Course Title: **Engineering Materials**

Date: 04 Jan 2018 (Final exam)

Course Code: MPD1104

Allowed time: 3 hrs

Year: 1st – Mechanical Engineering

No. of pages: 3

Answer all the following questions

Question 1: Select the most correct answer and put all in a tabular form [22 marks]

1. Solid crystals grow if their size is greater than the critical radius of nucleation (True || False).
2. Eutectic is a solid solution with a very low melting point (True || False).
3. Diffusion in interstitial solid solutions occurs only if vacancies are available (True || False).
4. The right order of preparing samples for microscopic examination is: Grinding, polishing, etching || Etching, polishing, grinding || Etching, grinding, polishing || Polishing, etching, grinding.
5. Equilibrium solidification of alloys represents the case of (limited atomic diffusion || unlimited atomic diffusion || limited solid solubility || unlimited solid solubility).
6. Microsegregation 'coring' occurs (above liquidus || below solidus || below liquidus || below solvus) line, as a result of (eutectic reaction || growth || non-equilibrium cooling || slow cooling).
7. Of the line crystal defects: (Grain boundaries || Impurities || Vacancies || Dislocations)
8. Heat-treatable wrought alloys are the precipitation hardenable alloys. (True || False)
9. Casting bronzes contains about (8%Sn || 15%Sn || 30%Zn || 16% Sb) and are used in manufacturing of (gears || pipes || springs || screws).
10. In iron-carbon phase diagram the (δ ferrite || α ferrite || austenite || cementite) phase possesses the highest solid solubility with (0.8% || 2 || 4.3 || 6.67) %C.
11. Ledeburite is the (eutectoid || pearlitic || 4.3%C || 6.67%C) steel.
12. Machinability of pearlite is improved after (hardening || spheroidize annealing || full annealing || tempering) heat treatment by heating and holding steel to certain temperature below (liquidus || eutectic || eutectoid || peritectic || solidus) temperature.
13. The weakest atomic bond you studied is the (ionic || metallic || covalent || van der Waal forces).
14. Iron has (BCC || FCC || HCP || BCT) structure at 1000°C.
15. The most important property for the abrasives used in grinding wheels is the (thermal conductivity || hardness || electrical resistivity || ductility)
16. HCP unit cell has (less || equal || more) compaction than FCC unit cell.
17. Linear density of [111] in BCC is (less || equal || higher) than in FCC.
18. There are (4 || 6 || 12 || 48) number of slip systems in FCC.

Question 2:

[8+4+8= 20 marks]

- Define the following terms: Malleability – Allotropy – CFRP – Thermosets
- Explain with the aid of sketch the use of X-Ray in determining inter-planar spacing in cubic symmetry.
- Ceramics have been used for many thousands of years.
 - What is the nature (structure and atomic bond) of most ceramics?
 - Explain the importance of coordination number in ceramics.
 - Show with a good sketch an example of AX-type ceramic.
 - Give two examples of ceramics to use in different functions.

Question 3:

[10 marks]

- Sodium is BCC and has a lattice constant of 0.371 nm. Calculate a value for the atomic radius of a sodium atom in nanometers.
- Calculate the atomic packing factor for the FCC structure.
- In a FCC unit cell plot $(1\bar{1}0)$ and $[111]$ and calculate ρ_p and ρ_l in terms of the lattice parameter.
- Get the theoretical density of α -iron if the atomic weight is 55.85 g/mol, atomic radius is 1.24 Å and Avogadro's No = 6.023×10^{23} atoms/mol.
- What is the theoretical relation between the height of a HCP unit cell and the atomic radius?

Question 4:

[3+2+4+3= 12 marks]

Two metal 'A' and 'B' have limited solubility in each other in the solid state and have melting points of 200 °C and 700 °C, respectively. A peritectic reaction takes place at 400 °C between the solid solution Beta which contains 20% A and the molten liquid which contains 75% A to form solid solution alpha which has 45% B. The minimum solubility percentages of Alpha and Beta at room temperature are 30% B and 10% A, respectively.

- Draw the equilibrium phase diagram (straight lines).
- Draw the cooling curve of the alloy containing 35% B.
- Describe in a table form the cooling of the alloy containing 35% B (showing the relative amount of phases, composition and microstructure.
- Is age hardening for the A-B alloy system possible?

If no, explain why?

If yes, what is the range of alloy compositions for which age hardening is possible? Describe the age hardening procedure for a specific alloy.

Course Title: Eng. Mathematics (2A)
Date: 9 Jan.2018 (1st term)

Course Code: PME 1107

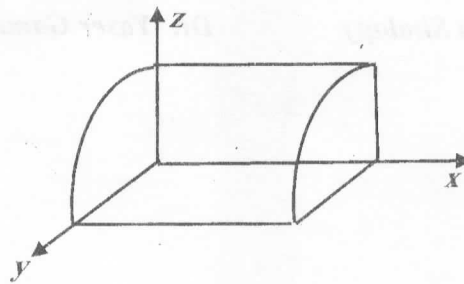
Allowed time: 3 Hrs. No. of Pages: (2)

Year: 1st year of Mechanical Eng.

Answer the Following Questions

Question Number (1) (50 Marks)

- a) Write and sketch the domain of $f(x, y) = \cos(x + y) + \frac{\tan^{-1} xy}{x^2 + y^2 - 4}$. (6 Marks)
- b) If $w = x^3 y$, $x^2 v + y u^3 = uv$, $x^2 v^2 + y^3 u = 6$, Find $\frac{dw}{dv}$. (6 Marks)
- c) If $Z = x f\left(\frac{y}{x}\right) + y g\left(\frac{y}{x}\right)$ Prove that: $x^2 Z_{xx} + 2xy Z_{xy} + y^2 Z_{yy} = 0$ (6 Marks)
- d) Find the envelope of $y = m x + \frac{a}{m}$, (m) is a variable parameter. (6 Marks)
- e) If $\int_0^\pi \frac{dx}{\alpha - \cos x} = \frac{\pi}{\sqrt{\alpha^2 - 1}}$, $\alpha > 1$, Find $\int_0^\pi \frac{dx}{(3 - \cos x)^3}$. (8 Marks)
- f) Evaluate $I = \iint_D xy \, dA$, where D is the region bounded by $x^2 = 2y$, $y = 4 - x$
(Hint: Take $dA = dydx$) (9 Marks)
- g) Using triple Integral evaluate the volume of the region bounded by
 $x = 0$, $x = 5$, $z = 0$, $y = 0$, $z = 4 - y^2$. (9 Marks)

**Question Number (2) (25 Marks)**

Solve the following differential equations:

- a) $ydx + x(\ln x - \ln y - 1)dy = 0$.
- b) $y' = \sin^{-1}[x - \ln y']$.
- c) $y'' + 3y' + 2y = x^2 e^{-3x}$.
- d) $(x^2 D^2 + 3xD + 1)y = (1 - x)^{-2}$.

Question Number (3) (25 Marks)



- a) $(3x^2 + 2y \sin 2x)dx + (2\sin^2x + 3y^2)dy = 0$.
- b) Find the orthogonal trajectory for the family of curves $r = -c(1 + \sin \theta)$.
- c) Show whether the function e^x represents a solution of the equation $y'' - (x + 1)y' - (x + 2)y = 0$ or not ?
If yes, solve the equation.
- d) Find the general solution of the differential equation $[(x + 3)D^2 - (2x + 7)D + 2]y = (x + 3)^2e^x$.

With Best Wishes


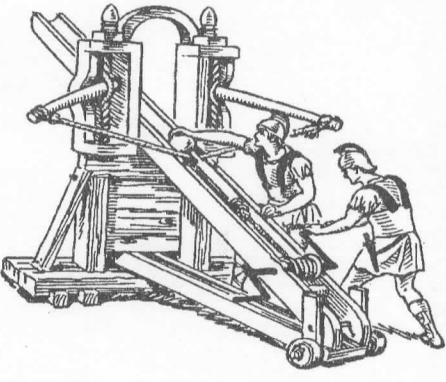
Course Examination Committee and Course Coordinators

Dr. AbdAlla Shalapy

Dr. Yaser Gamiel

Tanta University		Department: Mechanical Power Engineering		Faculty of Engineering
		Total Marks: 40 Marks		

Course Title: تفكير هندسي Date: January, 2018 (First Term)	Course Code : MEP11H3 Allowed Time : 2 hrs	Year : الاولى ميكانيكا No. of Pages: (1)
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السؤال الاول :- الدرجة (10)	1. اذكر مع الشرح العناصر الخمسة لعقبات التفكير العلمى ؟ 2. ما هى العوامل المؤثرة على اتخاذ القرار وما هى اساليبه ووضح كيف يمكنك اتخاذ القرار باستخدام نماذج المصفوفة ؟	5 درجات 5 درجات
السؤال الثانى :- الدرجة (10)	1. ماهو المقصود بالتفكير الابداعى والتفكير الناقد ؟ 2. عدد اخطاء التفكير؟	5 درجات 5 درجات
السؤال الثالث :- الدرجة (10)	3. للتفكير تصنيفات عدة ... بين كيف يمكنك تصنيف مستويات التفكير؟ 1. وضح باختصار ما هى مهارات التفكير من اجل الفهم؟	5 درجات 5 درجات
السؤال الرابع :- الدرجة (10)	1. بين كيف يمكنك استخدام مستويات التفسير والفهم الخمسة فى تفسير احدى النظم الموضحة:  	5 درجات
	2. ماهو المقصود باستراتيجية حل المشكلات وما هو المقصود باستراتيجية العصف الذهنى واهميتها؟	5 درجات

انتهت الاسئلة.....مع الحبيب الامنياء والتوضيق والنباع

أ. د. م. محمد عبد الوكيل الزيد الحولوى واللجنة

بيرة 31

Tanta
University



Department: Production Engineering & Mechanical Design
Total marks: 100 Marks



Faculty of
Engineering

Course Title: Mechanical Drawing
Course Code: MPD1103
Year: 1st Year Mechanical Engineer

Date: 16-1-2018
Allowed time: 4 hrs.
No. of pages: 2

Final Exam

Answer all the following questions, and assume any missing data

Q1. Solve as you can with free hand sketch

(25 marks)

1. What is a bearing and what is meant by journal?
2. Distinguish between:
 - (a) Sliding contact bearings and anti-friction bearings,
 - (b) Bracket and hanger bearings,
 - (c) Pivot bearing and collar bearing, and
 - (d) Journal bearing and thrust bearing.
3. Draw the different types of welded and riveted joints? (at least two types of each)

Q2. The feed check valve

(75 marks)

Key to assembly:

It is used in boilers to regulate the supply of feed water and to maintain the water level. It is fitted close to the boiler shell and in the feed pipe line. Figure shows the details of a feed check valve. The valve prevents water from being returned to the supply line, due to steam pressure in the boiler. Hence, it functions like a non-return valve.

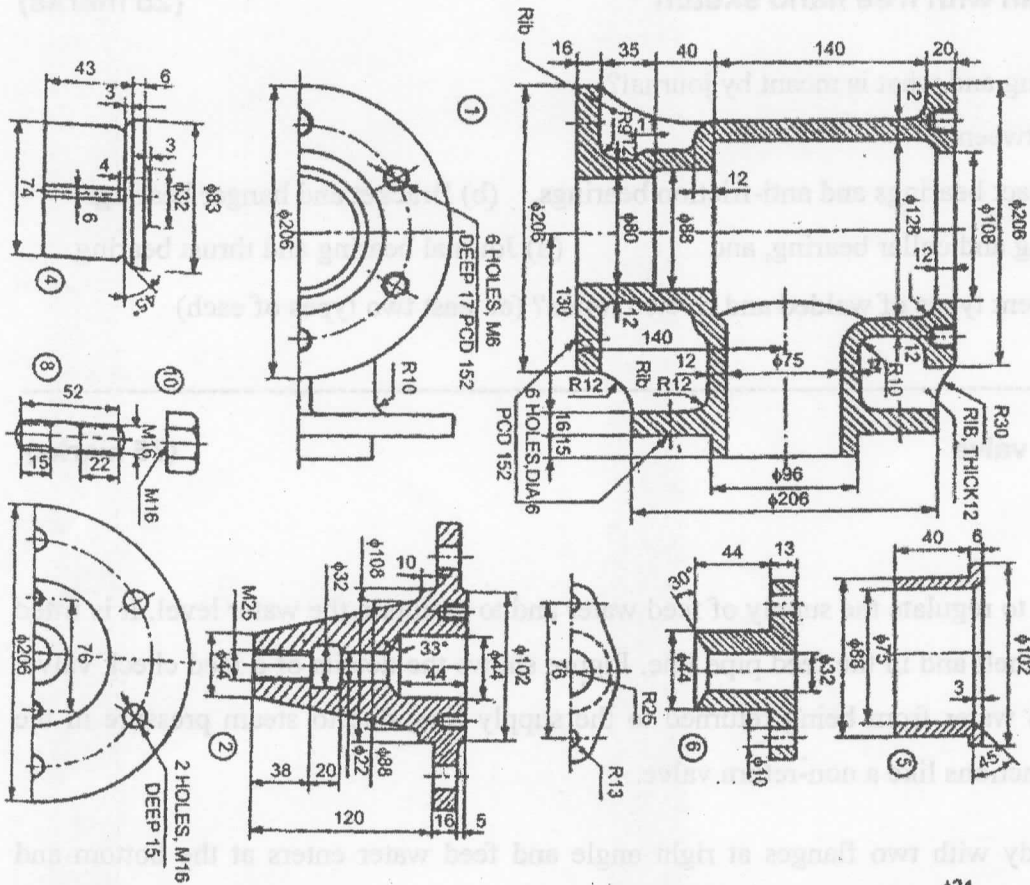
It consists of a body with two flanges at right angle and feed water enters at the bottom and enters the boiler through the side opening. The valve seat 5 is introduced into the body of the valve. The spindle 3 is screwed from bottom of the cover 2 such that, the square end of the spindle projects out through the cover. Studs 8 are screwed to the body and the spindle and cover assembly is fastened to the body by nuts 10. Studs 9 are screwed to the cover and the gland 6 is inserted into the cover and tightened by nuts 11. To prevent the leakage of water through the cover, packing material is introduced between the cover and gland. Hand wheel 7 is located on the spindle such that, the square hole in the hand wheel meshes with the square portion of spindle. The hand wheel is fixed to the spindle by nut 11.

By operating the hand wheel, the spindle permits the valve to get lifted from the valve seat and allows feed water to enter the boiler.

(1/2)

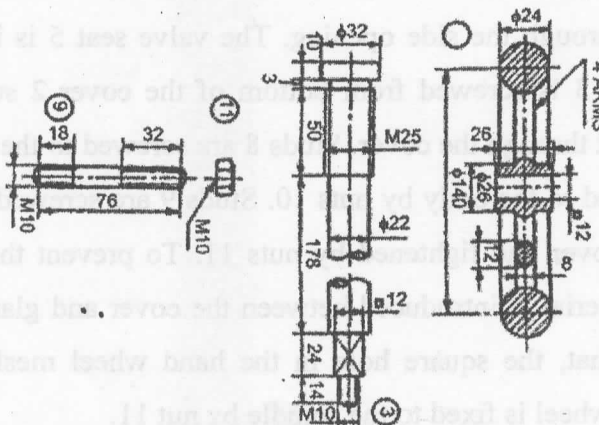
- Required: Assemble the parts of a feed check valve and Draw to a suitable scale the following:

- (1) Sectional elevation (35 marks)
- (2) Sectional side view (25 marks)
- (3) Complete plan (15 marks)



No.	Name	Matl.	Qty
1	Body	CI	1
2	Cover	CI	1
3	Splindle	MS	1
4	Valve	GM	1
5	Valve seat	GM	1
6	Gland	GM	1
7	Hand wheel	CI	1
8	Stud	MS	6
9	Stud	MS	2
10	Nut	MS	6
11	Nut	MS	3

Parts list



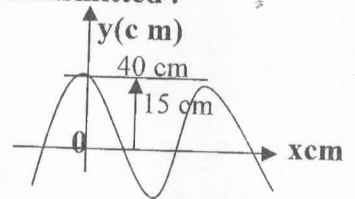
Answer the following:

- 1-a-There is analogy between mechanical vibrations and electromagnetic vibrations.
 _Derive the equations for damped oscillations for both mechanical and electromagnetic vibrations showing the rate at which the energy decays.
 _Show how You overcome these lose of energy in both systems, Using all differential equations and graphics in the two systems .

b-Choose the correct :

- i-When a pulse traveling along a light string reaches the knot , (part of it) or (totally) reflected (with) or (without) inversion , while (part of it) or (totally) is transmitted to the heavier string .
 ii-When a pulse traveling on a heavy string strikes the boundary of a light err string,(part of it) or (totally) is reflected (with) or (without) inversion and (part) or (totally) is transmitted .

- 2-a-A sinusoidal harmonic wave traveling in the +ve x- direction, has an amplitude of 15 cm and a wave length of 40 cm and a frequency Of 8 Hz.



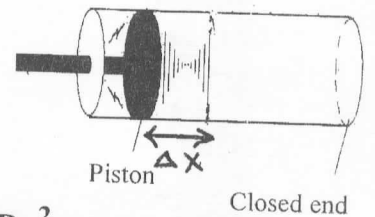
The displacement of the wave at $t=0$ and $x=0$ is also 15 cm Find :

- (i)- The wave number ,the period , angular frequency, and the phase velocity
 (ii)- Determine the phase constant Φ ,and write a general expression for the wave function

- b-All wave function $Y(x,t)$ of a wave motion on a string represent a solution called the Linear wave equation ., (i) -Deduce this equation . (ii)- Drive the wave velocity on a string by this equation .

- 3-a-The velocity of all mechanical waves depends on its elastic property as well as on it s inertial property.
Deduce the velocity of a longitudinal waves .

- b-In case of longitudinal waves :Write an expression ,that describes the particle displacement and pressure variation as a function of position and time. And then. Prove that :
 The pressure amplitude $\Delta P_m = \rho v \omega S_m$.



- 4-a-Consider a layer of air of mass Δm and width Δx in front of a piston of cross-section area A oscillating with a frequency ω as in figure.

The piston transmits energy to this layer of air . Prove that :-

- The average energy $\Delta E = 1/2 (\rho A \Delta x) (\omega S_m)^2$ and The intensity $I = \Delta P_m^2 / 2 \rho v$

- b- A point source emits sound waves of power output of (80 W) . Find :

- (i) - The intensity at a distance 3m from the source .
 (ii) -The distance at which the sound reduces to level of 40 dB

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With the best wishes !



Course Title: Production Engineering
Date: Jan 2018 (First term)

Course Code:
Allowed time: 3 hrs

Year: 1
No. of Pages: (3)

Remarks: (answer the following 4 questions... assume any missing data... answers should be supported by clear estimations, tables, sketches...etc)

Q1: marks (25)

Given:

As shown in Fig.1, two projections (Elevation and side views) for St 37 Square bar 200mm with length 220 raw material.

Requirements:

- 1- Estimate the total volume of the raw material and finished product
- 2- Describe with drawing the operations in process planning to estimate the total production time to produce 100 part, with drawing the fixation in each operation.

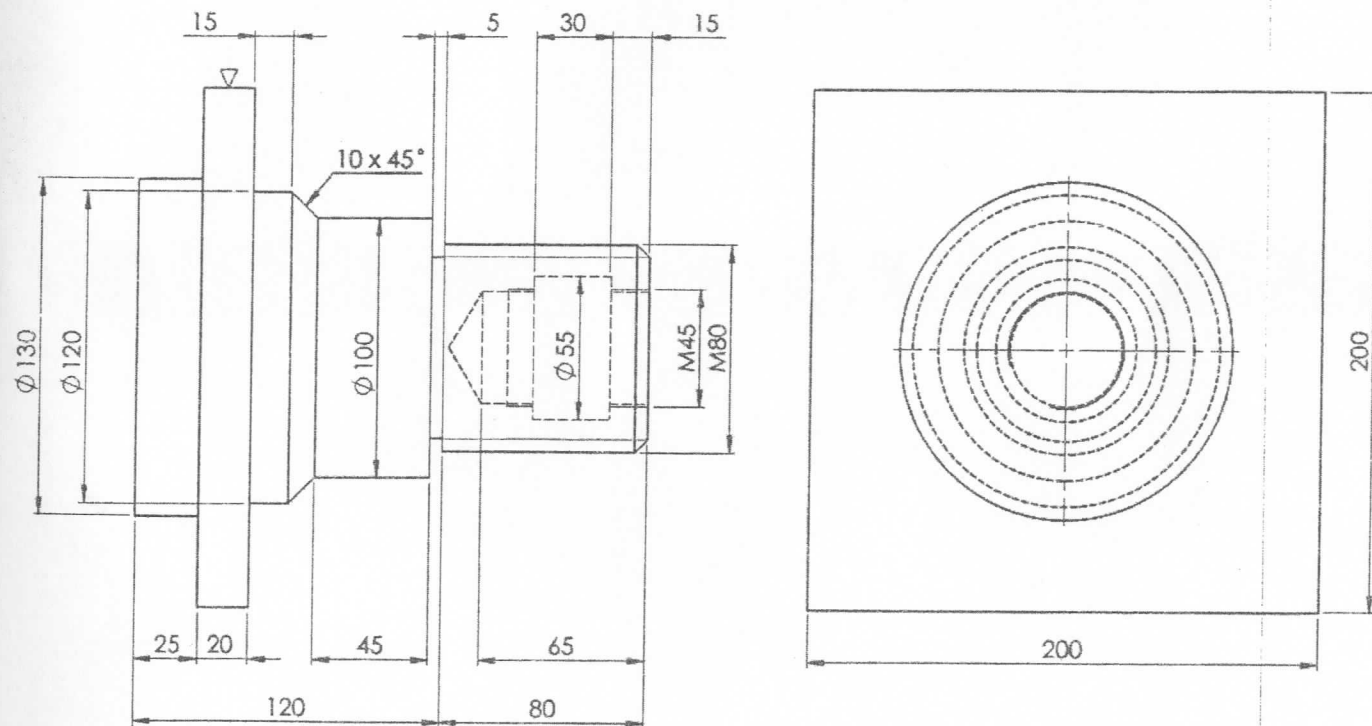
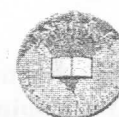


Fig.1



Course Title: Production Engineering
Date: Jan 2018 (First term)

Course Code:
Allowed time: 3 hrs

Year: 1
No. of Pages: (3)

Remarks: (answer the following 4 questions... assume any missing data... answers should be supported by clear estimations, tables, sketches...etc)

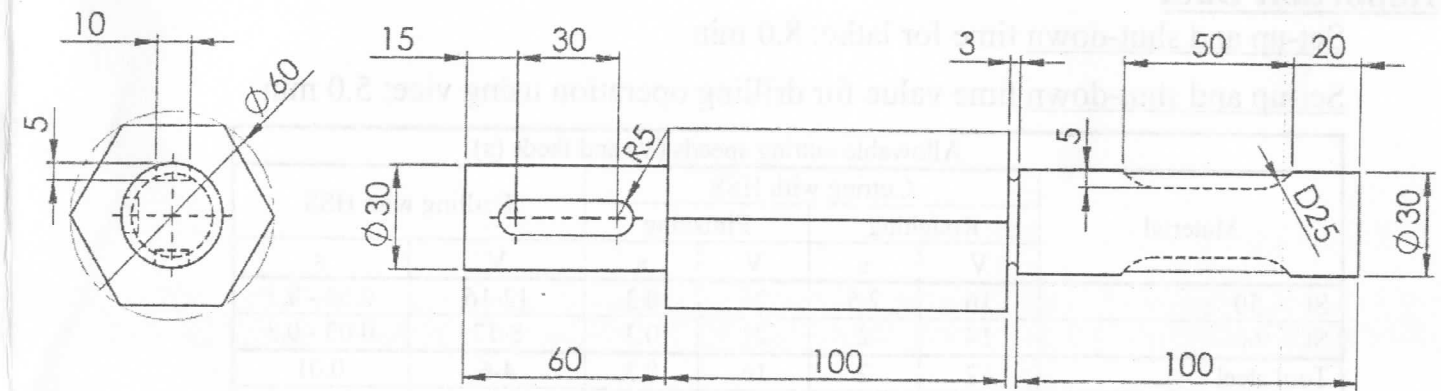


Fig.2

Q2: marks (25)

Given

As shown in Fig.2, two projections (Elevation and side views) for St 60 work piece cylinder bar 65 mm diameter with length 270 mm. Available milling machine (vertical and horizontal) is 2.5 kW, rpm =40, cutting speed 12m/min. use vertical cylindrical cutter of HSS with diameter 20mm for hexagon production.

Hint: take the Rate of feed 60 mm/min

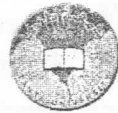
Requirements:

- a- Estimate the total production times for production of part in Fig 2 in all required machines. if it's necessary to use the index head for any operation and in Fig 2, please describe its calculations for each machine.

Q3: Describe the tree total production time in the process planning. : marks (5)

Q4: Define the Rolling process and draw famous shapes which can be produced. :

marks (5)



Course Title: Production Engineering
Date: Jan 2018 (First term)

Course Code:
Allowed time: 3 hrs

Year: 1
No. of Pages: (3)

Remarks: (answer the following 4 questions... assume any missing data... answers should be supported by clear estimations, tables, sketches...etc)

Important Data

Set-up and shut-down time for lathe: 8.0 min

Set-up and shut-down time value for drilling operation using vice: 5.0 min

Material	Allowable cutting speeds (V) and feeds (s)					
	Cutting with HSS				Drilling with HSS	
	Roughing		Finishing		V	s
V	s	V	s			
St 50	16	2.5	25	0.3	12-16	0.03 - 0.3
St 60	14	2	21	0.3	8-12	0.03 - 0.3
Tool steel	12	2	16	0.3	4-6	0.01
Malleable C.I	20	3	30	0.3	8-12	0.03 - 0.3
Copper and alloys	40	2.5	70	0.3	20-50	0.04 - 0.4
Aluminum	400	3	800	0.5	40-100	0.1 - 0.4

	times values for chucking and releasing (lath)			times values for chucking and releasing on milling machine
	< 5 kg	5-20 kg	> 20 kg	
centers / chuck	0.8 min	1.5 min	2.5 min	With vice, clamps or direct bolting : 5 min With indexing head : 3 min
Vice, clamps, direct bolting		1.6	2.6	

positioning tool and measuring time (lath)

Usually for the first cutting : 1.0 min,
For each rough cutting : 0.5 min
For each finish cutting : 1.0 min

Indexing Plate	Indexing plates groups of holes (milling)					
	Number of holes					
1st	15	16	17	18	19	20
2nd	21	23	27	29	31	33
3rd	37	39	41	43	47	49

With best wishes
A.M.Elkassas