

Wasit University/ College of Engineering  
Mechanical Engineering Department

Class: 4<sup>th</sup>

Subject: Design of machine systems

Time: 3 Hours

Exam: Final- 3<sup>rd</sup> attempt

Date: 6 / 11 / 2018

Examiner: Dr. B. M. Faisal

Note: - Using the sheets of rules and tables is allowed.

- Q1) A start square (normal series) power screw of 40 mm nominal diameter is acted upon by an axial load of 50 kN. The outside and inside diameters of the screw collar are 40 mm and 20 mm respectively. The coefficient of friction for both thread and collar are 0.2. The screw rotates at 20 r.p.m. The allowable thread bearing pressure is 15 N/mm<sup>2</sup> and the shear yield strength is 70 N/mm<sup>2</sup>. By using the uniform wear theory, determine a) the dimensions of the screw and the height of the nut, b) the number of the threads of the nut which are in engagement with screw, c) the stresses in the screw and the nut, d) the power required to drive the screw and state if the design is safe or not. (12 Marks)
- Q2) A rope drum with three grooves is used for slings a load of 39 kN in an elevator for 100 m with an acceleration of 0.9 m/s<sup>2</sup>. Design this grooved drum and the wire rope by using standard hosting wire rope from grade 120. Use  $E_r = 70 \text{ kN/mm}^2$ . (12 Marks)
- Q3) Design a simplex roller chain to transmit power from 20 kW and 1100 r.p.m motor to a reciprocating pump. The pump operates continuously 24 hr/day at speed of 300 r.p.m. The center distance is 40 times the pitch and it's correct for 5mm. (12 Marks)
- Q4) Determine the principal dimensions of a cone clutch faced with lather to transmit 40 kW at 800 r.p.m. from an electric motor to an air compressor. Sketch a sectional front view of the clutch and provide the main dimensions. Assume that the semi-angle of the cone is 10°, the coefficient of friction is 0.3, mean diameter of cone is (7-10)d, where d is the diameter of the shaft, allowable normal pressure for lather and cast iron is 0.1 to 0.2 N/mm<sup>2</sup>, shear stress 100 N/mm<sup>2</sup>, load factor is 2 and the mean diameter to face width ratio is 6. (12 Marks)
- Q5) Design a journal bearing for a main slow speed steam engine from the following data: load on the journal is 50000 N, speed of the journal 1000 r.p.m., type of oil SAE30 at working temperature of 60 °C, specific heat of the oil is 1900 J/Kg/°C, the ambient temperature of the oil is 20 °C, and the maximum pressure for the engine is 15N/mm<sup>2</sup>. Also state if the bearing working under hydrodynamic conditions or not and calculate the mass of the lubricating oil required for artificial cooling if the heat dissipation coefficient is 2000 W/m<sup>2</sup>/°C and the rise of the temperature of oil be limited to 20 °C. Assume the length of the journal is 80 mm. (12 Marks)

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Lecturer  
Dr. B. M. Faisal

Head of Dept.  
Asist. Prof. H. A. Bisher



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*Answer 5 questions only*

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- Q1) The distribution of velocity of a fluid over a fixed plate is given by an equation  $u = 0.5y - y^2$  where  $u$  is the velocity of flow at a distance  $y$  from the fixed plate. Determine the shear stress at  $y = 0$ ,  $y = 0.1\text{m}$  and  $y = 0.2\text{m}$  if the dynamic viscosity is  $0.75 \text{ N.s/m}^2$ .
- Q2) Calculate the specific weight, specific volume and specific gravity of a liquid having a volume of  $6 \text{ m}^3$  and weight of  $40 \text{ kN}$ .
- Q3) The cylindrical vessel shown in fig.1 is rotated about vertical axis contain water to a depth of  $1.5 \text{ m}$ . Calculate:
1. The angular velocity at which water will start to spill over the sides.
  2. The angular velocity at which the water depth at the centre is zero and the volume of water lost for this case.
- Q4) Compute the horizontal and vertical components of the hydrostatic force on the quarter circle panel at the bottom of the water tank shown in fig.2
- Q5) A solid cylinder shown in fig.3 of diameter  $4 \text{ m}$  has a height of  $4 \text{ m}$  find the metacentric height of the cylinder if the specific gravity of the cylinder is  $0.7$  and is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.
- Q6) Three pipes steadily deliver water to a large exit pipe as shown in fig.4. If the velocity  $V_2 = 5\text{m/s}$  and the exit flow rate  $Q_4 = 120\text{m}^3/\text{h}$ . Find  $V_1$ ,  $V_3$ ,  $V_4$  if it is known that increasing  $Q_3$  by  $20\%$  would increase  $Q_4$  by  $10\%$ .

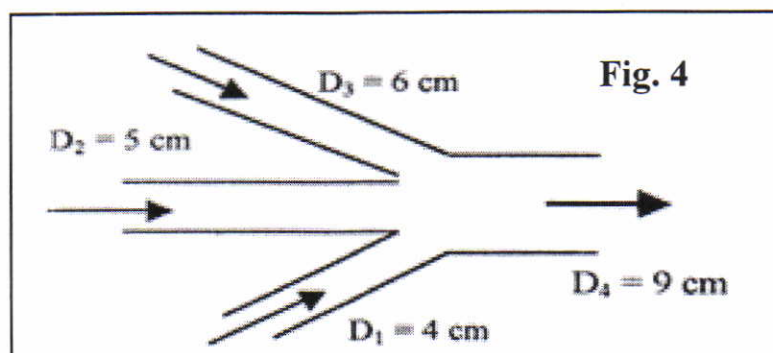
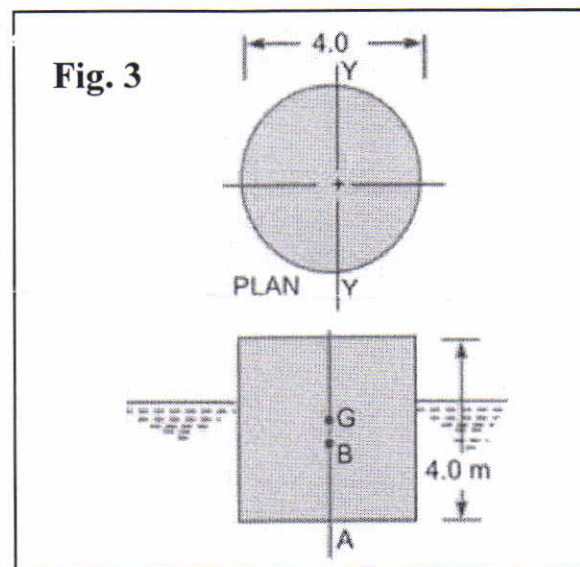
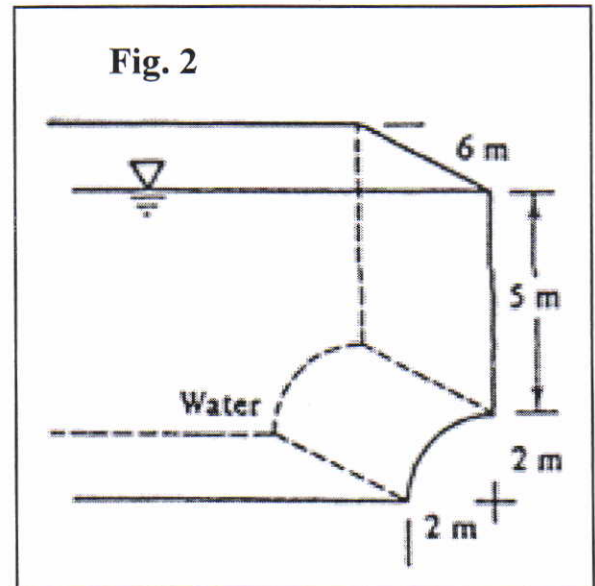
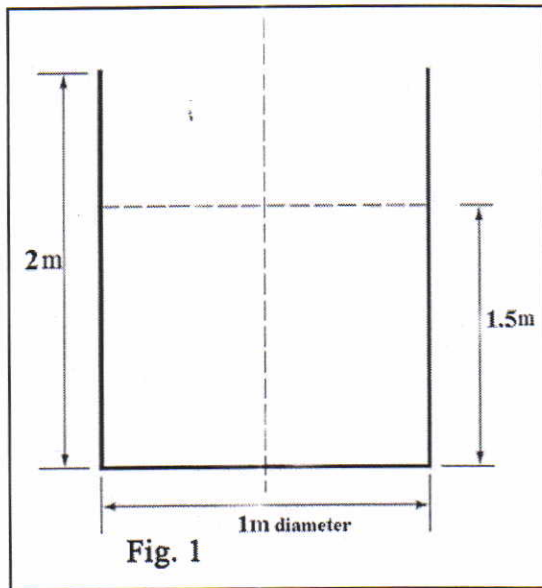


Examiner

Asst. prof. Dr. Hadi Abeid

GOOD LUCK



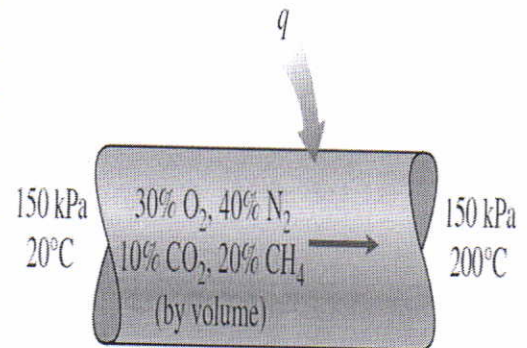




Q1

(20 marks)

The volumetric analysis of mixture of gases is 30 percent oxygen, 40 percent nitrogen, 10 percent carbon dioxide, and 20 percent methane. This mixture is heated from 20°C to 200°C while flowing through a tube in which the pressure is maintained at 150 kPa. Determine total mass, the mass fractions, constant-pressure specific heat of the mixture and the heat transfer to the mixture per unit mass of the mixture.



Q2

(20 marks)

An air-standard dual cycle has a compression ratio of 14 and a cutoff ratio of 1.2. The pressure ratio during the constant-volume heat addition process is 1.5. Determine the thermal efficiency, amount of heat added, the maximum gas pressure and temperature when this cycle is operated at 80 kPa and 20°C at the beginning of the compression. Use constant specific heats at room temperature.

Q3

(20 marks)

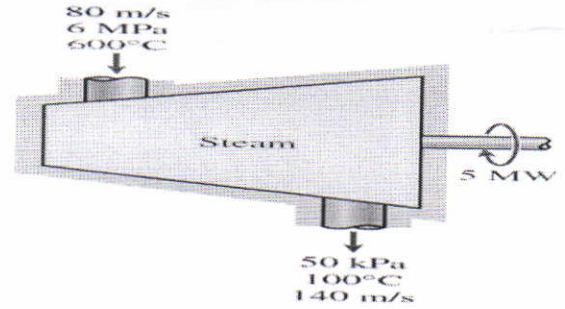
Answer five of the following question:

1. Consider a mixture of several gases of identical masses. Will all the mass fractions be identical? How about the mole fractions?
2. Is it possible to create entropy? Is it possible to destroy it?
3. Does a power plant that has a higher thermal efficiency necessarily have a higher second-law efficiency than one with a lower thermal efficiency? Explain.
4. As a car gets older, will its compression ratio change? How about the mean effective pressure?
5. Is it possible to maintain a pressure of 10 kPa in a condenser that is being cooled by river water entering at 20°C? Explain.
6. Is the exergy of a system different in different environments? Describe.
7. Starting with the Gibbs equation  $du = Tds - PdV$ , obtain the expression for the change in internal energy of an ideal gas having constant specific heats during the isentropic process  $PV^k = \text{constant}$ .

Q4

(20 marks)

Steam enters an adiabatic turbine at 6 MPa, 600°C, and 80 m/s and leaves at 50 kPa, 100°C, and 140 m/s. If the power output of the turbine is 5 MW, determine (a) the reversible power output and (b) the second-law efficiency of the turbine. Assume the surroundings to be at 25°C.



Q5

(20 marks)

Consider a steam power plant that operates on a regenerative Rankine cycle and has a net power output of 150 MW. Steam enters the turbine at 10 MPa and 500°C and the condenser at 10 kPa. The isentropic efficiency of the turbine is 80 percent, and that of the pumps is 95 percent. Steam is extracted from the turbine at 0.5 MPa to heat the feedwater in an open feedwater heater. Water leaves the feedwater heater as a saturated liquid. Show the cycle on a T-s diagram, and determine (a) the mass flow rate of steam through the boiler, and (b) the thermal efficiency of the cycle.

ومن الله العون والتوفيق

أ. م. د. هادي عبيد البشر  
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استاذ المادة





**Q1. Complete the sentences with (my, our, your, his, her, their). Choose five only (20M)**

- 1- What's your name?. ..... Name's Annie.
- 2- What are ..... names?. Our names are Emma and Vince.
- 3- Ali and Ahmed are students. .... school is in Paris.
- 4- My sister is married. What's ..... husband name?
- 5- My brother's office is in New York. What's ..... job.
- 6- We're in ..... English class.
- 7- Mum and Dad are in Rome. What's the name of ..... hotel.

**Q2. Choose the correct sentence. (20M)**

1-(a)Live in Abu Dhabi?

(b)Do you live in Abu Dhabi?

2-(a) Where do you come from?

(b)Where you come from?

3- (a) I don't speak Chinese.

(b) I no speak Chinese.

4- (a) Do you like football? Yes, I do

(b) Do you like football? Yes, I like

5- (a)He's a engineer.

(b)He's an engineer.

**Q3. Complete the sentences. Use have or has. Choose five only (20M)**

- 1- My parents ..... a house in the country.
- 2- My wife ..... a Japanese car.
- 3- My sister and I ..... a cat.
- 4- You ..... a very nice family.
- 5- Our school ..... fifteen classrooms.
- 6- We ..... English classes in the morning.

**Q4. A/ State whether each of these sentences is true or false. Choose five only (10 M)**


- 1- In hand writing a vector can be represented by any letter.
- 2- All scalar quantities have magnitudes.
- 3- Speed is a vector quantity.
- 4- Just as scalars can be added by simple arithmetic addition so can all vectors.
- 5- All vector quantities have magnitudes.
- 6- A mass of 7 kg and a length 4.3 cm are examples of vectors.

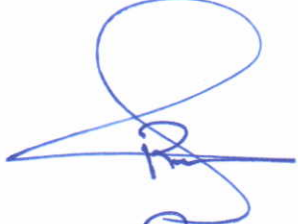
**B/ Give an equivalent meaning for the following words. Choose five only (10M).**

acceleration, perpendicular, in terms of, with regard to, defect, a brittle material.

**Q5. Answer the following questions. Choose five only (20 M)**

- 1- What does Hooke's law state?
- 2- What does the amount of deformation depend upon?
- 3- How can stress be expressed?
- 4- What will a plastic deformation retain after the removal of the applied load?
- 5- How is the hardness of a material described?
- 6- What are the three basic kinds of stress and strain?

  
د. محمد غالب حسن  
م/ رئيس قسم الميكانيك

  
Rwaa Alaa



**Note:** Answer All questions

**Q1:** Define (five) of the following:

(15 marks)

1-Machining.  
4- Milling Operation

2- Butt joint.  
5- Flux.

3- Redrawing.  
6- Deep Drawing

**Q2:** Draw and mark carefully (two )of the following:

(10 marks)

- A) Cavities in welding.
- B) Turning process .
- C) Cracks in welding.

**Q3:** Answer in details all of the following :

(15 marks)

- 1- What are the defects in Rolling.
- 2- What are the kinds of motion are given to the drill.
- 3- What are the kinds of Deep Drawing defects mansion three only.

**Q4:** Chose the correct answer (five only).

(15 marks)

- 1- In Turning the movement of the tool cutting edge is called :
  - a) depth of cut.
  - b) feed rate.
  - c) cutting speed.
  - d) Carriage.
- 2- In grinding the material that used to hold abrasive particles in place is called :
  - a) abrasive material
  - b) flux material
  - c) bonding material
  - d) filler material
- 3- Hexagonal bars, channels, H and I beams and special sections like rail sections are produced by :
  - a) rolling
  - b) turning
  - c) milling
  - d) deep drawing
- 4- Metallic or non-metallic solid material particles entrapped in the weld metal is non as :
  - a) cavities
  - b) imperfect fusion
  - c) incomplete fusion
  - d) solid inclusions
- 5- The most common flux in oxy-acetylene welding is:
  - a) borax
  - b) inert gas.
  - c) acetylene.
  - d)oxide.
- 6- Liner motion in drilling is called as :
  - a) rotary motion
  - b) cutting motion
  - c) feed
  - d) main motion

**Q5:** Answer both of the following:

(15 marks)

- A) A strip of 20 mm thick and a 350 mm wide is fed through a rolling mill with two powered rolls each of radius = 200 mm , at a roll speed 50 rev/min .and the coefficient of friction between the rolls and the work is 0.13 , if  $\sigma = 22 \text{ N/mm}^2$  find roll force , torque, power.
- B) What are the types of gas flames in oxy-acetylene welding ?





The final exam for the academic year 2017 -2018

Note: Answer four questions only

Q1: Answer only one branch;

(25 Mark)

- a- The winding of a motor has a resistance of  $80\Omega$  at a temperature of  $10^\circ\text{C}$ . After operating for several hours the resistance is measured to be  $100\Omega$ . Determine the steady state operating temperature of the winding. Take the temperature coefficient of resistance to be  $0.004$  per  $^\circ\text{C}$ .
- b- A  $6.6\text{ k}\Omega$  resistor has a tolerance of  $5\%$ . what are the color bands on the body of this resistor, use the table below?

| First, second and third band |     | Fourth band (% tolerance) |      |
|------------------------------|-----|---------------------------|------|
| black                        | = 0 | gold                      | = 5  |
| brown                        | = 1 | silver                    | = 10 |
| red                          | = 2 | none                      | = 20 |
| orange                       | = 3 |                           |      |
| yellow                       | = 4 |                           |      |
| green                        | = 5 |                           |      |
| blue                         | = 6 |                           |      |
| violet                       | = 7 |                           |      |
| grey                         | = 8 |                           |      |
| white                        | = 9 |                           |      |

Q2 Calculate equivalent resistance in the circuit of Fig. (1).

; (25 Mark)

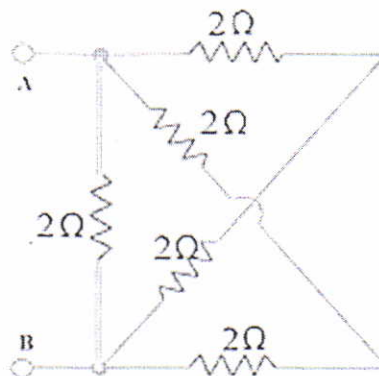


Fig. (1)

Q3: Use KVL & KCL to determine the current flowing in the resistor R in the circuit of Fig (2) :- (25 Mark)

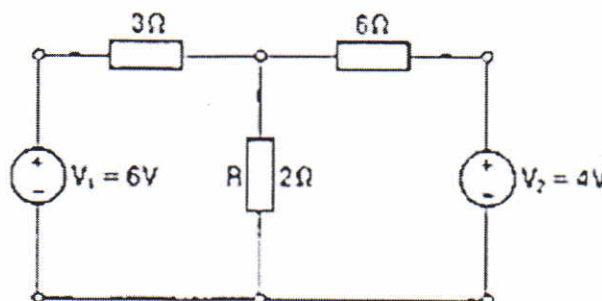


Fig. (2)

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Q4 : Use (DELTA-STAR TRANSFORMATION) to determine the resistance between A and B in the circuit of fig. (3). (25 Mark)

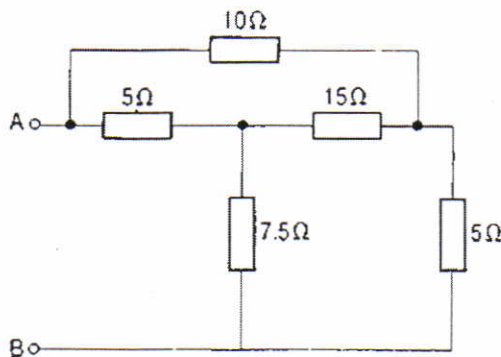


Fig. (3)

Q5: Use Maxwell's loop current Method to determine (value & direction ) the current supplied by each battery in the circuit of Fig. (4) :- (25 Mark)

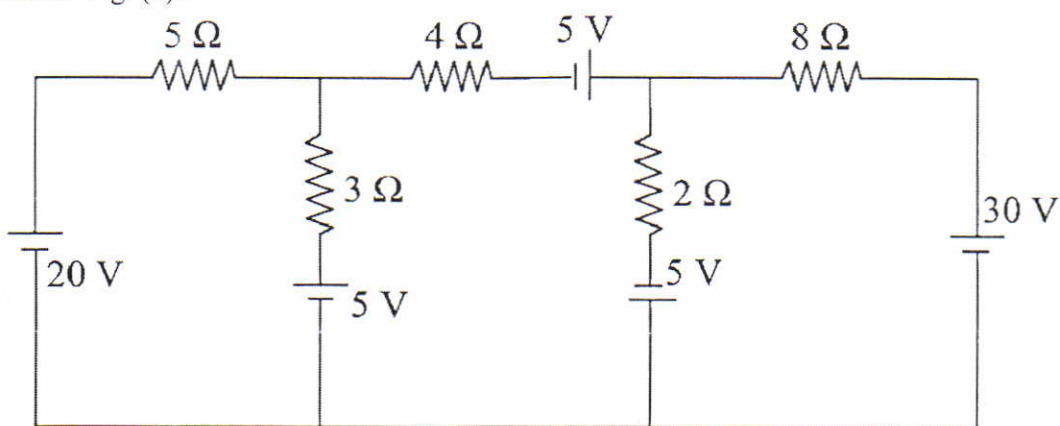


Fig. (4)

Good Luck

*Lecturer*  
Abdulkareem Sh. Alazawi

*Head of Dept.*  
A. Ph. D HADY ALBAGHER  
د. هادي العناب  
رئيس قسم الميكانيك



**Q1:** Use the Newton Raphson method to estimate the root of the function  $e^{-x} = x$ , employing initial value of  $X_{old} = 0.0$ . Write visual Basic code to compute the root  $X_{new}$ . Print the value of  $X_{new}$  when the value of  $|X_{new} - X_{old}| \leq 0.0001$ . Design the form with two text box and one command button.

Note:  $X_{new} = X_{old} - \frac{f(X_{old})}{f'(X_{old})}$

**Q2: Execute 8 of the following 10 points:**

1- What are the differences between the values of the following numerical variables?

Dim A as Date  
Dim C as Single

Dim B as Variant  
Dim D as Boolean

2- What is the error in each of the following VB sentences?

a) Dim (Sa#2) As data  
c) Dim my.name As long

b) Dim Num two As single  
d) Dim 2<sup>nd</sup> As string

3- Mention two arithmetic, two Comparison operators and two logical operators.

4- Write the result (number) of each of the following VB coding segments:

a)  $(3-3^3)/((3^2+3^3)/3^5)/3^4$       b)  $4E-8/2*5E8/6E16*4E14*3=$       c)  $5 \text{ Mod } 3=$

5- If (B=YOUR PICTURE), what will be value of C, D and E if C=Left(B, 4), and D=Mid(B,5) .

6- Convert the following arithmetic formula to visual Basic language.

a)  $\frac{c^2 + 7 \log(c)}{1 + \ln(c)}$

b)  $\sqrt{\frac{\tan(60) + \log(3)}{\cos(20) + e^4}}$

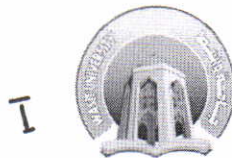
c)  $\frac{-b + \sqrt{b^2 - 4 * a * c}}{2 * a}$

7- Write the VB code to print the odd numbers between 1 and 8

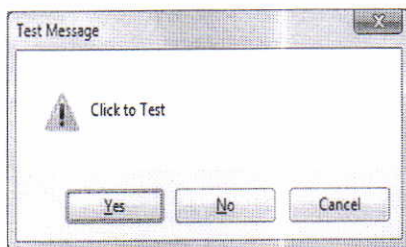
رئيس القسم

مدرس المادة  
م.م. حسن سادة محسن

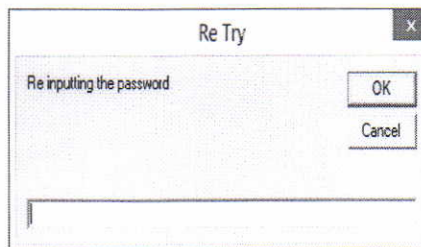




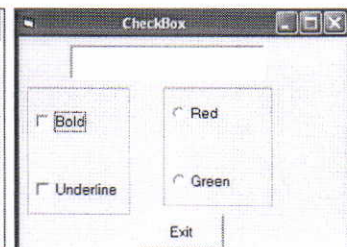
- 8- Write the VB code to display the message in **Figure 1**.
- 9- Design the input box (**Figure 2**) "at run time".
- 10- Write the VB code to implement the program below (**Figure 3**) if check box or option box are selected to change the text properties.



**Figure 1**



**Figure 2**



**Figure 3**

**Q3:** Write visual basic coding segment to enter the value of variable (Grade). Find the grade using **If-Block statement** and display the value of grade in a text box. When the value of variable (Grade) exceed 100, write a Message Box (Wrong entry, please Re-enter the Grade). Design form window and select all the control objects are used.

**Q4: answer either (A) or (B)**

**(A)** Create a Visual Basic project to enter an angle value (Degree, Minutes, and Seconds) into separate text boxes Design the program to find the value of angle (in degree only) as the following equation. Display Angle in separate text box.

$$\text{Angle} = \text{Degree} + (\text{Minutes}/60) + (\text{Seconds}/3600)$$

**(B)** Design a form and write code to find the summation of even numbers (from 2 to 80).



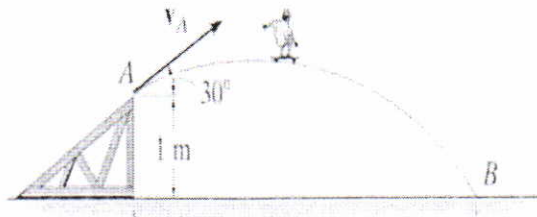
Final Examination 2018-2019 (1<sup>st</sup> Semester)

Answer all questions. Each question carries 20 marks.

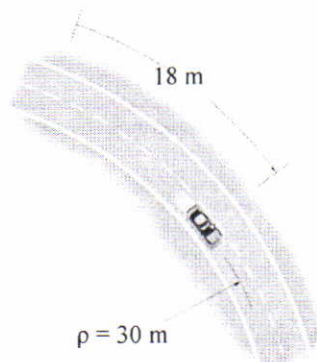
الكلية الهندسية

**Q1** A car is traveling at 15m/s, when the traffic light 50 m ahead turns yellow. Determine the required constant deceleration of the car and the time needed to stop the car at the light.

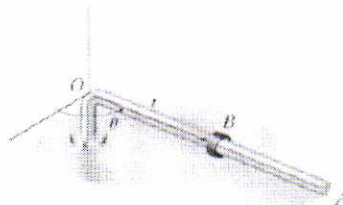
**Q2** The skateboard rider leaves the ramp at A with an initial velocity  $v_A$  at a  $30^\circ$  angle. If he strikes the ground at B, determine  $v_A$  and the time of flight. (Note: The horizontal distance between A and B is 5m)



**Q3** The car travels along the circular path such that its speed is increased by  $a_t = (0.5e^t) \text{ m/s}^2$ , where  $t$  is in seconds. Determine the magnitudes of its velocity and acceleration after the car has traveled  $s = 18 \text{ m}$  starting from rest. Neglect the size of the car.

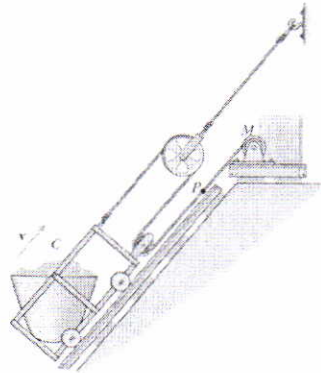


**Q4** The rod OA in the figure rotates in the horizontal plane such that  $\theta = (t^3) \text{ rad}$ . At the same time, the collar B is sliding outward along OA so that  $r = (100t^2) \text{ mm}$ . If in both cases  $t$  is in seconds, determine the velocity and acceleration of the collar when  $t = 1 \text{ s}$ .



*"Please turn the page"*

**Q5** The mine car C is being pulled up the incline using the motor M and the rope-and-pulley arrangement shown. Determine the speed  $v_p$  at which a point P on the cable must be traveling toward the motor to move the car up the plane with a constant speed of  $v = 2$  m/s.



  
Head of Department

*"Best of luck for exam"*

  
Dr. Anwer J. AlObaidi



**Wasit University/ Engineering College**  
**Mechanical Engineering Department**

**Exam: 1<sup>st</sup> semester**

**Class: 4<sup>th</sup>**

**Examiner: Dr. B. M. Faisal**



**Subject: Design of machine systems**

**Date: 30 / 1 / 2018**

**Time: 2 Hours**

**Note: 1- Using the sheets of rules and tables is allowed.**

**2- Answer only three questions.**

**Q1) Choose the correct answer:**

**(5 Marks)**

- i-** Multiple threads are used to secure
  - (a) low efficiency
  - (b) high efficiency
  - (c) high load lifting capacity
  - (d) high mechanical advantage
- ii-** A screw is said to be over hauling screw, if its efficiency is
  - (a) less than 50%
  - (b) more than 50%
  - (c) equal to 50%
  - (d) none of these
- iii-** All stresses produced in a belt are
  - (a) compressive stresses
  - (b) tensile stresses
  - (c) both tensile and compressive stresses
  - (d) shear stresses
- iv-** The power transmitted by means of a belt depends upon
  - (a) tension under which the belt is placed on the pulleys
  - (b) velocity of the belt
  - (c) arc of contact between the belt and the smaller pulley
  - (d) all of the above
- v-** The wire ropes make contact at
  - (a) anywhere in the groove of the pulley
  - (b) sides of groove of the pulley
  - (c) sides and bottom of groove of the pulley
  - (d) bottom of groove of the pulley
- vi-** The V-belts are particularly suitable for ..... drives.      (a) short      (b) long
- vii-** Which one of the following is a positive drive?
  - (a) Crossed flat belt drive
  - (b) Rope drive
  - (c) V-belt drive
  - (d) Chain drive
- viii-** The chain drive transmits ..... power as compared to belt drive.      (a) more      (b) less
- ix-** The speed of the sprocket reduces as the chain pitch ..... for a given number of teeth.
  - (a) increases
  - (b) decreases
- x-** A screw is said to be self-locking screw, if its efficiency is
  - (a) less than 50%
  - (b) more than 50%
  - (c) equal to 50%
  - (d) none of these

**Q2) Design a roller chain drive to transmit power of 30 kW between two shafts. The system operates for 24 hr/day. The speed of the small and large sprockets are 700 and 350 r.p.m.. The center distance is 40 times the pitch and correct for 5mm. **(5 Marks)****

**Q3) Design a standard hosting wire rope in oil well drilling under normal working from grade 180 to slings a load of 20 kN for 150 m. Use  $E_r = 90 \text{ kN/mm}^2$ . **(5 Marks)****

- Q4)** The cutter of a broaching machine is pulled by square threaded screw of 55 mm external diameter and 10 mm pitch. The operating nut takes the axial load of 400 N on a flat surface of 60 mm and 90 mm internal and external diameters respectively. If the coefficient of friction is 0.15 for all contact surfaces on the nut, determine the power required to rotate the operating nut when the cutting speed is 6 m/min. Also find the efficiency of the screw and the percentage of power change for changing the inclined angle with 10%. **(5 Marks)**

**Good Luck**



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