Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2019

SUBJECT: ADDITIVE MANUFATURING TECHNOLOGY [MTE 4009]

(27/11/2019)

Time: 3 Hours **MAX. MARKS: 50**

Instructions to Candidates:

- Answer **ALL** the questions.

1A.	As opposed to many of the liquid-based additive manufacturing systems which use photosensitive polymer, water is used in Rapid Freeze Prototyping (RFP). List out the pros and cons of using water.	**04**	**CO1**
1B.	Mention the advantages and disadvantages of the Initial Graphic Exchange Specification (IGES) file format.	**03**	**CO2**
1C.	Outline the challenges involved in the handling of powder materials for a powder-based system.	**03**	**CO1**
2A.	Additive Manufacturing is being widely used in the manufacturing of aerospace components. One classic example was that of the manufacturing of an antenna bracket for RUAG's (Swiss Technology Company) sentinel satellite certified for deployment in outer space. In the context of the above-mentioned example: i. Mention the challenges faced by the engineers at RUAG. ii. How many such brackets were manufactured? iii. What was the layer thickness used in the parameter set up and how much time did it take to complete the entire manufacturing? iv. Discuss the results obtained.	**06** **(2+1+1+2)**	**CO3**
2B.	Elevated temperatures change the chemical nature of various powders used in powder bed fusion process. What are the changes that are observed?	**03**	**CO1**
2C.	Define a prototype in the context of modern product development.	**01**	**CO1**
3A.	Aerospace Company, Airbus Defense and Space uses Additive Manufacturing for the production of retaining brackets. i. What are the challenges faced by the engineers at Airbus in regard to the construction of retaining brackets? ii. State the salient features of the newly found solution by the engineers at Airbus. iii. Discuss the results obtained.	**06** **(2+2+2)**	**CO3**

3B.	Describe the unique capabilities of additive manufacturing.	**04**	**CO1**
4A.	For figure Q4A, facet X is incorrectly orientated. Describe how the problem can be resolved. Draw the newly generated facet X with the corrected orientation.	**04**	**CO2**

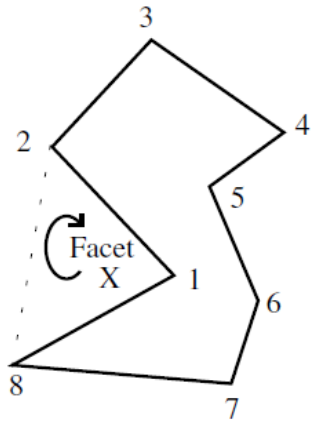

Figure Q4A

4B.	With the help of a diagram, discuss the hopper feeding powder delivery system to optimize the powder handling issues.	**04**	**CO1**
4C.	List the differences between direct and indirect tooling.	**02**	**CO3**
5A.	i. Each one of the following manufacturing processes/methods belongs to one of the three basic types of fabricators. Determine whether they belong to additive or subtractive or formative or hybrid systems. a. Plastic Injection Moulding b. Laminated Object Manufacturing c. CNC Coordinate Measuring Machine ii. Mention the tools required in the removal of manufactured parts in the Laminated Object Manufacturing (LOM) process.	**05 (3+2)**	**CO1**
5B.	Define the term design for manufacturing and assembly (DFMA). Classify it effort into various categories.	**03**	**CO1**
5C.	Draw the control system schematics of the Rapid Freeze Prototyping (RFP) system.	**02**	**CO1**