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| **PROGRAM** | : | BACHELOR OF ENGINEERING TECHNOLOGY: MECHANICAL |
| **SUBJECT** | : | MECHANICAL MANUFACTURING 2A (WKSMIA2) |
| | | WINTER EXAMINATION 2019 |
| **DATE** | : | 04 JUNE 2019 |
| **DURATION** | : | 3 hours (12:30 – 15H30 |
| **TOTAL MARKS** | : | 100 100 Marks = 100% |

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| **ASSESSOR** | : | MR MD MUKHAWANA |
| **MODERATOR** | : | DR. FK TEKWEME |
| **NUMBER OF PAGES** | : | 4 PAGES (INCLUDING FORMULA SHEET) |

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| **REQUIREMENTS** | : | DRAWING INSTRUMENTS TO BE SUPPLIED BY STUDENTS. |

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**INSTRUCTIONS TO STUDENTS**

1. READ THE QUESTIONS CAREFULLY.
2. ANSWER ALL THE QUESTIONS
3. SHOW ALL CALCULATIONS
4. NUMBER YOUR ANSWERS STRICTLY ACCORDING TO THE QUESTIONS.
5. ALL ANSWERS, BOTH INTERMEDIATE AND FINAL, MUST HAVE THE CORRECT UNITS
6. 100 MARKS = 100 PERCENT.
7. ALL SKETCHES ARE TO BE DRAWN IN PENCIL AND TO GOOD PROPORTION.
8. UNTIDY WORK WILL BE PENALISED.
9. GRAVITATIONAL ACCELERATION = 9.81 $m/s^2$

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## QUESTION 1

1.1) Briefly describe the following terms in metal casting

a) Solidification time (2)

b) Buoyancy in a sand casting operation. (2)

c) Centrifugal casting (2)

1.2) What is the difference between true centrifugal casting and semi centrifugal casting (4)

1.3) Write short notes about heat required to melt metal to molten metal (6)

1.4) Explain three limitations of using Permanent Mold Casting. (3)

1.5) One cubic meter of a certain eutectic alloy is heated in a crucible from room temperature ($20^oC$) to 100 $^0C$ above its melting point for casting. The alloy's density = 7.5 g/cm3, melting point =800 $^0C$, specific heat =0.33 J/g $^oC$ in the solid state and 0.29 J/g$^0C$ in the liquid state; and heat of fusion = 160 J/g. How much heat energy must be added to accomplish the heating, assuming no losses? (4)

**[23]**

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## QUESTION 2

2.1) Write short notes on the following.

a) Fusion welding (2)

b) Solid state welding (2)

2.2) Discuss disadvantages and limitations of welding (5)

2.3) What is the difference between Consumable electrodes and non-consumable electrodes (4)

2.4) Briefly discuss what is the importance of air shielding during welding. (2)

2.5) With help of neat sketches to illustrate spot welding processes. (5)

**[20]**

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## QUESTION 3

3.1) Define the following problem in bulk deformation

a) Rolling (1)

b) Forging (1)

c) Extrusion (1)

d) Wire and bar drawing (1)

3.2) Use neat sketches to illustrate rolling processes in bulk deformation (3)

3.3) A cylindrical work-part with D= 62.5 mm and h = 62.5 mm is upset forged in an open die to a height = 37.5 mm. Coefficient of friction at the die-work interface = 0.10. The work material has a flow curve defined by: K = 280 MPa and n = 0.15. Yield strength = 110 MPa. Determine the instantaneous force in the operation at height h = 47.5 mm. (14)

**[21]**

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## QUESTION 4

4.1) What is the difference between a sheet metal and a plate? (2)

4.2) Define the following terms in a sheet metal works

a) Cutting (2)

b) Bending (2)

c) Drawing (2)

d) Blanking (2)

e) Punching (2)

4.3) Write a short note on the following processes of a sheet metal works

a) Guerin Process (2)

b) Ironing (2)

c) Embossing (2)

4.4) Discuss the following types of presses in sheet metal works

a) Hydraulic presses (2)

b) Mechanical presses (2)

**[22]**

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## QUESTION 5

5.1) What is the difference between blending and mixing of powders? (2)

5.2) Discuss four secondary operations that can be performed on sintered part to increase density, improve accuracy, or accomplish additional shaping (8)

5.3) Differentiate between generating and forming during machining operation. (2)

5.4) What is the difference between drilling and boring? (2)

**[14]**

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**TOTAL = 100 Marks**

## Useful Information

$H = \rho V\{C_s(T_m - T_o) + H_f + C_l(T_p - T_m)\}$ $T_{TS} = C_m\left(\frac{V}{A}\right)^n$ $v = \sqrt{2gh}$ $T_{MF} = \frac{V}{Q}$ $Q = v_1 A_1 = v_2 A_2$

$g = 9.81\frac{m}{s^2} = 981\frac{cm}{s^2}$ $K = 3.33\ x\ 10^{-6}$ $H_w = f_1 f_2 H$ $U_m = KT_m^2$ $H_w = U_m V$

$R_{Hw} = U_m R_{WV}$ $R_{Hw} = f_1 f_2 R_H = U_m A_w v$

$d = t_o - t_f$ $d_{max} = \mu^2 R$ $r = \frac{d}{t_o}$ $s = \frac{v_f - v_r}{v_r}$ $\epsilon = \ln\frac{t_o}{t_f}$

$t_o w_o v_o = t_f w_f v_f$ $t_o w_o L_o = t_f w_f L_f$ $\overline{Y}_f = \frac{K\epsilon^n}{1+n}$ $F = \overline{Y}_f w L$ $L = \sqrt{R(t_o - t_f)}$

$T = 0.5\,FL$ $P = 2\pi NFL$

$V = Ah$ $V = \frac{\pi D^2 h}{4}$ $\epsilon = \ln\frac{h_o}{h}$ $K_f = 1 + \frac{0.4\,\mu D}{h}$ $Y_f = K\epsilon^n$ $F = K_f Y_f A$

$r_x = \frac{A_o}{A_f}$ $\epsilon = \ln r_x = \ln\frac{A_o}{A_f}$ $\overline{Y}_f = \frac{K\epsilon^n}{1+n}$ $\epsilon_x = a + b\ln r_x$ $p = \overline{Y}_f \epsilon_x$

$P = Fv$ $F = pA_o$ $p = \overline{Y}_f\left(\epsilon_x + \frac{2L}{D_o}\right)$ $K_x = 0.98 + 0.02\left(\frac{C_x}{C_c}\right)^{2.25}$ $p = K_x\overline{Y}_f\left(\epsilon_x + \frac{2L}{D_o}\right)$