CBCS SCHEME

USN | | | | | | | | | | |

15ME745

Seventh Semester B.E. Degree Examination, Aug./Sept.2020
Smart Materials and MEMS

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Make a comparison between Open and Closed loop smart structures with examples. **(08 Marks)**

b. State the reason for considering shape memory alloys as smart materials. **(02 Marks)**

c. List the characteristics of shape memory alloys. **(06 Marks)**

OR

2 a. Analyse the influence of stress on characteristic temperature of shape memory alloys using mathematical expressions. **(08 Marks)**

b. Justify how do you achieve increased frequency of response through multiplexing of embedded NiTiNOL actuators. **(08 Marks)**

Module-2

3 a. Indentify Electro Rheological and Magneto Rheological (ER and MR) effects in smart fluids. **(04 Marks)**

b. Elaborate on the mechanisms and properties of ER and MR fluids. **(08 Marks)**

c. Describe the operations of clutches working on the principle of ER/MR effect. **(04 Marks)**

OR

4 a. Explain the basic principle governing the operation of optical fibre. **(04 Marks)**

b. With a sketch describe the operation of Extrinsic-Fabry-Perot sensors. **(06 Marks)**

c. Write a note on the application of optical fibre in crack detection. **(06 Marks)**

Module-3

5 a. Derive necessary equations to analyse parallel damped vibration absorbers. **(10 Marks)**

b. Summarize the strategies and limitations involved in control of structures. **(06 Marks)**

OR

6 a. Discuss the characteristics of Natural structures quoting relevant examples. **(08 Marks)**

b. Quoting three analogs from natural systems, explain the principles of Biometric sensors. **(08 Marks)**

Module-4

7 a. State the important characteristics of MEMS. **(06 Marks)**

b. Bring out the principles of following microfabrication techniques:
(i) Thermal oxidation (ii) Thin film deposit. **(10 Marks)**

OR

8 a. List the properties and applications of Piezoelectric materials. **(08 Marks)**

b. Make a comparison between major sensing and actuating methods. **(08 Marks)**

Module-5

9 a. Briefly discuss about the polymers used in MEMS. **(08 Marks)**

b. Summarize the important considerations made in the selection of materials for channels and valves. **(08 Marks)**

OR

10 a. Conduct a case study to analyse design considerations in case of (i) Microphone (ii) BP sensor. **(08 Marks)**

b. List the primary concerns in developing MEMS and explain any two in detail. **(08 Marks)**

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