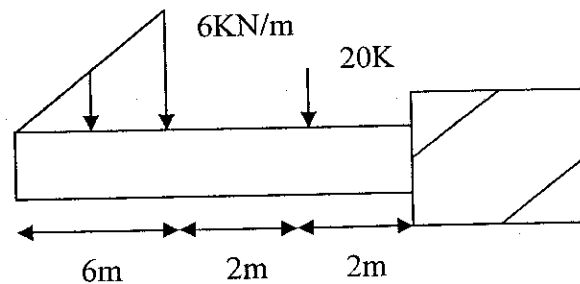




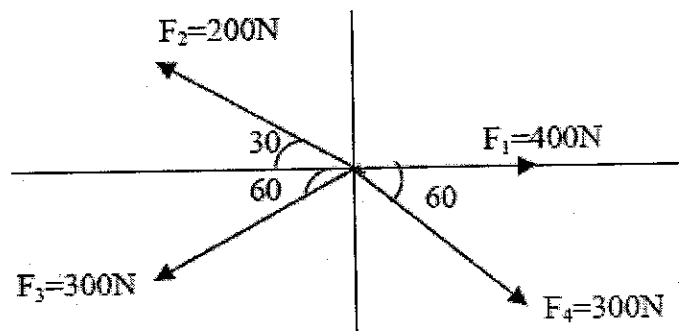
Note: Answer four questions only.

ملاحظة / توزع الدرجات بالساعات
هذا صيغة المسئلة

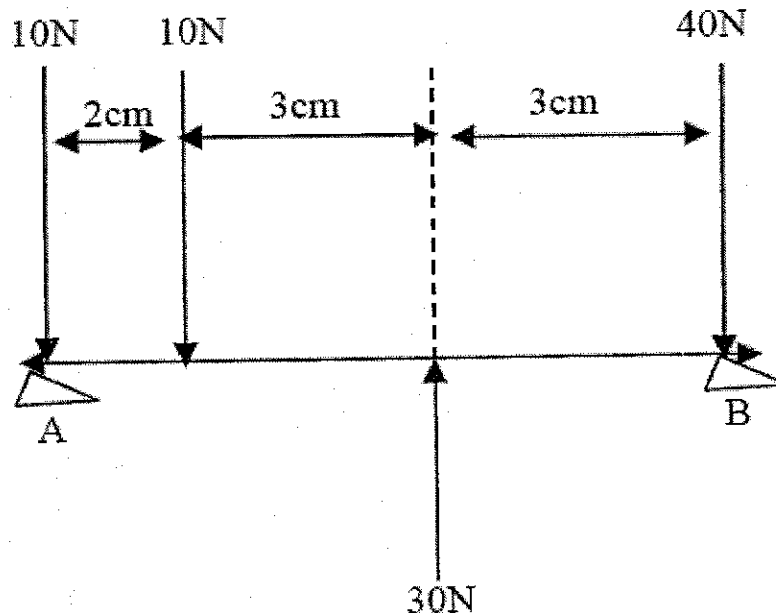
Q1: (A) Write shear and bending moment equations, and draw shear and bending moment diagram for the following figure.



Q1: (B) Determine the resultant for multi force and its direction.



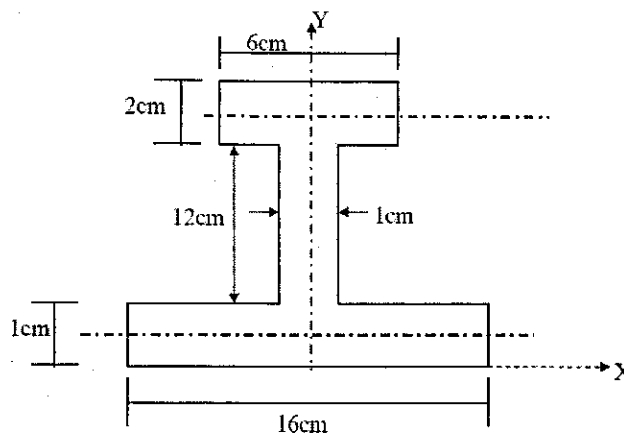
Q2: (A) Determined the resultant of the parallel force system acting on the bar AB.



Q2: (B) Explain the theory of friction.

Q3: (A) A block rests on a plane inclined to the horizontal at (15°) , $\mu=0.3$. The least force parallel to the line of greatest slope which will just move the block down the plane is (5N). Find the weight of the block and the least force acting parallel to line of greatest slope and which will just move the block up the plane.

Q3: (B) Find the position of the center of gravity (c.g.) of the section shown in figure:



Q4: (A) Show that when a thin walled spherical vessel of diameter (d) and thickness (t) is subjected to an internal fluid pressure (P), the increase in volume (δv) is equal to this term:

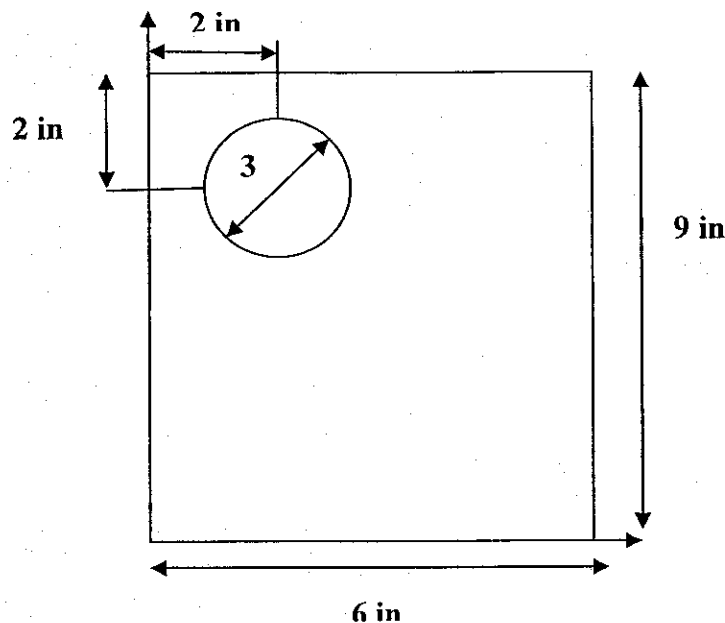
$$\frac{\pi \cdot d^3 \cdot p}{8 \cdot t \cdot E} (1 - \nu)$$

Q4: (B) Define each of the following:

1. Rigid bodies. 2. Static's. 3. Resultant. 4. Moment of a Force. 5. Friction.

Q5: (A) A solid wire of (6mm) diameter and length (150 m) supporting a load of (1 KN) to lifted from the bottom end of the wire. The density of wire material is ($7.7 \times 10^4 \text{ N/m}^3$) and modulus of elasticity (E) = 200 GN/m². Calculate the total elongation.

Q5: (B) Determine the moment of inertia of the shaded area about the (x-axis).



Good Luck



Note: Answer All questions

Q1: Read the following passage and answer (Seven) questions only:

Because chemical plant equipment is so different from that used in the laboratory, one of the major jobs of R&D engineers is to decide what kinds of equipment must be used to carry out a commercial chemical process. They also determine the sizes of equipment needed. Before designing the full-sized plant, the R&D engineer usually constructs a pilot plant, actually a small model of the final plant, containing small versions of the equipment. Pilot plants are particularly useful when designing continuous process plants which are so different from the research laboratory. A continuous process pilot plant will usually run twenty four hours a day with three or four groups of operators and engineers, each group working for eight hours. This is called shift work, and each group is called a shift. Most often, shifts work from 8 a.m. to 4 p.m., 4 p.m. to midnight, and midnight to 8 a.m. A fourth shift is needed if the plant is to run during weekends, although many pilot plants shut down at that time. This arrangement makes pilot plant experimentation unattractive to many chemical engineers who prefer to work during the day and leave the evening and night shifts to specially trained operators. However, a pilot plant is often complicated that engineers are required on all shifts.

Since the basic purpose of the pilot plant is to gather information, there are frequent changes of flowrates, pressures, and temperatures. R & D engineers are always looking for that combination of conditions that will enable them to produce the maximum amount of product at the minimum price. As information is gathered, it is passed along to the company's management. This may be done by memoranda and telephone calls but in most companies, once a month, the R & D engineers write all they have learned during the past month in a progress report. These become their main record of accomplishment. The purpose of R & D is to gather information: since a company's management judges R & D engineers by the reports they submit, a great deal of work goes into the reports' preparation. When the research and development project is completed, information on the various progress reports is consolidated into a final report that details everything learned during the research. This final report is invaluable to the process design engineers who will design the full-scale plant.

There is one thing about R & D that many engineers find frustrating: a project is seldom finished. As with all research, there are always more ideas than time or manpower. Eventually, the work must end, even get into full-scale production. The decision to end a project is usually made by the head of the research laboratories in consultation with the executives of the company.

1. What is the major job of R&D engineers?
2. When are pilot plants particularly useful?
3. What are the usual time period for each shift?
4. Why is pilot plant work unattractive to some engineers?
5. What do chemical engineers look for when running a pilot plant?
6. How do R & D engineers pass on information to a company management?
7. Why do many engineers find R&D frustrating?
8. Who usually decides when a research project should be ended? (14 Marks)

Q2: Define **(Five)** of the following:

- 1.Raw material; 2.Feasibility Study; 3.Process Design; 4. Flowsheet;
- 5.Heat Exchanger; 6.Flowmeter.

(10 Marks)

Q3: Put the verbs in brackets in the correct tense: **(Answer Ten only)**

- 1.My cousin (study) medicine in Baghdad next year.
- 2.Mr Brown normally (open) his shop at nine.
- 3.It (be) cold since yesterday.
- 4.Suha (not do) her duty yet.
5. The next plane for Basrah (leave) tomorrow.
- 6.I usually (take) my lunch at home.
- 7.How often you (speak) to him recently.
- 8.He (find) his lost watch ten minutes ago.
- 9.Your brother (get) a job yet?
- 10.How long ago you (arrive) here?
- 11.We (have) a holiday next week.

(10 Marks)

Q4: Choose the right answer **(Answer Five only)** :

- 1.My uncle ---- for Jeddah last Monday. a.leaves; b.will leave; c.left; d.is leaving.
2. I just ---- him about it. a.tell; b.have told. c.telling; d.tells.
- 3.Mother ---- some meat already. a.buys; b.will buy; c. has bought; d.buy.
4. ---- you listen to the news on the radio last night? a.were; b.do; c.did; d.have.
- 5.I haven't written to my cousin ----. a.three months ago; b.since three months; c.before three months; d.for three months.

(5 Marks)

Q5:Fill in the blanks with the following preposition **(Answer Five only)** :

(on , to , at , in , by , from , with , between , for , of)

- 1.We wear thick clothes ---- winter.
- 2.It gets hot ---- July.
- 3.Look ---- this picture.
- 4.We went to the station ---- taxi.
- 5.He was sitting ----- the table.
- 6.Please listen ----- me.

(5 Marks)

Q6: Punctuate the following putting in capitals where necessary **(Answer Eight Only)**

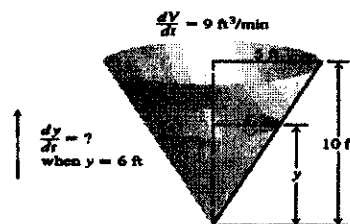
- 1.he visited babylon on a sunday morning in march
- 2.i said to yousif when did ali leave for kuwait
- 3.friday is a holiday in iraq
- 4.selma said i know where ahmad lives
- 5.i met mr browns son in london last september
- 6.mr john said ive had a pleasant walk along the river euphrates
- 7.bahrain and saudi arabia lie in asia while libya and tunisia are in africa
- 8.lets go to the iraqi museum next thursday
- 9.when we finish our work they said well leave for beirut

(16 Marks)



Note: Answer five questions only.

- Q.1 (a):** Water runs into a conical tank at the rate of $(9 \text{ ft}^3/\text{min})$. The tank stands point down and has a height of (10 ft) and a base radius of (5 ft) . How fast is the water level rising when the water is (6 ft) deep?



- (b):** Let $z_1 = 1 + i$ and $z_2 = \sqrt{3} - i$. Find $z_1 z_2$, $\arg(z_1 z_2)$, and $|z_1 z_2|$.

- Q.2 (a):** The region bounded by the parabola $y = x^2$ and the line $y = 2x$ in the first quadrant is revolved about the y-axis to generate a solid. Find the volume of the solid.

- (b):** Solve the equations (Using Cramer's Rule):

$$x + y + z = 12$$

$$z - x + 1 = 5$$

$$y + 2x - 3z = -10$$

- Q.3 (a):** Solve the Integrals 1. $\int \frac{1}{2 + \sin x} dx$ 2. $\int \frac{1 - x + x^2 - x^3}{x(x^2 + 1)^2} dx$ 3. $\int x \sec^{-1} x dx$

- (b):** Show that the point $(2, 4)$ lies on the curve $x^3 + y^3 - 9xy = 0$. Then find the tangent and normal to the curve.

- Q.4 (a):** Evaluate the Integrals 1. $\int \frac{x+1}{x^2 - 4x + 8} dx$ 2. $\int \frac{2x dx}{\sqrt{x^2 + 1}}$ 3. $\int_{-\pi/2}^{\pi/2} \frac{4 \cos \theta}{3 + 2 \sin \theta} d\theta$

- (b):** Express $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ in term of r and s if $w = x + 2y + z^2$, $x = \frac{r}{s}$, $y = r^2 + \ln s$.
 $z = 2r$

- Q.5 (a):** Find the length of the curve $y = (x/2)^{2/3}$, $0 \leq x \leq 2$.

- (b):** Sketch the curve with polar equation $r = 1 - \cos \theta$, then find the Cartesian equation for the curve.

- Q.6 (a):** Find the inverse function $f(x) = \frac{a + bx}{c + dx}$ and check the results a, b, c and d are constants.

- (b):** Find the limits 1. $\lim_{x \rightarrow 0} (1 - x^2)^{-1/x^2}$ 2. $\lim_{x \rightarrow 0} \frac{\cot(2x)}{\csc(x)}$
3. $\lim_{x \rightarrow \infty} \frac{5x^2 - 3x}{7x^2 + 1}$ 4. $\lim_{x \rightarrow 1} x^{(\frac{1}{x-1})}$

GOOD LUCK

$$\sinh^{-1} x = \ln(x + \sqrt{x^2 + 1})$$

$$\cosh^{-1} x = \ln(x + \sqrt{x^2 - 1})$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\sec^2 \theta = 1 + \tan^2 \theta$$

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta$$

$$\cos^2 \theta = \frac{1 + \cos 2\theta}{2}$$

$$\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\frac{d(\sin^{-1} u)}{dx} = \frac{du/dx}{\sqrt{1-u^2}} \quad -1 < u < 1$$

$$\frac{d(\tan^{-1} u)}{dx} = \frac{du/dx}{1+u^2}$$

$$\frac{d(\sec^{-1} u)}{dx} = \frac{du/dx}{|u|\sqrt{u^2-1}} \quad |u| > 1$$

$$\frac{d(\cos^{-1} u)}{dx} = -\frac{du/dx}{\sqrt{1-u^2}}$$

$$\frac{d(\csc^{-1} u)}{dx} = -\frac{du/dx}{|u|\sqrt{u^2-1}} \quad |u| > 1$$

$$\frac{d(\cot^{-1} u)}{dx} = -\frac{du/dx}{1+u^2}$$

$$\int \frac{du}{\sqrt{1+u^2}} = \sinh^{-1} u + C$$

$$\int \frac{du}{\sqrt{u^2-1}} = \cosh^{-1} u + C$$

$$\int \frac{du}{u\sqrt{1-u^2}} = -\operatorname{sech}^{-1}|u| + C$$

$$\int \frac{du}{u\sqrt{1+u^2}} = -\operatorname{csc} h^{-1}|u| + C$$

$$\int \frac{du}{1-u^2} = \begin{cases} \tanh^{-1} u + C & \text{if } |u| < 1 \\ \coth^{-1} u + C & \text{if } |u| > 1 \end{cases}$$

Follow

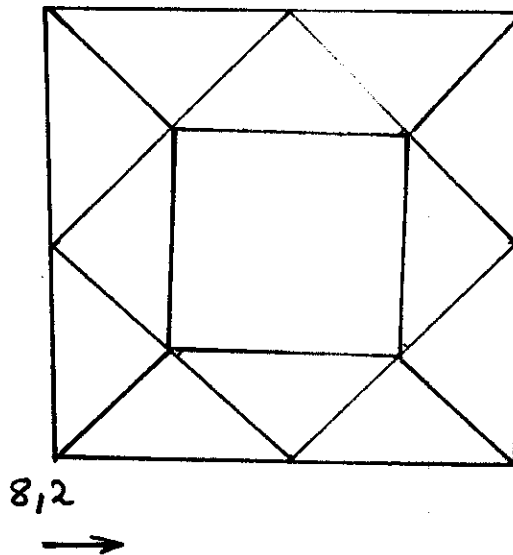
Q5/ (a) Define the followings :

Carbon copy , Hide layer , Pan Realtime , Slide pane , Base line , Print layout .

(b) Briefly describe the methods of producing arcs ?

(c) What is a "Hardware " consist of ?

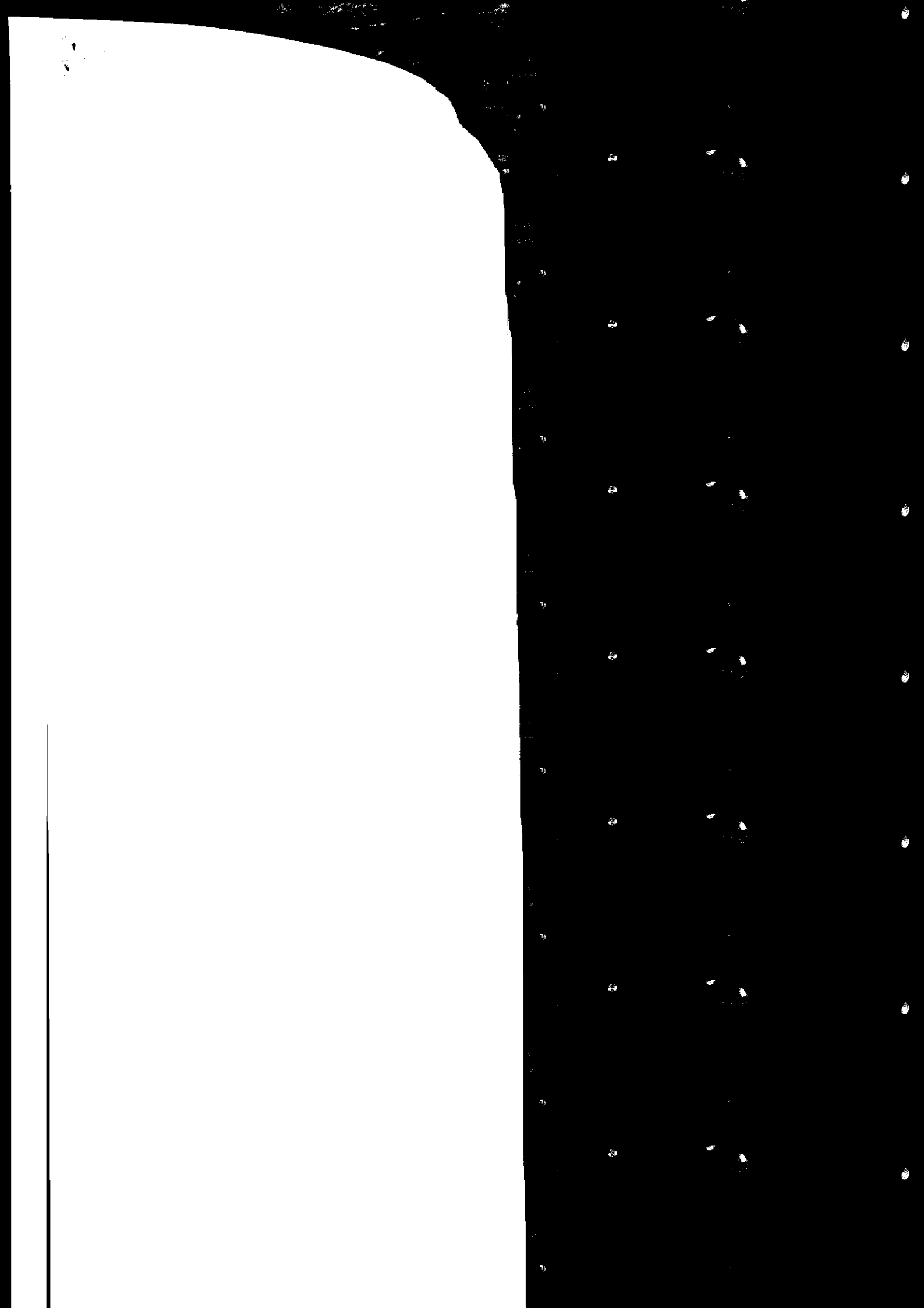
Q6/ (a) Write down main steps to draw the square (length = 5) using Auto CAD program and absolute coordinate



(b) In what pull – down menu is the following commands found ?
Toolbars , Layer , Circle , Leader .

(c) Give the full name for the expressions :
CPU , www , CAD , Ttr

GOOD LUCK





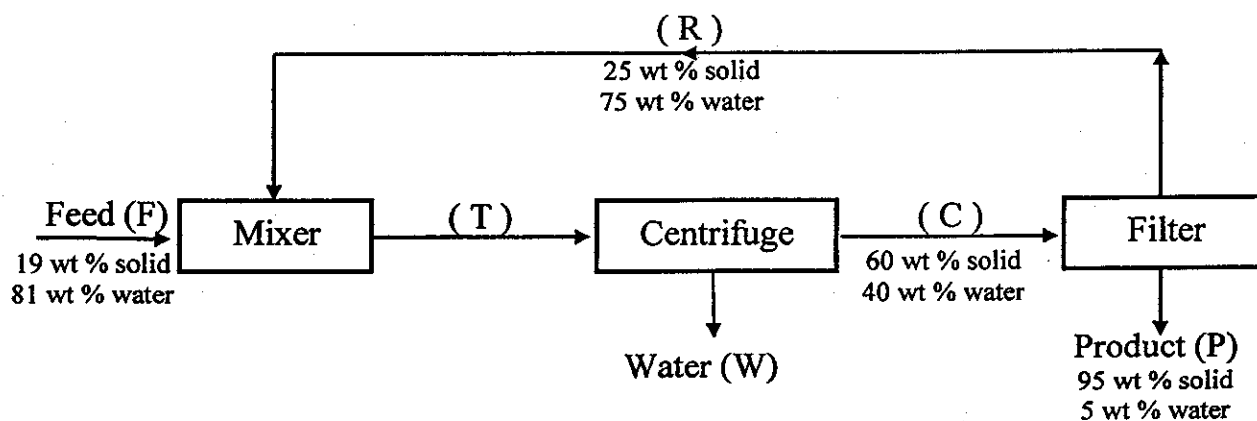
Note: Answer four questions only.

Q1: Fill the following blanks:

- 1- Viscosity can be expressed in terms of dimensions as
- 2- Degree is one of the practical scales of specific gravity which is specifically used in sugar industry. It's relation with spg for liquids heavier than water is
- 3- The significant figures of 0.0012651 is
- 4- Barometer is used to measure, whereas closed end manometer is used to measure
- 5- One liter of 20 ppm NaOH solution contains gm of NaOH.
- 6- One mole of ethanol (C_2H_5OH) contains gm atoms of hydrogen and gm of oxygen.
- 7- One mole of ideal gas occupies liters at standard conditions.
- 8- stream is used to prevent accumulation of inert material in the process.
- 9- Work and heat are known as functions, whereas ΔU and ΔH are functions.
- 10- The relationship between C_p and C_v for ideal gas is

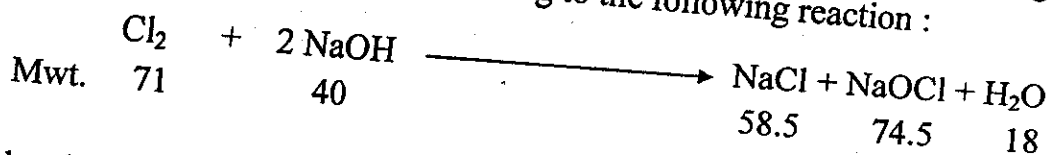
(15 Marks)

Q2: A suspension (F) consists of 19 wt% solid and 81 wt% water is continuously fed to the process consists of mixer, centrifuge and filter at a rate of 1000 kg/hr in order to obtain a product (P) containing 95 wt% solid as shown in the following flow diagram. Calculate the flow rates of streams W, P, C, R, T and composition as (wt%) of the total feed stream (T) with complete checking.



(15 Marks)

Q3: Sodium hypochlorite bleach (NaOCl) is manufactured by bubbling chlorine gas through caustic soda solution according to the following reaction :



A batch of 710 lb of chlorine gas is bubbled through 2500 lb of caustic soda solution containing 40 wt% NaOH so that 596 lb of NaOCl is produced. Calculate :

- The limiting reactant, the excess reactant and % excess.
- % conversion and % degree of completion.
- The mass of exit chlorine gas.
- The mass and composition of the aqueous reaction product.

Note: check the accuracy of calculation by computing total mass input and output.

(15 Marks)

Q4: A gaseous fuel consists of 70 mol % butane (C_4H_{10}) & 30 mol % N_2 at 30°C and 160 kPa is fed to the furnace through a pipe of 10 cm diameter at a rate of 300 mol / min. The fuel is completely burned with 20% excess air. Assuming ideal gaseous behavior, Calculate:

- Volumetric flow rate of the fuel in (m^3/min).
- Mass flow rate of the fuel in (kg/min).
- Velocity of the fuel in (m/sec).
- Moles of air input to the furnace per second.
- Orsat analysis of the flue gases.

Given that : $R = 8.314 \text{ kPa} \cdot \text{liter} / \text{mol} \cdot \text{K}$.

(15 Marks)

Q5:

A: Calculate the volume of the tank in (ft^3) that contains 9 lb moles of a mixture consists of 40 mol % propane and 60 mol % nitrogen at 40°C and absolute pressure of 74 atm using Kay's method (pseudocritical constants).

Given that : for propane, $P_c = 42.1 \text{ atm}$ and $T_c = 369.9 \text{ K}$.

for nitrogen, $P_c = 33.6 \text{ atm}$ and $T_c = 126 \text{ K}$.

$R = 0.73 \text{ atm} \cdot \text{ft}^3 / \text{lb mole K}$ $R = 1.3145 \text{ atm} \cdot \text{ft}^3 / \text{lb mole K}$.

(7 Marks)

B: Calculate the actual horsepower of the pump works with efficiency of 60 % that required to pump water from a well 5 m deep to a storage tank at a height of 50 m above the ground at a rate of 100 liter /min.

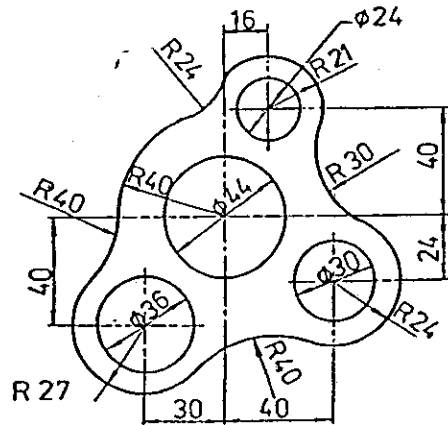
State the assumptions used in the solution.

Given that $1 \text{ hp} = 745.7 \text{ W} = 550 \text{ ft} \cdot \text{lb}_f / \text{sec}$.

(8 Marks)

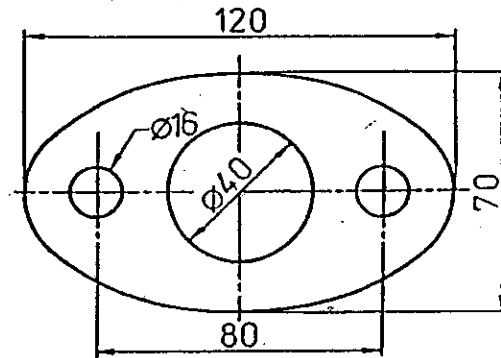


(١٥ درجة)

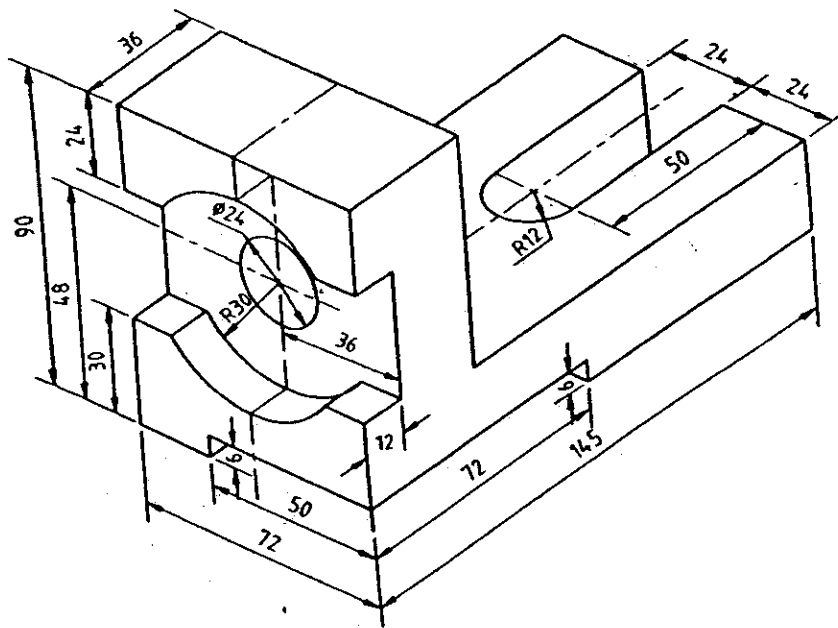


س ١/ ارسم لواء واحد مما يلي بنفس الابعاد مع وضع الابعاد.

ب-



(٣٥ درجة)



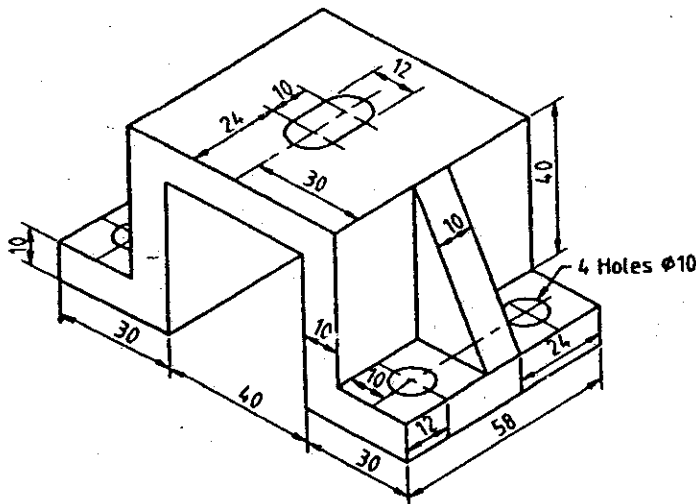
س ٢/ اجب عن احد الفرعين الاتيين

ا- ارسم لما يلي بنفس الابعاد

- ١- المقطع الامامي
- ٢- المسقط الجانبي
- ٣- المسقط العلوي

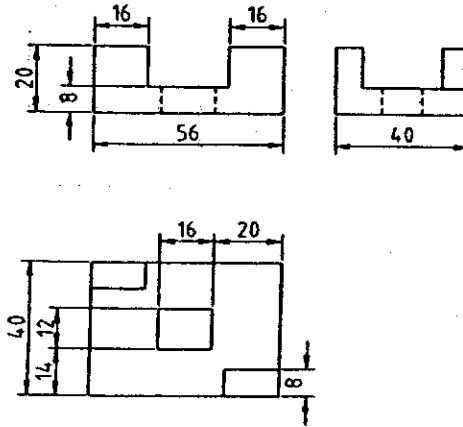
ب- ارسم لما يلي بنفس الابعاد

- ٤- المسقط الامامي نصف مقطوع
- ٥- المسقط الجانبي نصف مقطوع
- ٦- المسقط العلوي



س٣/ ارسم الشكل الايزومتري لما يلي بنفس الابعاد.

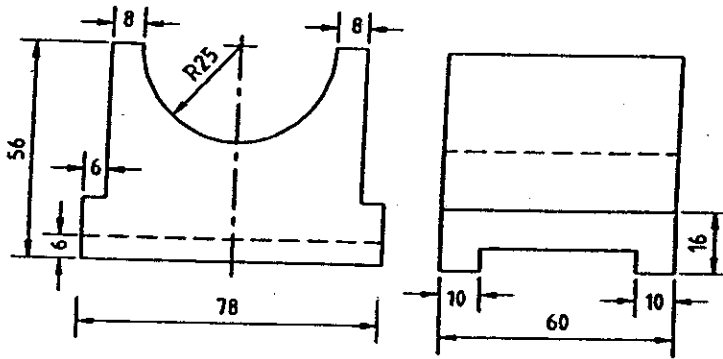
(٢٥ درجة)



(٢٥ درجة)

س٤/

- ا- استنتج المسقط العلوي
ب- اكتب خطوات رسم المسقط الامامي و المسقط العلوي ببرنامج (Auto CAD) باستخدام احدائيات (Relative Coordinate) فقط علما ان نقطة البداية هي (0,0)





Note: Answer 4 questions only.

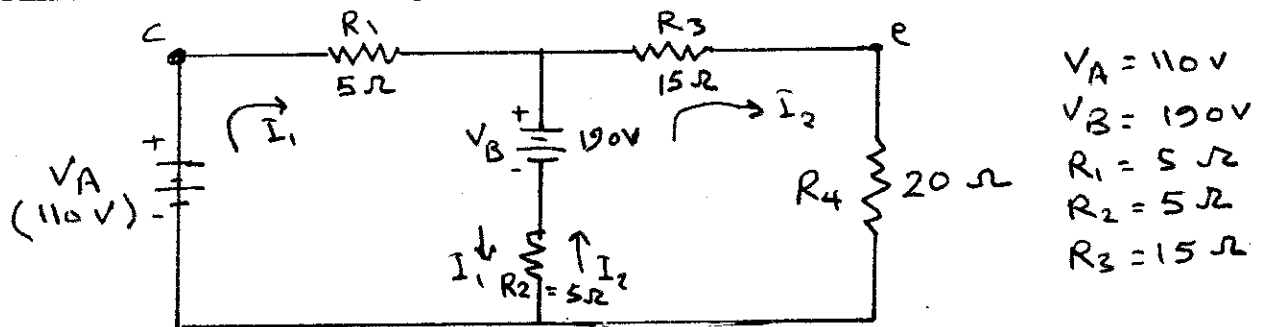
Q1-A: Explain with equations, two methods for resistor measurement (draw the circuit in each case). (13 Marks)

B: Define the resistance, resistor and explain the types of the resistors. (12 Marks)

Q2-A : A 5kVA transformer has a full-load secondary current rating of 50A. Copper loss at short circuit = 100W. If the resistance of the primary winding is 0.6Ω , find the resistance of secondary winding and power loss in the secondary. If the power factor PF of the load is 85% find the efficiency of the transformer at full load. (13 Marks)

B: A generator receives 7hp and supplies 20A at 220V. Find the power supplied by the generator and its efficiency. How much energy in kilowatthours is used in a week (6 day), if the generator in use 10 h/d (10 hour / day). find the total cost per week if the utility rate is 6 cent per kilowatthour? (12 Marks)

Q3-: Find all mesh current and voltage drops for the two mesh circuit shown in figure(1) (25 Marks)



Q4-A: If an ac-voltage has a peak value of 155.6 V. What is the phase angle at which the instantaneous voltage is 110V. If the peak current is 7A, find the power at the same phase angle. (12 Marks)

B: A series circuits contains a resistance of 20Ω and inductance of 10H connected a cross a voltage source of 110V. (13 Marks)

a-calculate the initial current

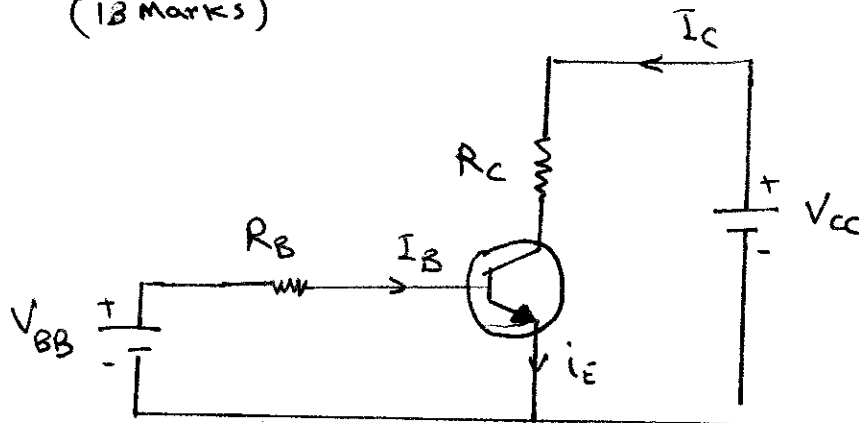
b-the current at 1 second after close the circuit

c-find V_R, V_L



Note: Answer 4 questions only.

Q5-A: Transistor has $\alpha=0.99$, Base current= $25 \mu\text{A}$. Find the collector current(I_C) and emitter current(I_E) (12 Marks)



B: explain the full wave rectification by 4 diodes(bridge rectifier network). Draw circuit and the shape of input and output signals (12 Marks)



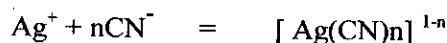
**Note: Answer four questions including question one
(25 Marks for each question)**

Q1. Fill each of the following blanks:

1. ----- is one of the optical methods used for analysis.
2. A one molal solution is the solution which contains 1 mole of solute per ----- of Solvent.
3. 1 ppm of zinc equal ----- M of zinc (M.wt. of Zn= 65.37).
4. ----- indicators which are useful for complexation titrations.
5. The solubility is often measured in units of -----.
6. In gasoline, the conversion of continuous-chain hydrocarbons into branching structures is called ----- process.
7. The dissociation of a large molecule into (n) units of monomer is called -----.
8. Maltose is one of -----.
9. Esters can be prepared by esterification from the reaction of fatty acids with -----.
10. Organic compounds are divided into classes or groups, the compounds of each class have the same -----.

(25 Marks)

Q2. A. Silver ion reacts with cyanide to form a complex with a formation constant of 7.1×10^{19}



Calculate the value of n in the balanced chemical equation if at equilibrium the molar Concentration of the complex was 1.25, that of silver ion was 3.5×10^{-8} , and that of Cyanide was 7×10^{-7}

(10 Marks)

B. Calculate the pH for the titration of 50ml of 0.1M NH_3 by the addition of 0ml, 25ml, 50ml and 55ml of 0.1M HCl. Given that K_b for ammonia = 1.75×10^{-5} .

(15 Marks)

Q3.

- A. Sodium hydroxide was added to 0.1M of acetic acid solution until the pH of the Solution was 6.0. Calculate the concentration of acetate ion and acetic acid in the Final solution. Given that K_a for acetic acid = 1.76×10^{-5}
- B. How many milliliters of concentrated sulfuric acid with specific gravity of 1.84 are required to prepare 500 milliliter of a 0.5M H_2SO_4 solution

M.wt. of $\text{H}_2\text{SO}_4 = 98$

(10 Marks)

Q4. A. Write the chemical equation with the catalyst (if present) for the preparation of the following compounds.

1. nonane from nonyl magnesium bromide
2. Octyl chloride from octanol.
3. Butyl amine from butanol.

(15 Marks)

B. Write the chemical structure of the following compounds.

a. Lactose, b. diethyl zinc, c. decane, d. methyl phenyl sulfide, e. butanal

(10 Marks)

Q5.

- A. Give the general chemical formula of the following compounds.
a. Polysaccharides, b. paraffins, c. ethers, d. tertiary amine, e. thioacid

(10 Marks)

B. Write the chemical equation of the following

1. Oxidation of naphthalene(in the presence of acid permanganate).
2. Sulphonation of benzene.
3. Chlorination of furan.

(15 Marks)





Note: Answer five questions only.

Q.1

(20 Mark)

(a): How rapidly will the fluid level inside a vertical cylindrical tank drop if we pump the fluid out at the rate of 3000 L/min.

(b): 1. Express $1-i$ in polar form .

2. Find $\frac{2-3i}{2+i}$

Q.2

(20 Mark)

(a): The region bounded by the curve $y=x^2+1$ and the line $y=-x+3$ is revolved about the x-axis to generate a solid. Find the volume of the solid by using Washer method.

(b): 1. Prove that

$$\frac{d}{dx}(\cos x) = -\sin x$$

2. For what value of B will

$$\begin{vmatrix} B & B & 1 \\ 2 & 0 & 5 \\ 6 & 7 & 1 \end{vmatrix} = 0$$

Q.3

(20 Mark)

(a): Solve the integrals

1. $\int \frac{2x^3-4x^2-x-3}{x^2-2x-3} dx$ 2. $\int \frac{x^2}{\sqrt{9-x^2}} dx$ 3. $\int \sec^3 x dx$

(b): Graph the two equations and find the points in which the graphs intersect,

$$y = \frac{1}{4}x^2, \quad y = (x-1)^2$$

Q.4

(20 Mark)

(a): Evaluate the Integrals

1. $\int \frac{e^{\sin^{-1}x}}{\sqrt{1-x^2}} dx$ 2. $\int 2e^{\theta} \cosh \theta d\theta$ 3. $\int_0^1 x^{2x}(1 + \ln x) dx$

(b): Find f_x & f_y if

$$f(x, y) = \frac{2y}{y + \cos x}$$

Q.5

(20 Mark)

(a): Find the area of the region enclosed by the parabola $y = 2 - x^2$ and the line $y = -x$

(b): Replace the following polar equations by equivalent Cartesian equations.

1. $r = 1 - \cos \theta$

2. $r = \frac{4}{2 \cos \theta - \sin \theta}$

Q.6

(20 Mark)

(a): Find $\frac{dy}{dx}$ if $y^2 = x^2 + \sin xy$.

(b): Use l'Hopital's Rule to find the limits

1. $\lim_{x \rightarrow 0} \frac{x(\cos x - 1)}{\sin x - x}$ 2. $\lim_{x \rightarrow \infty} \frac{\sqrt{9x+1}}{\sqrt{x+1}}$

GOOD LUCK

$$\sinh^{-1} x = \ln(x + \sqrt{x^2 + 1})$$

$$\cosh^{-1} x = \ln(x + \sqrt{x^2 - 1})$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\sec^2 \theta = 1 + \tan^2 \theta$$

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta$$

$$\cos^2 \theta = \frac{1 + \cos 2\theta}{2}$$

$$\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\frac{d(\sin^{-1} u)}{dx} = \frac{du/dx}{\sqrt{1-u^2}} \quad -1 < u < 1$$

$$\frac{d(\tan^{-1} u)}{dx} = \frac{du/dx}{1+u^2}$$

$$\frac{d(\sec^{-1} u)}{dx} = \frac{du/dx}{|u|\sqrt{u^2-1}} \quad |u| > 1$$

$$\frac{d(\cos^{-1} u)}{dx} = -\frac{du/dx}{\sqrt{1-u^2}}$$

$$\frac{d(\csc^{-1} u)}{dx} = -\frac{du/dx}{|u|\sqrt{u^2-1}} \quad |u| > 1$$

$$\frac{d(\cot^{-1} u)}{dx} = -\frac{du/dx}{1+u^2}$$

$$\int \frac{du}{\sqrt{1+u^2}} = \sinh^{-1} u + C$$

$$\int \frac{du}{\sqrt{u^2-1}} = \cosh^{-1} u + C$$

$$\int \frac{du}{u\sqrt{1-u^2}} = -\operatorname{sech}^{-1}|u| + C$$

$$\int \frac{du}{u\sqrt{1+u^2}} = -\operatorname{cosech}^{-1}|u| + C$$

$$\int \frac{du}{1-u^2} = \begin{cases} \tanh^{-1} u + C & \text{if } |u| < 1 \\ \coth^{-1} u + C & \text{if } |u| > 1 \end{cases}$$



Note: Answer 4 questions only.

Q1-A: Two resistors 20Ω and 100Ω are connected in parallel across $120V$, $60Hz$ ac-line (figure 1). Find the total resistance and the total power drawn by the circuit and the phasor diagram. (15 Marks)

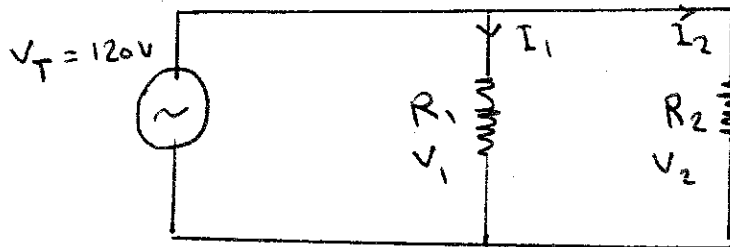


Figure-1

$$R_1 = 20 \Omega$$

$$R_2 = 100 \Omega$$

$$V_T = 120 V$$

B-: State the classification of measuring instruments (12 Mark)

Q2-A: A step down transformer with a turns ratio of $50\,000:500$ has its primary connected to ($20\,000 V$) transmission line. If the secondary is connected to a 20Ω load, Find : a-The secondary voltage b-the secondary current c-the primary current d-the power output (465) (13 Marks)

B: in the circuit shown in figure (2). Calculate R_x, I_x, I_1 (12 Mark)

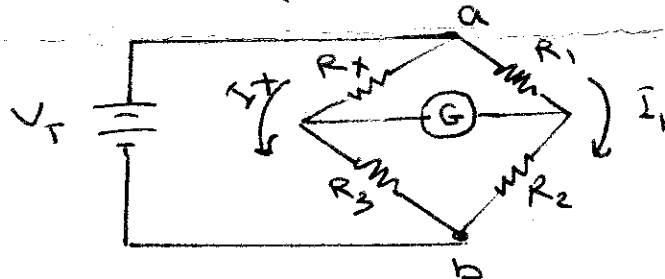
$$V_T = 11 V$$

$$R_1 = 1 K\Omega$$

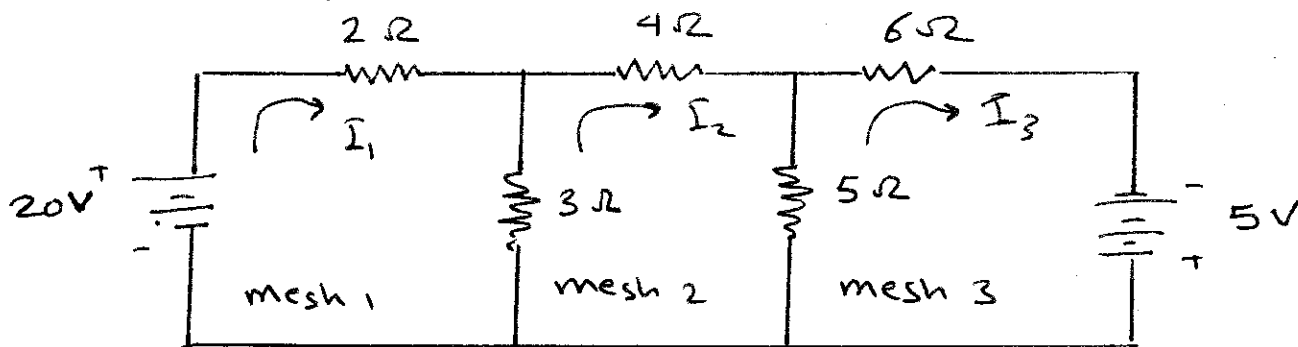
$$R_2 = 10 K\Omega$$

$$R_3 = 43 K\Omega$$

$$R_x = ?$$



Q3-Write the mesh equations for three mesh circuit shown in figure(3) 25 Marks

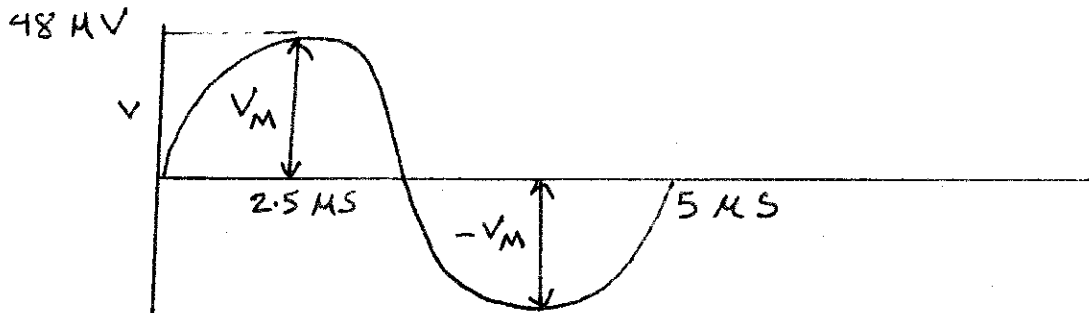




Note: Answer 4 questions only.

Q4-A: find V , period T , frequency f , and peak to peak voltage of voltage of the voltage waveform shown in figure (4)

(2.5 Marks)

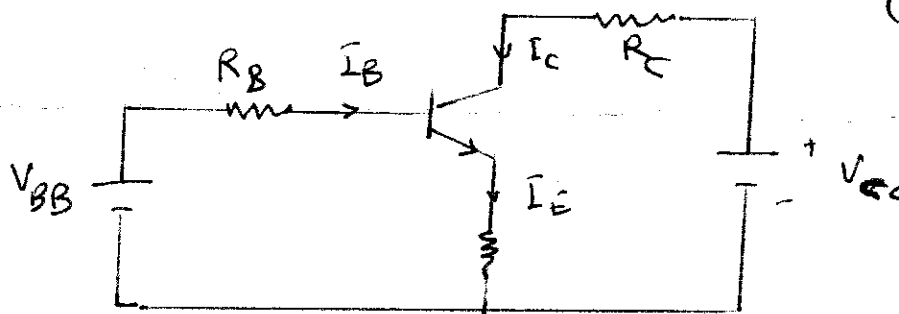


B-Give the properties of electric insulator materials

(2 Marks)

Q5-A: in transistor shown in figure(5). $\beta=100$, $I_B=40 \mu A$, $V_{CC}=15V$, $R_C=3000\Omega$. Find I_E , V_{CE} , if R_C changed to 6000Ω find V_{CE}

(13 Marks)



B-Define rectification and explain the method of rectification by 2 diodes(full wave rectifier). Draw the circuit and the signal in and signal out

(12 Marks)



Note: Answer four questions only.

- 1- Determine the moment of inertia of the area shown in Fig. (1) W.R.T. It's centroidal axis.

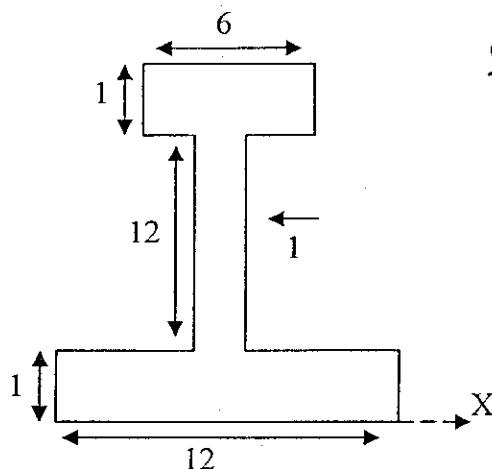


Fig. (1)

ملاحظة / توزيع الدرجات بالساعات
بجميع الأسئلة

2. The resultant of the concurrent forces shown in fig. (2) Is (300) N pointing up along the y-axis , compute the values of (F) and (θ) required to give this resultant.

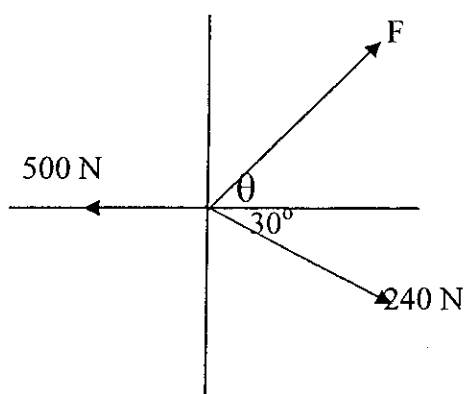


Fig. (2)

3. A (26) m ladder weight (50) kg_f is placed against a smooth vertical wall its lower end (10) m from the wall. The coefficient of friction between the ladder and the floor is (0.3). Determine the friction force at (A) acting on the ladder. The mass center of ladder is assumed to be at its mid point.

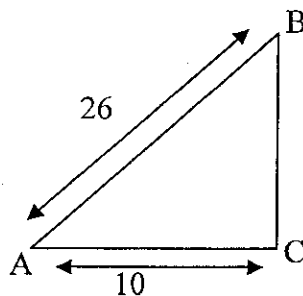


Fig. (3)

4. Calculate the total elongation caused by the weight of the body.

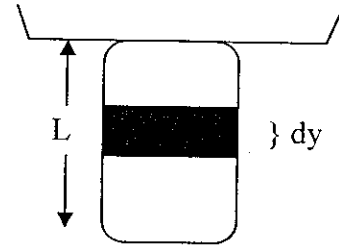
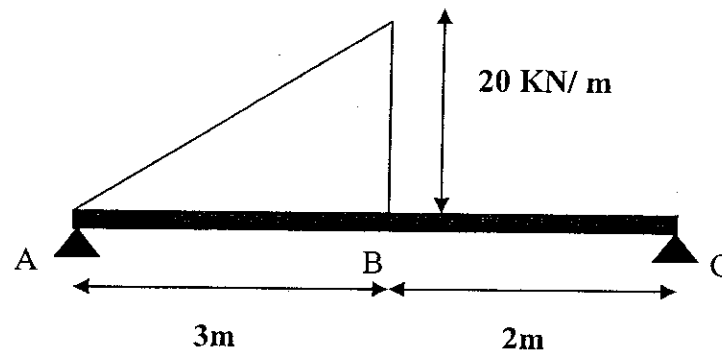


Figure (4)

5. Write shear and bending moment equations, and draw shear and bending moment diagram for the following figure.



Good Luck



Note : Answer four questions only.

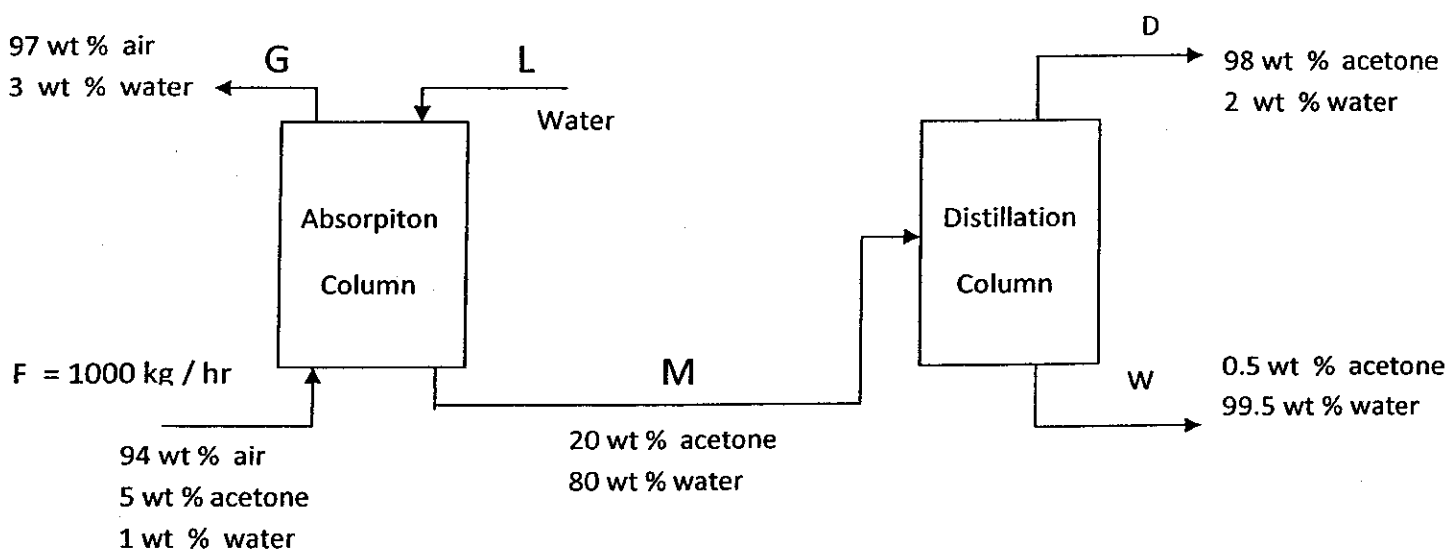
Q1 : Fill the following blanks :

1. Diffusivity (D_{AB}) can be expressed in terms of dimensions as
2. If 15 moles of N_2 and 36 moles of H_2 are fed to the reactor to produce NH_3 , hence is the limiting reactant .
3. The temperature that its value is the same in Fahrenheit and Celsius scales is
4. Pyrometer is the instrument used for measurement .
5. 1kPa is equivalent to N/cm^2 .
6. Methane (CH_4) consists of wt % carbon and wt % hydrogen .
7. stream is used in two step process for preparing caustic soda solution in order to control the very high heat of dissolution of NaOH in water .
8. Van der Waals constants can be estimated from the critical constants according to the relations : $a = \dots\dots\dots$, $b = \dots\dots\dots$.
9. is the ratio between moles of the desired product to that of the undesired product when the process consists of many reactions .
10. The enthalpy change for phase transition of a pure substance from solid to liquid at melting point is known as

(25 Marks)

Q2 : Actone can be recovered from a gaseous mixture by absorption followed by distillation as shown in the following flow diagram .

Calculate the flow rates of streams G, L, D, W and M in kg / hr with complete checking .



(25 Marks)

Q3 A: Caustic soda solution with specific gravity of 1.160 contains 14 wt % NaOH. Calculate $^{\circ}\text{Tw}$, $^{\circ}\text{Be}$ and molarity of solution.

Given that : Mwt. of NaOH = 40.

(10 Marks)

B: A steel cylinder with volume of 20 liters contains argon at 100 kPa and 27°C . A quantity of heat is added to the cylinder so that the temperature of argon increases to 57°C . Assuming argon as ideal gas, calculate :

- (a) The final pressure in kPa .
- (b) ΔU , ΔH , W and Q in Joules .

Given that : $R = 8.314 \text{ liter. kPa /mol.K} = 8.314 \text{ J / mol .K}$.

(15 Marks)

Q4: A tank contains 0.15 lb mole of nitrogen at 100°F & 20 psia . A quantity of a hot paraffinic gas is added to the tank . The partial pressures of gases after mixing are 21 psia for N_2 and 14 psia for the paraffinic gas . The specific gravity of the mixture referred to air at the same conditions is 1.3795 . Assuming ideal behavior of gases , calculate :

- (a) Volume of the tank and the partial volume of each gas in ft^3 .
- (b) lb moles of the paraffinic gas added .
- (c) Final temperature of the mixture in $^{\circ}\text{F}$.
- (d) Identify the paraffinic gas .

Given that : $R = 10.73 \text{ psia . ft}^3/\text{lb mole }^{\circ}\text{R}$.

(25 Marks)

Q5: Ethylene (C_2H_4) is heated and then it is burned with 40% excess air so that 80% is converted to CO_2 and the rest is burned to CO . Calculate :

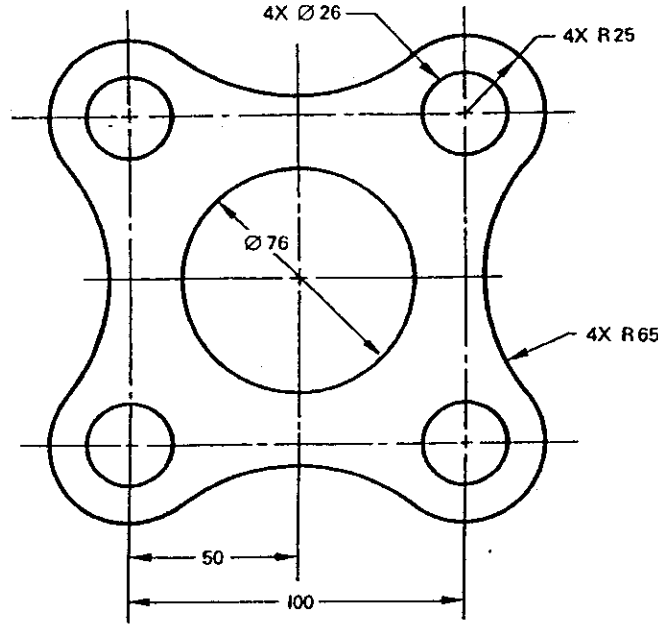
- (a) The enthalpy change for 10 moles of ethylene as heated at constant pressure from 20°C to 300°C .
- (b) The molar ratio of air input to ethylene.
- (c) The Orsat analysis of the flue gas.

Given that: The heat capacity equation for ethylene is :

$$C_p = 40.75 + 0.1147 T - 6.891 \times 10^{-5} T^2 \quad (\text{J/mol.}^{\circ}\text{C and } T \text{ in } ^{\circ}\text{C}) \quad (25 \text{ Marks})$$

(١٥ درجة)

س١ / ارسم لما يلي بنفس الابعاد مع وضع الابعاد.



(٣٥ درجة)

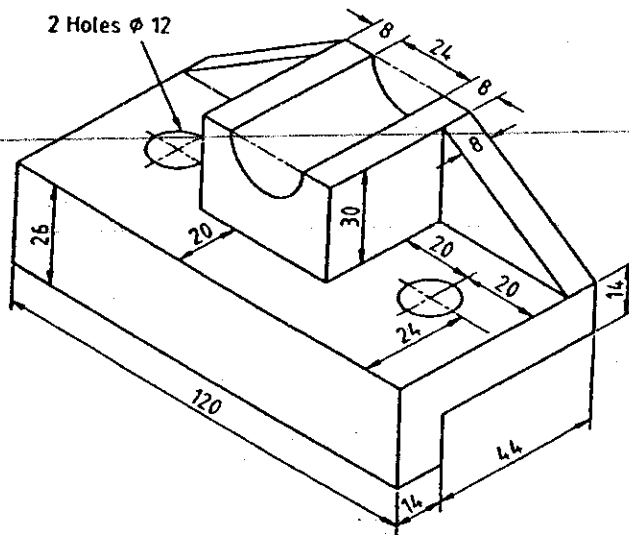
س٢ / اجب عن احد الفرعين الاتيين

أ- ارسم لما يلي بنفس الابعاد

١- المقطع الامامي

٢- المسقط الجانبي

٣- المسقط العلوي

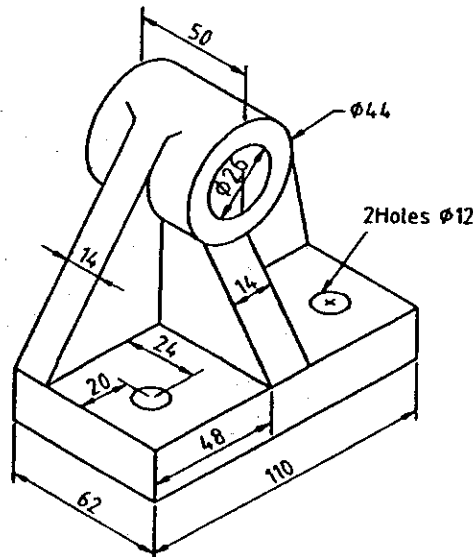


ب- ارسم لما يلي بنفس الابعاد

١- المسقط الامامي

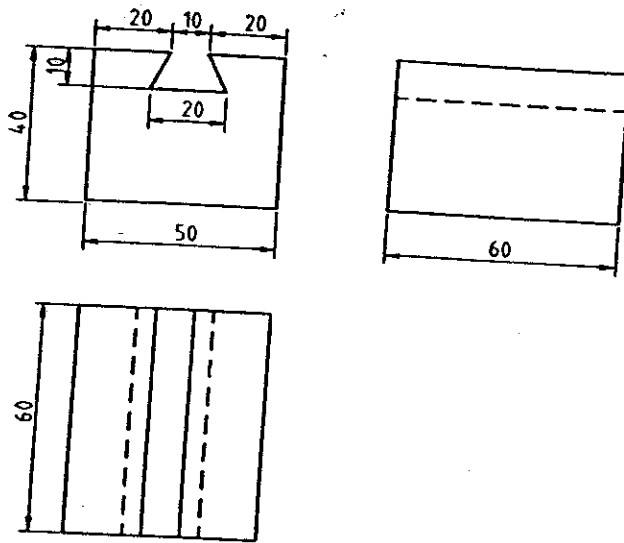
٢- المقطع الجانبي

٣- المسقط العلوي



س ٣ / ارسم الشكل الايزومتري لما يلي بنفس الابعاد.

(٢٥ درجة)

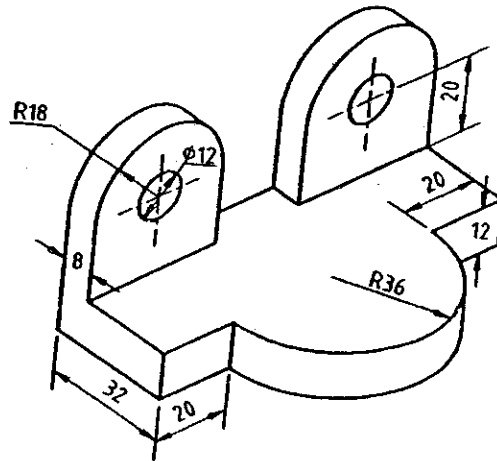


س ٤ /

- أ- ارسم لما يلي المساقط الثلاثة (free hand)
 ب- اكتب خطوات رسم المسقط الامامي والمسقط العلوي ببرنامج (Auto CAD) باستخدام احداثيات (Relative Coordinate) فقط علما ان نقطة البداية هي (0,0)

(٥ درجة)

(٢٠ درجة)





Note : Answer four questions only.

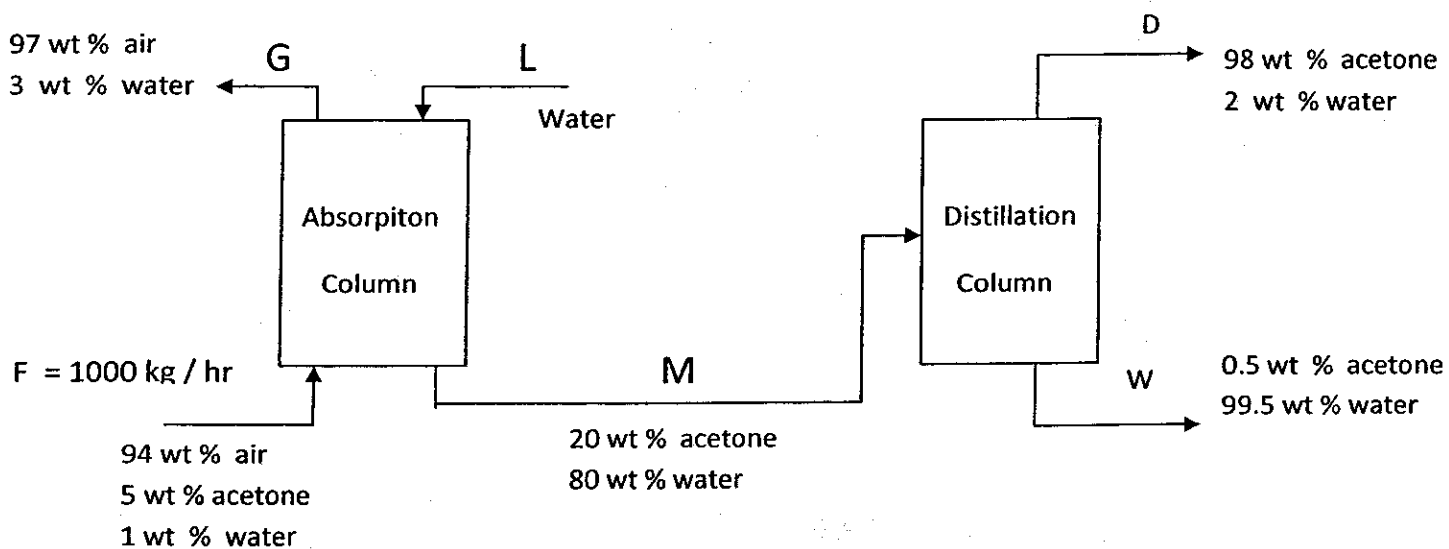
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(25 Marks)

12/9-07

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(10 Marks)

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(15 Marks)

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Note: Answer All questions

Q1: Read the following passage and answer **(Seven)** questions only:

Because chemical plant equipment is so different from that used in the laboratory, one of the major jobs of R&D engineers is to decide what kinds of equipment must be used to carry out a commercial chemical process. They also determine the sizes of equipment needed. Before designing the full-sized plant, the R&D engineer usually constructs a pilot plant, actually a small model of the final plant, containing small versions of the equipment. Pilot plants are particularly useful when designing continuous process plants which are so different from the research laboratory. A continuous process pilot plant will usually run twenty four hours a day with three or four groups of operators and engineers, each group working for eight hours. This is called shift work, and each group is called a shift. Most often, shifts work from 8 a.m. to 4 p.m., 4 p.m. to midnight, and midnight to 8 a.m. A fourth shift is needed if the plant is to run during weekends, although many pilot plants shut down at that time. This arrangement makes pilot plant experimentation unattractive to many chemical engineers who prefer to work during the day and leave the evening and night shifts to specially trained operators. However, a pilot plant is often complicated that engineers are required on all shifts.

Since the basic purpose of the pilot plant is to gather information, there are frequent changes of flowrates, pressures, and temperatures. R & D engineers are always looking for that combination of conditions that will enable them to produce the maximum amount of product at the minimum price. As information is gathered, it is passed along to the company's management. This may be done by memoranda and telephone calls but in most companies, once a month, the R & D engineers write all they have learned during the past month in a progress report. These become their main record of accomplishment. The purpose of R & D is to gather information: since a company's management judges R & D engineers by the reports they submit, a great deal of work goes into the reports' preparation. When the research and development project is completed, information on the various progress reports is consolidated into a final report that details everything learned during the research. This final report is invaluable to the process design engineers who will design the full-scale plant.

There is one thing about R & D that many engineers find frustrating: a project is seldom finished. As with all research, there are always more ideas than time or manpower. Eventually, the work must end, even get into full-scale production. The decision to end a project is usually made by the head of the research laboratories in consultation with the executives of the company.

1. What is the major job of R&D engineers?
2. When are pilot plants particularly useful?
3. What are the usual time period for each shift?
4. Why is pilot plant work unattractive to some engineers?
5. What do chemical engineers look for when running a pilot plant?
6. How do R & D engineers pass on information to a company management?
7. Why do many engineers find R&D frustrating?
8. Who usually decides when a research project should be ended? (14 Marks)

Q2: Define **(Five)** of the following:

- 1.Raw material; 2.Unit Operation; 3.Consultant; 4. Flowsheet; Exchanger; 6.Instrumentation.

5.Heat

(10 Marks)

Q3: Put the verbs in brackets in the correct tense: **(Answer Five only)**

- 1.My father (buy) this pen three days ago and I (use) it already.
- 2.It (rain) heavily when they (set) out for the village.
- 3.The police (catch) the thief before he (get) away.
- 4.When he saw me, he (not know) me because he (not wear) his glasses.
- 5.I (call) on you last night but you (be) out.
- 6.My father usually (have) milk for breakfast but today he (have) coffee.

(10 Marks)

Q4: Choose the right answer **(Answer Five only)** :

- 1.A couple of days ago we ---- a tea party. (have, had, will have, are having)
- 2.Letters ---- usually sent by air. (is, am, was, are)
- 3.The telephone ---- now. (rang, ring, rung, is ringing)
- 4.Yesterday there ----- a lot of people at the stadium. (was, will be, are, were)
- 5.He hasn't finished the work ----. (ago, already, just, yet)
- 6.He works as if he ----- a machine. (is, are, be, were)

(5 Marks)

Q5: Fill in the blanks with the following preposition **(Answer Five only)** :

(on , to , at , in , by , from , with , between , for , of)

- 1.He was born ----1952.
- 2.I'm waiting ---- the bus.
- 3.The postman comes ----- bicycle.
- 4.I saw him ----- Saturday morning.
5. Nada sat ---- her father and mother.
- 6.I meet my friend ---- the bus stop.

(5 Marks)

Q6: Punctuate the following putting in capitals where necessary **(Answer Eight Only)**

- 1.in 1492 columbus discovered america
- 2.dr zeki will leave for germany at 8 am next monday wont he yes he will
- 3.the river nile rises in central africa runs through sudan and egypt
4. the english channel was first crossed captain webb in august 1875
- 5.mosul is a city lying on the river tigris
- 6.the nine planets are mercury venus earth mars jupiter saturn uranus neptune and pluto
(planets=الكواكب السيارة)
- 7.did laylas brother buy this car in england last june
- 8.have you been to paris yes i have
- 9.yousif and i are clever arent we

(16 Marks)



Note: Answer five questions only.

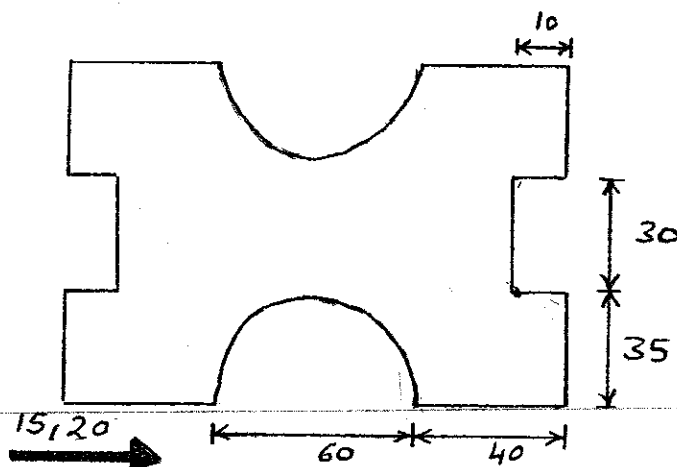
- Q1/ (a) In Microsoft Power Point, how can you add new slide ?
(b) Describe a situation in which the mirror command would be helpful ?

(10 mark)

- Q2/(a) In Microsoft Excel, how can you select cell ?
(b) Briefly describe the methods of producing circles ?

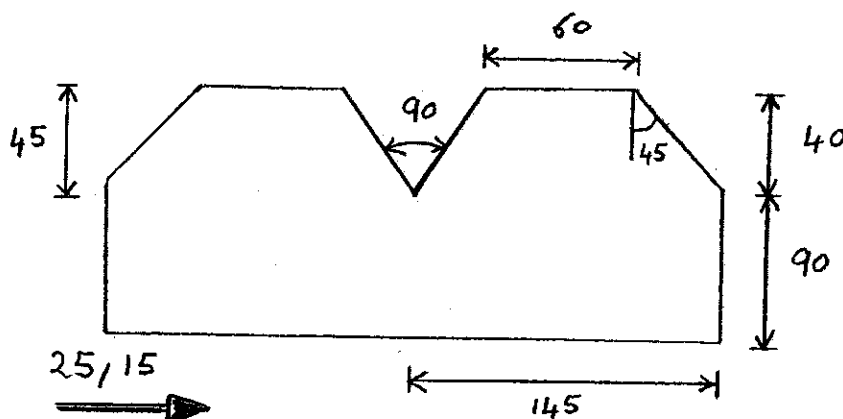
(10 mark)

- Q3/ Write down main steps to draw the figure below using Auto CAD program and Relative Coordinate



(10 mark)

- Q4/ Use Auto CAD program and Polar Coordinate to draw the figure below



(10 mark)

- Q5/ (a) Define the followings :
Leader , Layers , Zoom , CPU , Snap .
(b) How can you create "E-mail" ?

(10 mark)

- Q6/ (a) What is the duty of the followings :
Trim , Offset , Hatch , Erase , Array .
(b) How could the " Multilines " be drawn ?

(10 mark)

GOOD LUCK