technology with mechanism? 5
- (b) Describe the superplastic forming process and write down its advantages? 5
8. Write short notes on any TWO: 5X2
- (a) Lithography
- (b) Inconel
- (c) Organic light emitting diode (OLED)
- (d) Ni-Ti shape memory alloy