Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B. TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER MAKEUP EXAMINATIONS, JUNE 2017

SUBJECT: AUTOMOTIVE PRODUCTION TECHNOLOGY (AAE 2253)

REVISED CREDIT SYSTEM

(19/06/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Assume missing data suitably by clearly stating the assumption.
- Give sketches/graphs/examples wherever necessary.

1A A disk 40 cm in diameter and 5 cm thick is to be cast of pure aluminum in an open mold casting operation. The melting temperature of aluminum = 660°C, and the pouring temperature will be 800°C. Assume that the amount of aluminum heated will be 5% more than what is needed to fill the mold cavity. Compute the amount of heat that must be added to the metal to heat it to the pouring temperature, starting from a room temperature of 25°C. The heat of fusion of aluminum = 389.3 J/g, density ρ = 2.70 g/cm^3 and specific heat C = 0.88 J/g°C .Assume the specific heat has the same value for solid and molten aluminum **(03)**

1B The height of the down-sprue is 175 mm and its cross-sectional area at the base is 200 mm^2. The cross-sectional area of the horizontal runner is also 200 mm^2, assuming no losses, indicate the time (in seconds) required to fill a mold cavity of volume 106 mm^3. (Use g = 10 m/s^2). **(02)**

1C With the help of sketches, explain in detail the casting process used for the mass manufacturing of engine blocks. **(03)**

1D What is the function of following in a casting (a) riser (b) sprue? **(02)**

2A Compare the relative merits and limitations of hot working and cold working. **(02)**

2B A metal has a flow curve with strength coefficient = 850 MPa and strain-hardening exponent = 0.30. A tensile specimen of the metal with gage length = 100 mm is stretched to a length = 157 mm. Determine the flow stress at the new length and the average flow stress that the metal has been subjected to during the deformation. **(02)**

2C Compare the advantages and limitations of powder metallurgy process compared to other production routes for making a component. **(02)**

2D Explain the manufacturing process used for making steel bearing balls. **(02)**

2E A metal has a flow curve with strength coefficient = 850 MPa and strain-hardening exponent = 0.3. A tensile specimen of the metal with gage length = 100 mm is **(02)**

stretched to a length = 157 mm. Determine the flow stress at the new length and the average flow stress that the metal has been subjected to during the deformation.

3A A cup is to be drawn in a deep drawing operation. The height of the cup is 75 mm and it's inside diameter = 100 mm. The sheet-metal thickness = 2 mm. If the blank diameter = 225 mm, determine (a) drawing ratio, (b) reduction, and (c) thickness-to-diameter ratio. (d) Does the operation seem feasible? **(02)**

3B (a) With the help of a sketch, distinguish between blanking and punching operation. **(04)**
(b) A blanking operation is to be performed on 2.0 mm thick cold-rolled steel. The part is circular with diameter = 75.0 mm. Determine the appropriate punch and die sizes for this operation. The clearance is given as 0.15 mm. Determine the blanking force required if the shear strength of the steel = 325 MPa and the tensile strength is 450 MPa.

3C A 42.0 mm-thick plate made of low carbon steel is to be reduced to 34.0 mm in one pass in a rolling operation. As the thickness is reduced, the plate widens by 4%. The yield strength of the steel plate is 174 MPa and the tensile strength is 290 MPa. The entrance speed of the plate is 15.0 m/min. The roll radius is 325 mm and the rotational speed is 49.0 rev/min. Determine (a) the minimum required coefficient of friction that would make this rolling operation possible, (b) exit velocity of the plate, and (c) forward slip. **(04)**

4A Compare the principle of operation of ultrasonic machining and rotary ultrasonic machining. **(03)**

4B A hollow cylinder made of hardened steel with inner diameter 12 mm and outer diameter 16 mm requires improved surface finish of the order of 0.2 µm on its outer and inner curved surfaces. The permissible dimensional change on its diameter is 20 µm only. Select a machining process for this application. Justify your selection. **(02)**

4C With the help of sketches explain the principle of operation of electrical discharge machining (EDM). **(03)**

4D Explain the material removal mechanism of Electrochemical machining (ECM) process? **(02)**

5A With the help of sketches, compare (a) friction welding (b) friction stir welding. **(03)**

5B A gas welding torch supplies 0.25 m^3 of acetylene per hour and sufficient quantity of oxygen for an OAW operation on 4.5-mm-thick steel. Heat generated by combustion (approximately 55 MJ/m^3) is transferred to the work surface with a heat transfer factor of 0.25. If 85% of the heat from the flame is concentrated in a circular area on the work surface that is 10 mm in diameter, find (a) rate of heat liberated during combustion, (b) rate of heat transferred to the work surface, and (c) average power density in the circular area. **(03)**

5C Sketch the microstructure of weld bead and explain the various zones and its characteristics. **(02)**

5D With the help of a sketch, describe the principle of operation of stereolithography based additive manufacturing process. **(02)**