Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent institution of MAHE, Manipal)

M.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2018

SUBJECT: DIGITAL MANUFACTURING [MTE 5135]

REVISED CREDIT SYSTEM
(27/11/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL Five** questions.
- Data not provided may be suitably assumed

1A. Distinguish between variant and generative process planning methodologies. **03**

1B. Explain mechanical problems associated with Surface Micro-Machining. **03**

1C. Through describing the different types of manufacturing systems, assess the importance of Computer integrated Manufacturing in manufacturing domain by stating the nature and role of its elements. **04**

2A. Discuss Bio-Sensors and Biomedical Sensors on the basis of applications. What are the technical issues involved for MEMS in biomedical applications? **03**

2B. Elucidate Design for Quality with mentioning the quality design guidelines. **03**

2C. Discuss various aspects of Virtual Manufacturing based on significance and scope in Digital Manufacturing. Exemplify Digital Twin concept. **04**

3A. A truck suspension producing company is about to rent a robot for miscellaneous operations. The products in its assembly line arrive at the rate of 3 per hour. Non-processing of products i.e. idle time in system incur a loss of Rs: 16/hr. Two alternatives for robots is given and you as chief engineer have been tasked for choosing one for the company. **03**

Details of robots are as follows:

ROBOT 1	ROBOT 2
Charges: Rs: 8/hr	Charges: Rs: 10/hr
Service rate: 4/hr	Service rate: 6/hr

Which robot would you hire? Assume an 8-hr working day and incoming of product rate following Poisson's distribution.

3B. Discuss the use of Silicon and any of its two compounds in MEMS. **03**

3C. "Concurrent engineering is an innovative system". Validate the statement by describing the system and process. **04**

4A. Discuss "Simultaneous" and "Over the wall" approaches over their way of action towards limiting design changes and working methodologies. **03**

4B. Briefly describe the LIGA process and explain what makes it different from surface and bulk micro-manufacturing techniques. List three advantages and disadvantages. **03**

4C. Justify the significance of Distributed Artificial Intelligence in computational domain of Industry 4.0. Describe the essential properties and any one organizational pattern for such systems. **04**

5A. Describe briefly how Information Technology plays an important role in concurrent Engineering. **03**

5B. Explain the Principle Design Theory of Accelerometers and list different types of Accelerometers. **03**

5C. Tables Q5.C1 and Q5.C2 contain excerpts of Annual Results Analysis of a company employing DFMA techniques. Using the data, describe the process of DFMA methodology. **04**

Table Q5.C1

Entries including repeats	Original	Redesign
Parts meet minimum part criteria	24	24
Parts are candidates for elimination	5	0
Analyzed subassemblies	6	6
Separate assembly operations	22	15
Total entries	57	45
Design efficiency		
DFA Index	15.99	19.93

Table Q5.C2

Cost Comparison of original and redesign models.

Cost component	Cost in original design model (in USD)	Cost in redesign model (in USD)	Cost reduction (in USD)	% Change in cost
Main processor machine assembly	8.53	8.38	0.15	1.75
Top lid	1.29	1.21	0.08	6.2
Assembly cost	0.12	0.1	0.02	16.67
Other components	5.76	5.76	0	0
Total	15.7	15.45	0.25	1.59