
 <p>كلية الهندسة بطنان</p>	<p>Mechanical Dept. Production Eng. Division. Academic level: Fourth Semester: Jan.2016 Course code & title: Die Design (MEC5411) Instructor: Dr. Hussein Mohamed & Dr. Gamal Badawy Total mark: 100 mark Time allowed: 3 hrs</p>	 <p>بالتصديقات</p>
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Answer the following questions:

Question (1)

(25 Marks)

- 1-1. Classify the sheet metal die types into 3 groups according to the sheet metal process (Shearing, Bending, Forming)? [5 Marks]
- 1-2. Sketch and name the Punch Face Geometry?[5 Marks]
- 1-3. Compare using sketches between Blanking and Piercing based on Scrap? [5 Marks].
- 1-4. It is required to make a complete design of a circular die block for blanking operation. The work piece is circular of diameter 100 mm and thickness 3 mm, it has ultimate tensile stress of 400 MPa. The die block is supported by circular ring of inner diameter equal to 120 mm. The die block is made of heat treated alloy tool steel where it's allowable bending stress is 450 MPa. The punch is made of hardened tool steel where its permissible compression stress is 200 MPa and its modulus of elasticity is 2.1×10^5 MPa. Assuming flat punch-flat die combinations are used.

Calculate each of the following:

- Inner and outer diameter of the die block.
- Dimensions of punch if its length equals 1200mm. and the punch is fixed at one end.
- Check if dimensions of both the punch and the die block are acceptable or not.
- If the work piece is cut from a stock of dimensions 2656 x 294 x3 mm in alternate triple line layout, find each of the following:

The number of circular blanks that can be produced from this stock.

* Dimensions of the scrap left at the end of the stock.

* Material utilization factor.

Constant to be taken into considerations

C = 1.0

K = 0.01

n = 6 mm. [10 Marks]

Question (2)

(25 Marks)

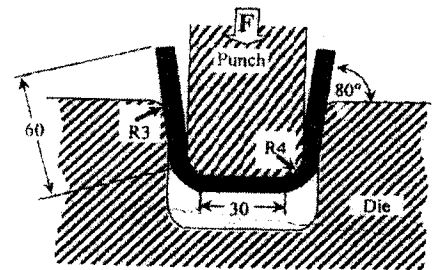
- 2.1 Define is the most important points to consider when selecting appropriate tool materials? [5 Marks]
- 2.2 How can distortion be minimized in die components? [5 Marks]
- 2.3 What is the main 7 factors taken into consideration during sheet Metal Utilization. [5 marks]
- 2.4 If it is required to select a die material for hot impact extrusion process to produce parts with high accuracy and the die can be used for long term production.
 - a) What are the most important factors that should be taken into consideration during selecting die material for this process explain these factors briefly
 - b) How can you achieve these factors if there is a contraction between them?[10 Marks]

Question (3)**(25 Marks)**

- 3.1 Define what is the main difference between the following types of dies [Compound, Combination, Progressive] [5 Marks]
- 3.2 Discuss the Function of: (1-Backing Plate), (2-Segmentation in die and punch) (3-Center of pressure) in the die. [5 Marks]
- 3.3 Compare between the Process Planning Concept in Sheet Metal parts in case of (Blanking, Progressive dies, Deep Drawing Dies). [5 Marks].
- 3.4. The following bending die is used to produce U-profile shown in the figure from a steel sheet of width 40 mm and thickness 2 mm. The steel sheet has ultimate tensile stress of 320 MPa , a yield stress of 260 MPa and modulus of elasticity of 210 GPa.

Calculate each of the following:

- The bending force in case of;
 - * Bending in the elastic-plastic domain.
 - * Bending in the purely plastic domain.
- Check the maximum bend radius of the U-profile
- The tensile stress in the outer fibers.
- The spring back factor, assuming the bend angle is decreased by 20% after releasing the load.
- The pre-bend length of the strip.

Take the coefficient of hardening correction $n = 1.7$ 

R/T	0.4	0.5	0.8	1.0	1.5	2.0	3.0
ζ	0.35	0.37	0.4	0.41	0.44	0.45	0.45

[10 Marks]

Question (4)**(25 Marks)**

- 4-1 Define are the significant factors in deep drawing. [5 Marks].
- 4-2 What are the common defects in deep drawing process? [5 Marks].
- 4-3 compare between the Progressive Deep Drawing Dies and the Combination Dies. [5 Marks].
- 4-4. It is required to make a complete design for deep drawing of a cup of outer diameter 50 mm, height 70 mm and thickness 1 mm with corner radius of 5 mm, given that the cup is made of mild steel whose ultimate tensile stress is 400 MPa and the original true stress is 88 MPa. The flow stress of mild steel can be given by $\sigma = 500 \epsilon^{0.25}$ MPa. Take the coefficient of friction 0.1, the drawing ratio in first draw $m_1 = 0.55$ and the clearance factor $k = 0.07$.

[10 Marks]

With our best wishes

Dr. Hussein Mohamed & Dr. Gamal Badawy

- d) A brass plumbing fitting produced from a *Cu-30% Zn alloy* operates in hot water system of a large office building. After some period of use, failure and leaking occur. **Offer** an explanation for why the fitting failed. **Explain** the possible *forms* and *mechanisms* of failure.

Q6: Compare between the following:

(15 Marks)

- Pitting and crevice corrosion mechanisms.
- Anodizing and galvanizing processes.
- Strain hardening and precipitation hardening.

Q7

(6 Marks)

For an iron based-2.8% carbon alloy, explain the effect of the following factors on the type and structure of the produced cast alloy:

- Silicon content.
- Cooling rate.
- Addition of 3% Si with 0.05% Mg.

Q8: Choose the correct answer:

(4 Marks)

- The illustrated diagram is called ----- diagram.

[CCT - IT - TTT - S]

- The cooling curve no. (1) is the ----- cooling curve required to produce marenсите and it is called the ----- cooling curve. This type of phase transformation is considered ----- transformation.

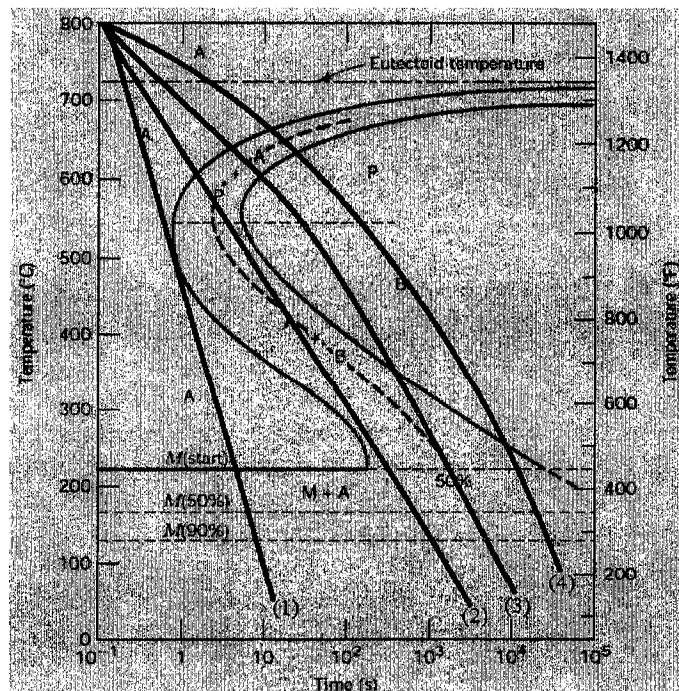
[lowest - highest - optimum - critical - diffusional - isothermal - athermal]

- The cooling curve no. (2) produces a steel structure consists of ----- . This type of phase transformation is considered ----- transformation.

[A - A+P - A+B - M - P+B+M - diffusional - diffusionless- isothermal- athermal]

- The cooling curve no. (3) produces a steel structure consists of ----- while the cooling curve no. (4) produces a steel structure consists of -----.

[fine A - coarse A - fine P - coarse P - A+50% M - M]



With best wishes

January 2016

Try to answer the following questions, assume any missing data.

Question 1

- A) Mention the reasons responsible for the development of non-conventional machining methods.
- B) What is the function of dielectric fluid used in EDM, write down the names of four fluids used in EDM.
- C) Mention the advantages and disadvantages of ECG.

Question 2

For a R-C circuit adjusted for maximum power delivery conditions the following data are available: resistance (R) = 650 Ohm, capacitance (C) = 40 μ F and supply voltage V_s = 120 V. Calculate the charging current at the instant when the circuit is switched on and frequency of discharge.

Question 3

Calculate the time required to drill a hole of one mm diameter x 120 mm long in a steel alloy plate using ECM. The current supply is 150 Ampere and the electrolyte is 20% NaCl solution, atomic weight is 56, valency is 2 and density is 7.8 gr/cm³. 1 Farad F = 96500 Ampere . second.

Question 4

A five steel plates want to be cut on laser cutting machine. What is the machining time required. Where the workpiece dimension is 100x50x20. the workpiece thickness is 20mm, metal removal rate 200mm³/sec. The workpiece density 7.85 gr/cm³. Kerf width 1mm. Total energy required for cutting process 250 KJ/Kg.

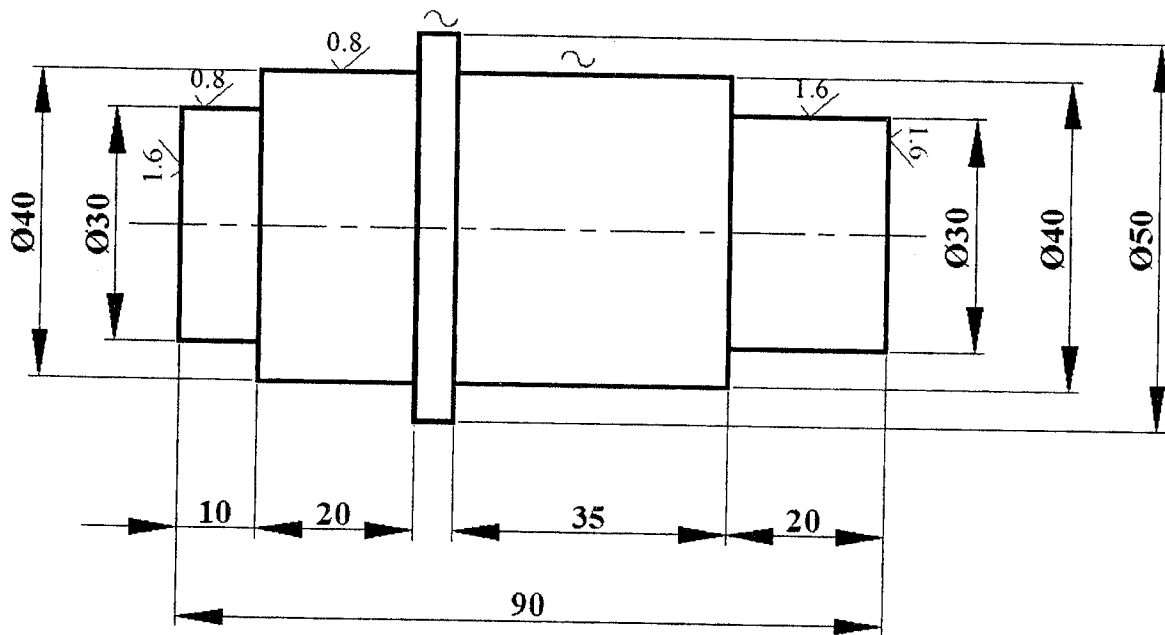
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Question 5

Make a complete process plan and process sheet for the shown Fig where:- The maximum depth of cut that the tool can withstand =5mm. The maximum surface cutting speed for the tool 150m/min. Tool nose radius =0.8mm. Machine bore diameter 42mm. Max rpm for the machine 3000 rpm. Machine power 10KW. Workpiece specific cutting force 2000 N/mm².

Feed selection table

Surface finish μm		T-MAX P - CoroTurn 10		
		Nominal nose radius, mm		
Ra	Rt	0,2	0,4	0,8
0,6	1,6	0,05	0,07	0,10
1,0	4	0,08	0,11	0,15
3,2	10	0,10	0,17	0,24
6,3	6	0,13	0,22	0,30



GOOD LUCK

Prof. Dr. Eng. A.M.MOUSSA- Dr. A. MAHROUS