School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 24. 02. 2018

Subject : **Introduction to Aeronautics (Th)** Batch : AE - 10 & 11

Faculty Name : Mr. Praveen Pratap Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Discuss the variation of pressure distribution over an airfoil at different angle of attack. Also explain the variation of lift co-efficient with angle of attack, for symmetric and cambered airfoils. (6+3)	Unit No.: Topic Name: Source:
2.	Define the following with the help of neat diagram. a. Centre of Pressure b. Aerodynamic Centre c. Aspect Ratio d. Taper Ratio e. Effective angle of attack f. SweepAngle (1.5*6)	Unit No.: Topic Name: Source:
3.	Consider two points on the surface of an airplane wing flying at 80 m/s. The pressure co-efficient and flow velocity at point 1 are -1.5 and 110 m/s. The pressure co-efficient at 2 is -0.8. Assuming incompressible flow, calculate the flow velocity at point 2. (9)	Unit No.: Topic Name: Source:
4.	Consider an airfoil with chord length c and the running distance x measured along the chord. The leading edge is located at x/c=0 and trailing edge at x/c=1. The pressure co-efficient variations over the upper and lower surfaces are given respectively as Cp,u = 1- 300 (x/c)^2 for 0 d< (x/c) d< 0.1 Cp,u = -2.2277 + 2.2777 (x/c) for 0.1 d<(x/c)d<1 Cp,u = 1- 0.95 (x/c) for 0 d<(x/c) d<1 Calculate lift force co-efficient. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Derive an expression for calculating lift force by dimensional analysis. (9)	Unit No.: Topic Name: Source:
6.	Discuss different types of drag. Write an expression for total drag and explain drag polar. (6+3)	Unit No.: Topic Name: Source:
7.	Explain various types of high lift devices. (9)	Unit No.: Topic Name: Source:
8.	Consider an aircraft flying at an altitude of 3000m. The wing of aircraft has a wing area of 206 metre square, an aspect ratio of 10, a span effectiveness factor of 0.95, and an NACA 4412 airfoil which has c_a value of 0.006. The weight of the airplane is 7.5 x 105 N. If the flight velocity is 100 m/s, calculate the total drag on the aircraft. Density at 3000 m is 0.909 kg/cubic metre. (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

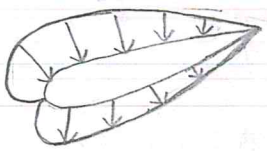
I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

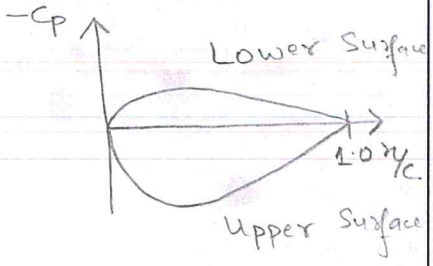
MODEL ANSWER PAPER

Name of Examination: Mid-term I Date of Examination: _____

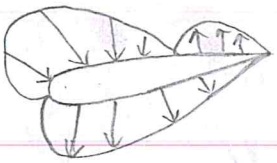
Subject Introduction to Aero Batch 10, 11 Semester IV

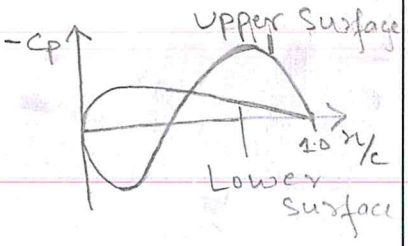
Q. NO.	ANSWER	MARKS
1.	The distribution of pressure over an airfoil varies with its attitude, i.e. incidence. The variation is shown below.	



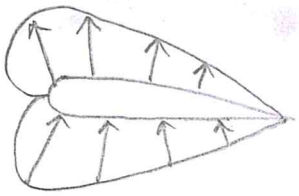


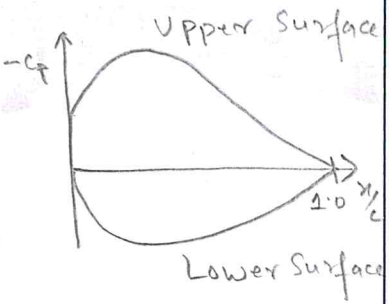
(a) $\alpha = -5^\circ$



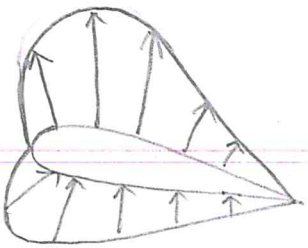


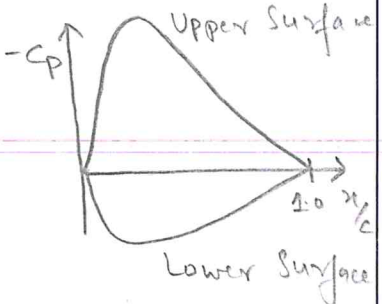
(b) $\alpha = -2^\circ$





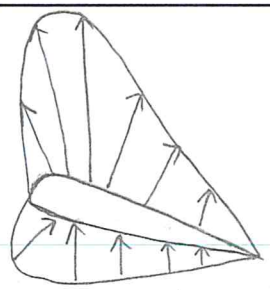
(c) $\alpha = +2^\circ$

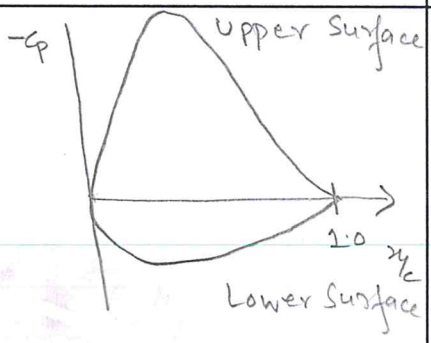




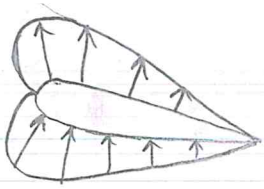
(d) $\alpha = 8^\circ$

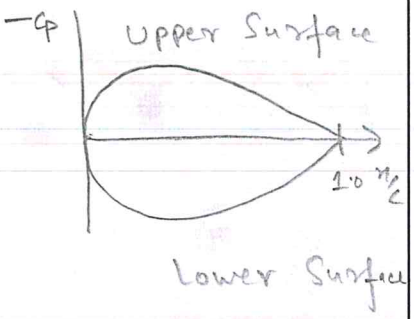
Q. NO.	ANSWER	MARKS





(c) $\alpha = 15°$





(d) $\alpha = 20°$

From the above sketches, it is observed that

(a) at $\alpha = -5°$, there will be a negative lift on the airfoil as pressure on upper surface will be more that pressure on lower surface.

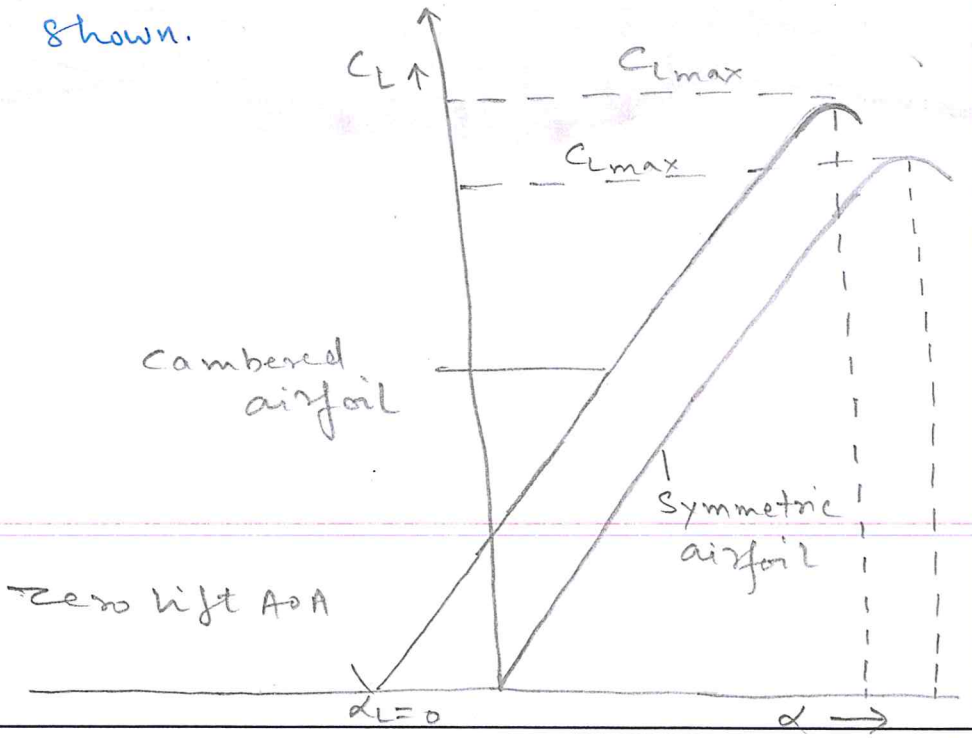
(b) at $\alpha = -2°$, the pressure on lower surface & upper surface will be equal and there will be no lift on the airfoil. This is called zero-lift angle of attack.

Q. NO.	ANSWER	MARKS

(c) As angle of attack is further increased, the pressure on upper surface will reduce while that on lower surface will increase upto angle of attack of 15°.

(d) If Angle of AOA is increased beyond 15°, flow seperation will occur, and there will be no lift increament, ~~load~~ Moreover, lift will reduce and drag will rise. This is called Stalling AOA. ~~At~~ Stalling AOA, lift co-efficient will have the max value.

The lift co-efficient Vs. AOA curve for Symmetric and Cambered airfoil is shown.



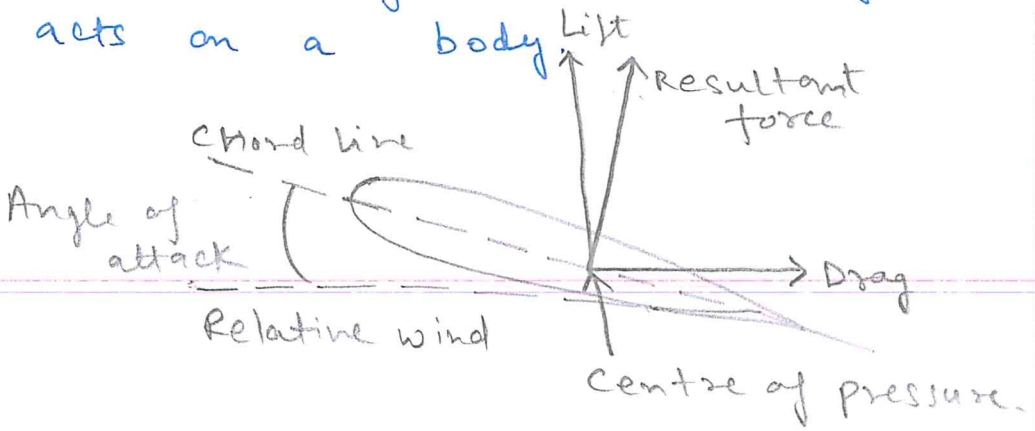
Q. NO.	ANSWER	MARKS

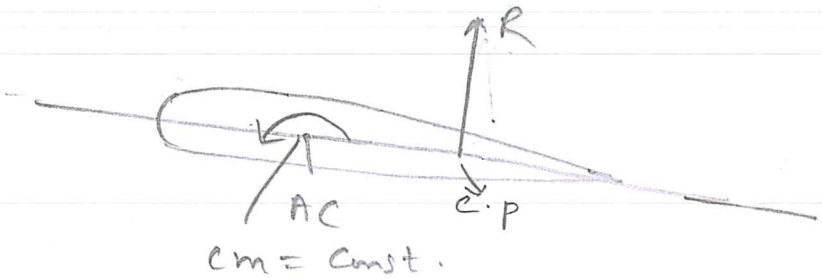
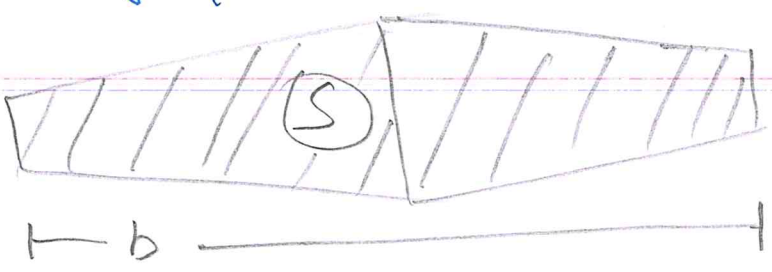
The variation between C_L and α is found linear for both symmetric and cambered airfoil, however it is observed that C_{max} for cambered airfoil will be more than that for symmetric airfoil.

Also, at 0° A.O.A, there will be no lift generated in symmetric ~~angle~~ airfoil but cambered airfoil will have some value of lift at zero angle of attack. To obtain zero-lift in cambered airfoil, it must be pitched at some negative incidence.

2. (a) Centre of pressure.

The centre of pressure is that point where sum of total pressure field acts on a body



Q. NO.	ANSWER	MARKS
2.	(b) Aerodynamic Centre The resultant force on an airfoil causes a moment on it. The point at which pitching moment remains constant is called aerodynamic centre. at AC, $\left(\frac{d C_m}{d\alpha}\right)_{AC} = 0$  C_m = Const.	
	(c) Aspect Ratio Aspect ratio is defined as the ratio of square of wing span to wing area, i.e. $AR = \frac{b^2}{S}$ S – wing area b – wing span  	

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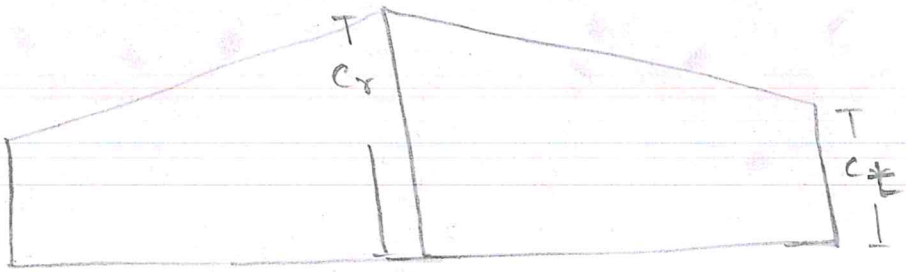
MODEL ANSWER PAPER

Name of Examination: _____ Date of Examination: _____

Subject _____ Batch _____ Semester _____

Q. NO.	ANSWER	MARKS
2	(d.) Taper ratio:	

The ratio of tip chord to root chord of a wing is called taper ratio

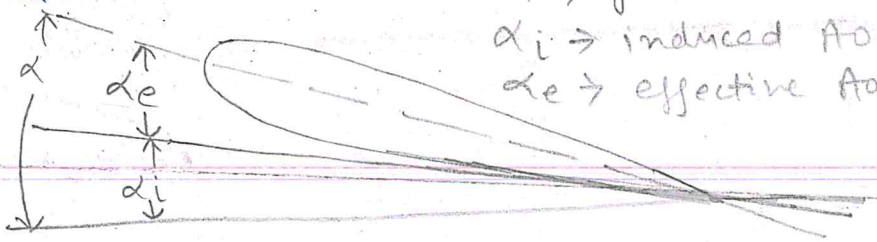


$$\lambda = \frac{C_t}{C_r}$$

(c.) Effective angle of attack:

The effective angle of attack is defined as the difference between geometric AOA and induced AOA. Induced Angle of attack is formed between effective direction of relative wind (due to downwash) and original direction of relative wind.

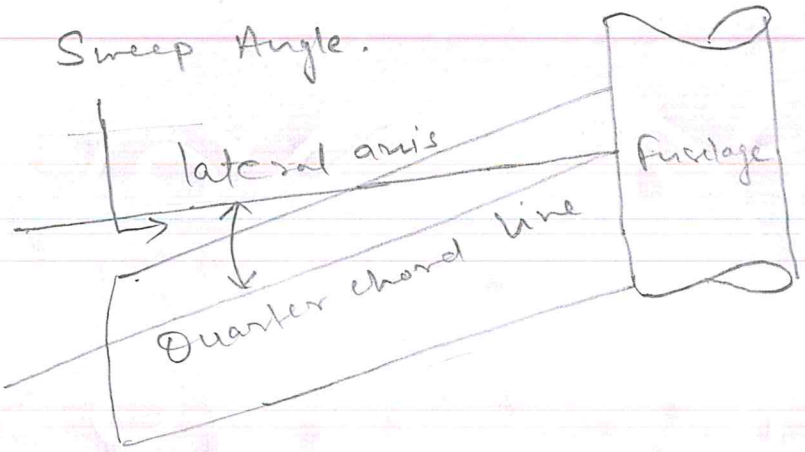
$\alpha \rightarrow$ geometric AOA
$\alpha_i \rightarrow$ induced AOA
$\alpha_e \rightarrow$ effective AOA



Q. NO.	ANSWER	MARKS

2. (f) Sweep Angle:

Sweep Angle is defined as the angle between Lateral axis and quarter chord line of the airfoil section.



3.

$$C_{p_1} = \frac{P_1 - P_\infty}{q_\infty} \Rightarrow P_1 - P_\infty = C_{p_1} q_\infty \quad \text{--- (1)}$$

$$C_{p_2} = \frac{P_2 - P_\infty}{q_\infty} \Rightarrow P_2 - P_\infty = C_{p_2} q_\infty \quad \text{--- (2)}$$

(1) − (2)

$$P_1 - P_2 = q_\infty (C_{p_1} - C_{p_2})$$

from Bernoulli's eqn

$$P_1 + \frac{1}{2} \rho V_1^2 = P_2 + \frac{1}{2} \rho V_2^2$$

$$P_1 - P_2 = \frac{1}{2} \rho (V_2^2 - V_1^2)$$

$$\frac{P_1 - P_2}{q_\infty} = \left(\frac{V_2}{V_\infty}\right)^2 - \left(\frac{V_1}{V_\infty}\right)^2$$

Q. NO.	ANSWER	MARKS

$$C_{p_1} - C_{p_2} = \left(\frac{V_2}{V_\infty}\right)^2 - \left(\frac{U_1}{V_\infty}\right)^2$$

$$-1.5 - (-0.8) = \left(\frac{V_2}{V_\infty}\right)^2 - \left(\frac{110}{80}\right)^2$$

$$\left(\frac{V_2}{V_\infty}\right)^2 = 1.19$$

$$V_2^2 = 1.19 V_\infty^2$$

$$= 1.19 \times 80^2$$

$$\boxed{V_2 = 87.3 \text{ m/s}}$$

4. $$C_l = \frac{1}{c}\int_0^1 (C_{pl} - C_{pu})\, dx$$

$$= \int_0^1 (C_{pl} - C_{pu})\, d\left(\frac{x}{c}\right)$$

$$= \int_0^1 \left(1 - .95\frac{x}{c}\right) d\left(\frac{x}{c}\right) - \int_0^{0.1} \left[1 - 300\left(\frac{x}{c}\right)^2\right] d\left(\frac{x}{c}\right)$$

$$- \int_{0.1}^{1.0} \left(-2.2277 + 2.2277\frac{x}{c}\right) d\left(\frac{x}{c}\right)$$

$$= \left(\frac{x}{c}\right)_0^1 - (.475)\left(\frac{x}{c}\right)_0^1 - \left(\frac{x}{c}\right)_0^{0.1}$$

$$+ \frac{300}{3}\left(\frac{x}{c}\right)_0^{0.1} + \left[2.2277\left(\frac{x}{c}\right)^2\right]_{0.1}^1$$

$$- \left[\frac{2.2277}{2}\left(\frac{x}{c}\right)^2\right]_{0.1}^1$$

Q. NO.	ANSWER	MARKS

$$C_l = 1 - 0.475 - 0.1 + 0.1 + 2.2277 - .22277 - 1.1388 + 0.011388$$

$$\boxed{C_l = 1.40}$$

5. $L = f(V_\infty, \rho_\infty, S, \mu_\infty, a_\infty)$

$V_\infty \rightarrow$ Free stream velocity

$\rho_\infty \rightarrow$ Free stream density

$S \rightarrow$ Area of wing

$\mu_\infty \rightarrow$ viscocity co-efficient of free stream air

$a_\infty \rightarrow$ Speed of Sound

$$L = Z V_\infty^a \rho_\infty^b S^d a_\infty^e \mu_\infty^f$$

writing the dimensional form

$$[MLT^{-2}] = Z [LT^{-1}]^a [ML^{-3}]^b [L^2]^d [LT^{-1}]^e [ML^{-1}T^{-1}]^f$$

$$= Z [M]^{b+f} [L]^{a-3b+2d+e-f} [T]^{-a-e-f}$$

equating, we get

$1 = b + f$, $\quad -2 = -a - e - f$

$1 = a - 3b + 2d + e + f$

Q. NO.	ANSWER	MARKS

$\therefore \quad b = 1 - f$

$a = 2 - e - f$

$d = 1 - \frac{f}{2}$

$$L = 2 (V_\infty)^{2-e-f} \rho_\infty^{1-f} S^{1-f/2} a_\infty^{e} \mu_\infty^{f}$$

$$= 2 \rho_\infty V_\infty^2 S \left(\frac{q_\infty}{V_\infty}\right)^e \left(\frac{\mu_\infty}{\rho_\infty V_\infty S^{1/2}}\right)^f$$

$$= 2 \rho_\infty V_\infty^2 S \left(\frac{1}{M_\infty}\right)^e \left(\frac{1}{Re}\right)^f$$

defining

$$\frac{C_L}{2} \equiv 2 \left(\frac{1}{M_\infty}\right)^e \left(\frac{1}{Re}\right)^f$$

$$L = \frac{1}{2} \rho_\infty V_\infty^2 S C_L$$

$$\boxed{L = q_\infty S C_L}, \quad q_\infty = \frac{1}{2} \rho V^2$$

$$C_L \equiv \frac{L}{q_\infty \cdot S}$$

$$C_L = f(\alpha, M_\infty, Re)$$

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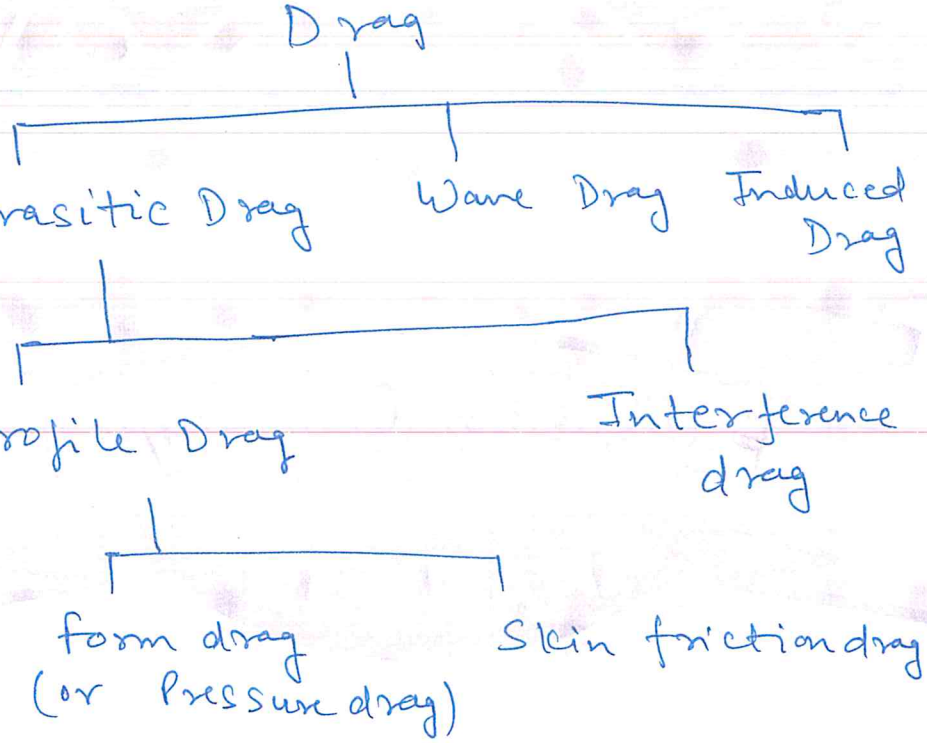
MODEL ANSWER PAPER

Name of Examination: _____ Date of Examination: _____

Subject _____ Batch _____ Semester _____

Q. NO.	ANSWER	MARKS
6	Drag is a resistive force that an aircraft experiences against its forward motion. Drag can be classified as follows:  Parasitic Drag: Parasitic drag results when an object is moved through a fluid medium form drag :- form drag arises due to shape of an object. It follows drag equation and increases with increase in area & velocity	

Q. NO.	ANSWER	MARKS
	Skin friction Drag :- Skin friction drag arises from the interaction between the fluid and the skin of the body, and is directly related to the area of surface of the body that is in contact with the fluid. **Interference drag** :- when airflow around one part of an object (such as fuselage) is interfered by airflow around other part (such as wing) at the intersection of the two, then the drag that arises due to this intersecting airflows is called as interference drag. **Wave drag** :- It is a component of aerodynamic drag on aircraft's wing, fuselage, propeller blade tips etc. moving at transonic and supersonic speed, due to presence of shock waves. **Induced Drag** :- Induced drag is a drag that occurs as the result of the creation of lift on a three dimensional body.	

Q. NO.	ANSWER	MARKS

The total drag is obtained as

$$D = \frac{1}{2} \rho V^2 S C_D$$

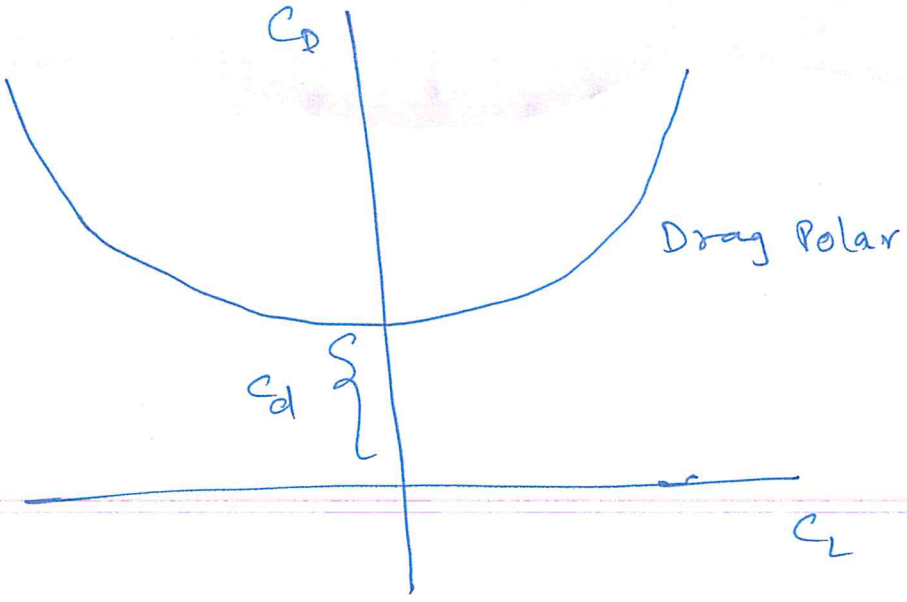
where C_D is total drag co-efficient.

$$C_D = C_d + C_{D,i}$$

Total drag = Profile drag + Induced drag

$$\boxed{C_D = C_d + \frac{C_L^2}{\pi e AR}}$$

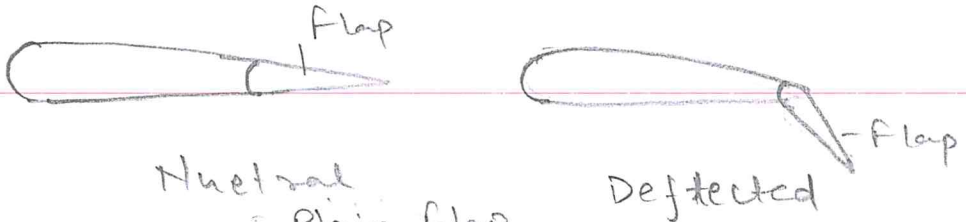
The above expression gives a parabolic relationship between C_D and C_L, which when plotted results into a graph called as Drag Polar



Q. NO.	ANSWER	MARKS
7.	**High lift devices:-** High lift devices are auxiliary components incorporated in the wing of an aircraft for generating additional lift when desired. High lift devices can be classified broadly into two categories viz (i) Those which alter geometry of airfoil (ii) Those which control behaviour of boundary layer **Trailing edge flaps:-** Trailing edge flaps are small airfoil sections attached to the rear end of wing, which when deflected increases the camber ~~result~~ resulting into higher lift. The main types of trailing edge flaps are — 1) Plain flap 2) Split flap 3) Slotted flap 4) fowler flap	

Q. NO.	ANSWER	MARKS

Plain flap:- It is simplest of all designs as shown below. When higher lift is desired, flaps can be deflected downward and can be rendered ineffective when lift is not needed. When deflected, it increases the camber and results into higher value of ~~lift~~ co-eff at slightly lower angle of attack, which also prevents separation and improves pilot's range of vision.



Plain flap

Split flap:- In split flap, only lower surface of the rear part of the airfoil is movable, upper surface remains unaltered which keeps the flow attached to the surface. It provides higher value of lift co-efficient compared to plain flap ~~at~~ but at slightly higher angle of attack.

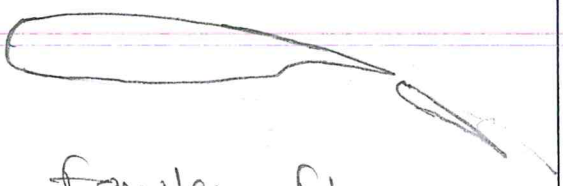
Q. NO.	ANSWER	MARKS

Split flap

Slotted flap :- Slotted flaps move downward and create a slot. This increases the effective camber and slot helps in keeping the flow attached to the surface. The air below the airfoil is at higher pressure, blows up from the slot and re-energizes the boundary layer to keep it attached to the surface.

Slotted flap

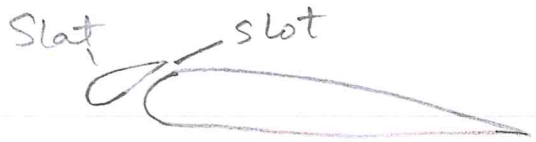
Fowler flap :- It is combination of split flap & slotted flap.



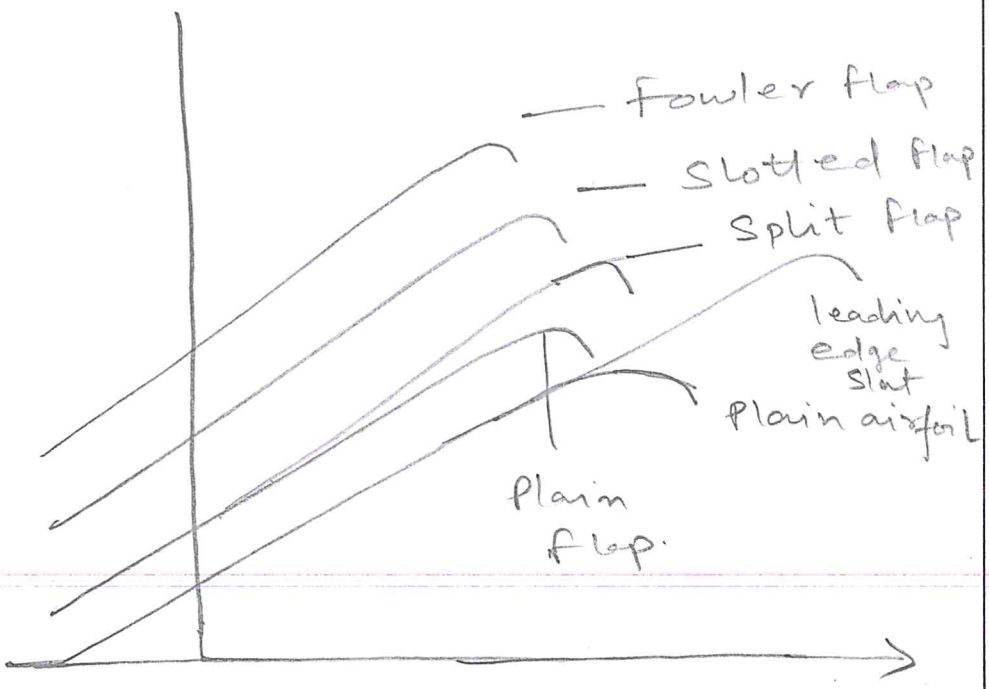
fowler flap.

Q. NO.	ANSWER	MARKS

Leading edge slats & slots :- Slats are auxiliary airfoil section attached at leading edge of the wing. It can be mixed or movable. It increases the camber of airfoil while providing a slot that delays the separation at leading edge. Air from the slot blows up and re-energizes the boundary layer as in slotted flap.



Comparison of lift co-efficients



Q. NO.	ANSWER	MARKS

8.

$h = 3000\ m$

$S = 206\ m^2$

$AR = 10$

$e = 0.95$

$C_d = 0.006$

$W = 7.5 \times 10^5\ N$

$V = 100\ m/s$

$\rho_{(3000\ m)} = 0.909\ kg/m^3$

Total Drag Co-efficient

$$C_D = C_d + \frac{C_L^2}{\pi e AR}$$

$\because \quad L = W = \frac{1}{2} \rho V^2 S C_L$

$$C_L = \frac{2W}{\rho V^2 S}$$

$$= \frac{2 \times 7.5 \times 10^5}{0.909 \times (100)^2 \times 206}$$

$$= 0.8$$

$\therefore \quad C_D = 0.006 + \frac{0.8^2}{\pi \times 0.95 \times 10}$

$= 0.006 + 0.021$

$= 0.027$

$\therefore \quad D = \frac{1}{2} \rho V^2 S C_D$

$= \frac{1}{2} \times 0.909 \times (100)^2 \times 206 \times 0.027$

Q. NO.	ANSWER	MARKS
	$D = 2.53 \times 10^4 N$	

Note

1. Paper Setter is required to carefully write the answers for the questions, after consulting all the relevant books.
2. For any discripencies found in answers, paper setter will be held responsible for playing with the career of the students,and doing breach of trust with them, and accordingly action can be taken by the disiplinary committee in this regard.
3. Principal before signing for the correctness of the answer shall ensure the same from relevant books. Point No. 1 & 2 above are applicable to Principal also in case any discripencies are found in answers

Dated 22-02-18 Signature of Paper Setter Signature of Principal/HOD

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

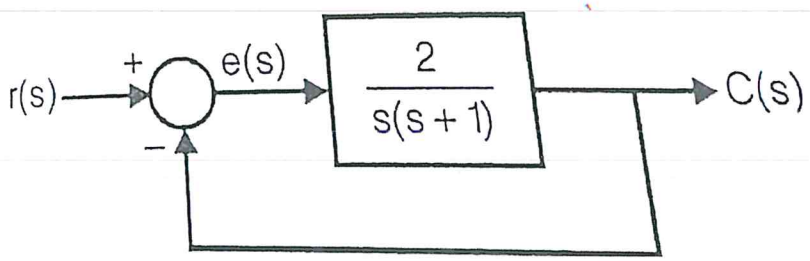
Fortnightly/Term : Mid Term -1 Date : 24. 02. 2018

Subject : **Instrumentation & Control Engg.(Th)** Batch : AE-10&11 & MT-2

Faculty Name : Mr. Tushar Garg Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	What is the difference between zero order and first-order instrument and what will be the response of standard first-order system for step input signal. (9)	Unit No.: Topic Name: Source:
2.	Define following term a) Delay time b) Rise time c) Settling time d) Maximum peak overshoot e) Peak time f) Bandwidth (9)	Unit No.: Topic Name: Source:
3.	What is the difference between type and order of the system with example, define steady state error with full derivation and define initial value theorem and final value theorem. (9)	Unit No.: Topic Name: Source:
4.	Define transient response and steady-state response of the system and define impulse signal, step signal, ramp signal, and parabolic signal with its Laplace transform. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Define Routh-hurwitz criteria for stability and determine the value of k for stability condition if characteristics equation is $s^4+5s^3+4s^2+2s+k$. (9)	Unit No.: Topic Name: Source:
6.	The open loop transfer function of a unity gain feedback system is given by: $G(s)\frac{K(s+3)}{(S+1)(s+2)}$ The range of positive values of K for which the closed loop system will remain stable is. (9)	Unit No.: Topic Name: Source:
7.	A unit ramp input is applied to the system shown in the adjoining figure. The steady state error in its output is.  (9)	Unit No.: Topic Name: Source:
8.	The unit step response of a negative unity feedback system with the open loop transfer function $G(s)\frac{6}{s+5}$ is. (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: Mid term Examination Date of Examination: _____

Subject Instrumentation & Control. Batch 10, 11, MT-2 Semester 4th

Q. NO.	ANSWER	MARKS
8	given data is $R(S) = \frac{1}{5}$, $H(S) = 1$, feedback is Negative, $G(S) = \frac{6}{S+5}$, $y(t) = ?$	6

We know for a given System

$$\frac{y(S)}{R(S)} = \frac{G(S)}{1+G(S)H(S)} \quad \text{— I}$$

$$\frac{y(S)}{R(S)} = \frac{\frac{6}{S+5}}{1+\frac{6}{S+5}\times 1} \quad \text{— II (from given data)}$$

$$\frac{y(S)}{R(S)} = \frac{6}{S+11}$$

$$y(S) = \frac{6}{(S+11)} \times \frac{1}{S} \quad \text{— III}$$

to Solve III, we Require Partial fraction of III.

$$y(S) = \frac{A}{S} + \frac{B}{S+11}, \text{ after}$$

Solving III we will get (A & B)

$$y(S) = \frac{6/11}{S} - \frac{6/11}{S+11} \quad \text{— IV}$$

$$A = \frac{6}{11}, \quad B = \frac{-6}{11}$$

Q. NO.	ANSWER	MARKS

Taking Laplace Inverse of IV

$$\left\{ y(t) = \frac{6}{11}\left[1 - e^{-11t}\right] u(t) \right\} \longrightarrow \text{Answer}$$

∵ we know

$$u(t) \xrightarrow{L} \frac{1}{s}$$

$$\frac{1}{s+11} \xrightarrow{\text{I.L (Inverse Laplace)}} e^{-11t}u(t)$$

Laplace transform.

$$e^{-11t}u(t) \xrightarrow{L} \frac{1}{s+11}$$

(END)

7> given data is :→ $R(s) = \frac{1}{s^2}$ (Input signal), $e_{ss} = ?$, $G(s) = \frac{2}{s(s+1)}$, $H(s) = 1$, feedback is negative. (6)

∵ we know steady state error is

$$\left\{ e_{ss} = \lim_{s \to 0} \frac{s\,R(s)}{1 + G(s)\,H(s)} \right\} \text{—(I)}$$

formula

Put the given data values in equation (I)

$$e_{ss} = \lim_{s \to 0} \frac{s \times \frac{1}{s^2}}{1 + \frac{2}{s(s+1)} \times 1}$$

Q. NO.	ANSWER	MARKS

$$e_{ss} = \lim_{s\to 0} \frac{\frac{1}{s}\,s(s+1)}{(s^2+s)+2}$$

$$e_{ss} = \lim_{s\to 0} \frac{s+1}{s^2+s+2}$$

Apply Limit

$$e_{ss} = \frac{0+1}{0+0+2} = \frac{1}{2}$$

$\left\{e_{ss} = \frac{1}{2}\right\}$ Answer.

(END)

6) given data is $G(s) = \frac{K(s+3)}{(s+1)(s+2)}$, (6)

$H(s) = 1$, feedback is Negative,

$K = ?$ (for which the system is stable).

We know, we can solve this question with Routh Hurwitz – (R-H) Criteria very easily.

We Require characteristics equation to solve with the Help of R-H Criteria.

Q. NO.	ANSWER	MARKS

Characteristics equation is

$1 + G(s)H(s) = 0$ —— I

Put the given values in I.

$$1 + \frac{K(s+3)}{(s+1)(s+2)} \times 1 = 0$$

$$s^2 + 3s + 2 + Ks + 3K = 0 \text{ —— II}$$

or

$$s^2 + s(3+K) + (2+3K) = 0 \text{ —— II}$$

Now make the Routh array for IInd equation.

s^2	1	$2+3K$
s	$3+K$	0
s^0	$2+3K$	

We know for stable all the sign of Routh array for first column should be same.

So $K+3 > 0$ and $2+3K > 0$

$K > -3$ $\quad 3K > -2$

$K > -\frac{2}{3}$

So $\left\{K > -\frac{2}{3}\right\}$ answer

to get stable condition $\left[K > -\frac{2}{3}\right]$.

(END)

Q. NO.	ANSWER	MARKS
5)	for K=? (to get stable condition), and chariactrestics equation is $S^4 + 5S^3 + 4S^2 + 2S + K = 0$ — I first we will make Routh array from (I) S^4 1 4 K S^3 5 2 0 S^2 18/5 K 0 S^1 $\frac{36/5 - 5K}{18/5}$ 0 S^0 K we know for Stable Condition all the sign of first Column of Routh-array should be same. So for stability $K>0$, $\frac{\frac{36}{5} - 5K}{18/5} > 0$, $\frac{36}{25} > K$ So $\left\{0 < K < \frac{36}{25}\right\}$ Answer (END)	(7)

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MODEL ANSWER PAPER

Name of Examination: Midterm Date of Examination: _____

Subject Instrumentation & Control Batch 10, 11, M-2 Semester 4th

Q. NO.	ANSWER	MARKS
1)	The Basic difference in zero order and first order Instrument is Energy storage element (Like Inductor & Capacitor). → IN Zero order Instrument, there is No Energy storage element is present and $y = Kx$ (is a Example of Zero order Instrument), means there is No derivative term present in the System. Example:- Potentiometer. → IN first order Instrument, there is only one Energy Element Present Like (one Capacitor, one Inductor). or We Can Represent first order system by following equation $\left\{ a_0 \frac{dy}{dt} + b_0 y(t) = K x_0(t) + d \frac{dx_0}{dt} \right\}$ Where x is Input and y is output. Example's R-C ckt, thermometer. Second Part:- given data is, $R(s) = \frac{1}{s}$, $G(s) = \frac{K}{s\tau + 1}$	(6)

Q. NO.	ANSWER	MARKS

$\rightarrow G(s) = \frac{K}{St+1}$ (Standard first order Instrument).

$$y(s) = \frac{K}{(St+1)} \times \frac{1}{S} \quad \text{— II}$$

taking Partial fraction of II.

$$y(s) = \frac{K}{S} \quad \frac{-K\tau}{St+1} \quad \text{— III}$$

$$y(s) = K\left[\frac{1}{S} - \frac{\tau}{St+1}\right]$$

$$y(s) = K\left[\frac{1}{S} - \frac{1}{S+1/\tau}\right]$$

$$y(t) = K\left[1 - e^{-t/\tau}\right] u(t)$$ Answer

This is the Response of standard first order System with unit step as Input signal.
Where τ = time Constant, which is Inversely proportional to Response of the System means SLow Response Large time Constant and fast Response, Small time Constant.

(END).

Q. NO.	ANSWER	MARKS
3)	For type we use open Loop transfer function or Loop transfer function which is used for steady state error and Steady state Response. It is the Pole at origin (which shows the Behaviour of System in Beginning).	(6)

$G(s)H(s)$ = open Loop transfer function or Loop transfer function.

$$G(s)H(s) = \frac{(s+P_1)(s+P_2)\cdots(s+P_n)}{s^n(s+K_1)(s+K_2)\cdots(s+K_n)}$$

→ where no of (n) Represents type of System.

For order we Can Check by either open Loop transfer function and Closed Loop transfer function. It Represents the heighEst Power of S in denomenator of any type of transfer function.

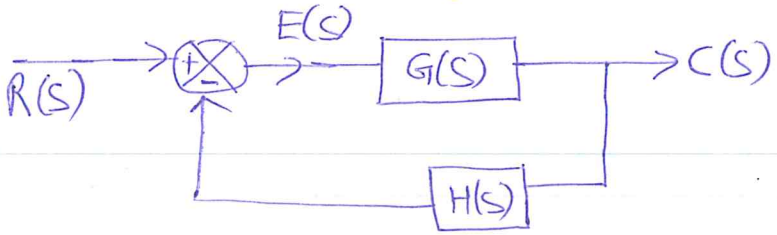
Steady State error's

$e(t) = R(t) - y(t)$

Required — Acheived or Actual Response of System.

Q. NO.	ANSWER	MARKS

derivation for steady state error:-



$$E(S) = R(S) - H(S)\,C(S) \quad \text{---I}$$

$$C(S) = G(S)\,E(S) \quad \text{---II}$$

$$E(S) = R(S) - H(S)\,G(S)\,E(S)$$

$$E(S)[1 + G(S)\,H(S)] = R(S) \quad \text{---III}$$

We know

$$e(t) = r(t) - c(t)$$

$$\& \quad e_{ss} = \lim_{t\to\infty} e(t) = \lim_{S\to 0} S\,E(S) \quad \text{---IV}$$

Put III in IV

$$e_{ss} = \lim_{S\to 0} \frac{S\,R(S)}{1+G(S)\,H(S)}$$

Answer.

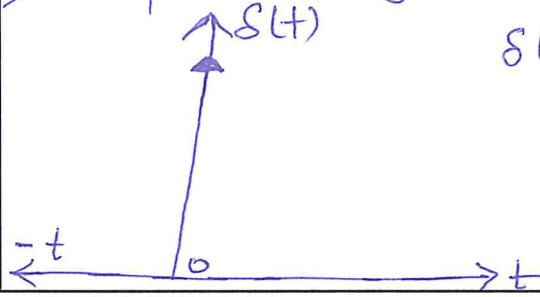
INITIAL VALUE THEOREM:-

$$\Rightarrow \lim_{t\to 0} e(t) = \lim_{S\to\infty} S\,E(S)$$

FINAL VALUE THEOREM:-

$$\Rightarrow \lim_{t\to\infty} e(t) = \lim_{S\to 0} S\,E(S)$$

END

Q. NO.	ANSWER	MARKS
4)	Transient Response is defined as $\lim_{t\to\infty} y(t) = 0$, means as time approaches to Infinity Response should also approach to Zero. Transient Response is used to check Stability of System & is used to check all Speed – Characteristics of System like T_r, T_s, T_d, M_p, ξ, etc. Steady State Response is that Response which Left out after the transient has died out. Basically steady State Response is used to check Stability & Accuracy of the System. 1) Impulse Signal :→ Sudden Shock  $\delta(t) = \begin{cases} \infty, & t = 0 \\ 0, & t \neq 0 \end{cases}$ $\delta(t) \xrightarrow{L} \{1\}$	(6)

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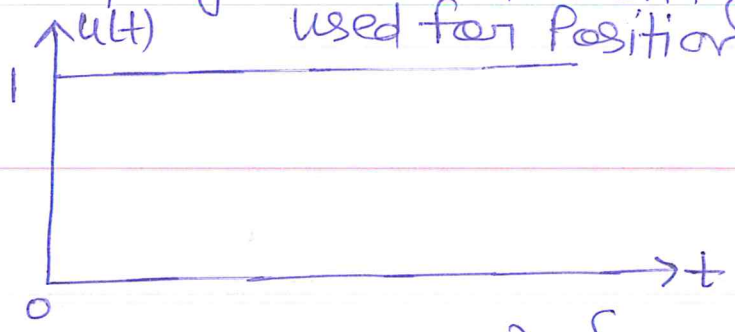
MODEL ANSWER PAPER

Name of Examination: Midterm Date of Examination: _____

Subject Instrumentation & Control Batch I, II, M-2 Semester 4th

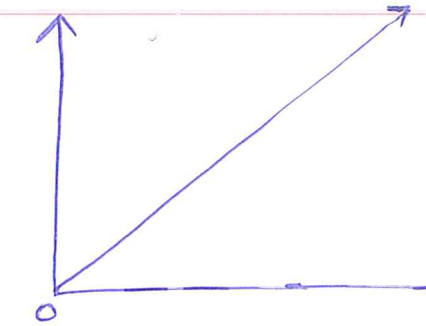
Q. NO.	ANSWER	MARKS

ii) Step Signal is Sudden change or used for Positional tracking.



$$u(t) = \begin{cases} 1, & t > 0 \\ 0, & t < 0 \end{cases}, \quad \left\{ u(t) \xrightarrow{L} \frac{1}{s} \right\}$$

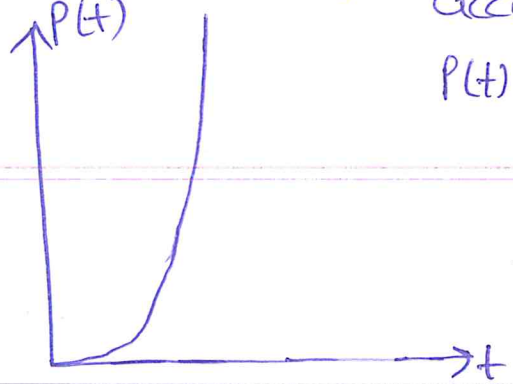
iii) Ramp Signal:→ used for Velocity tracking.



$$r(t) = \begin{cases} t & t \geq 0 \\ 0, & t < 0 \end{cases}$$

$$\left\{ r(t) \xrightarrow{L} \frac{1}{s^2} \right\}$$

iv) Parabolic Signal is used for Constant acceleration tracking.



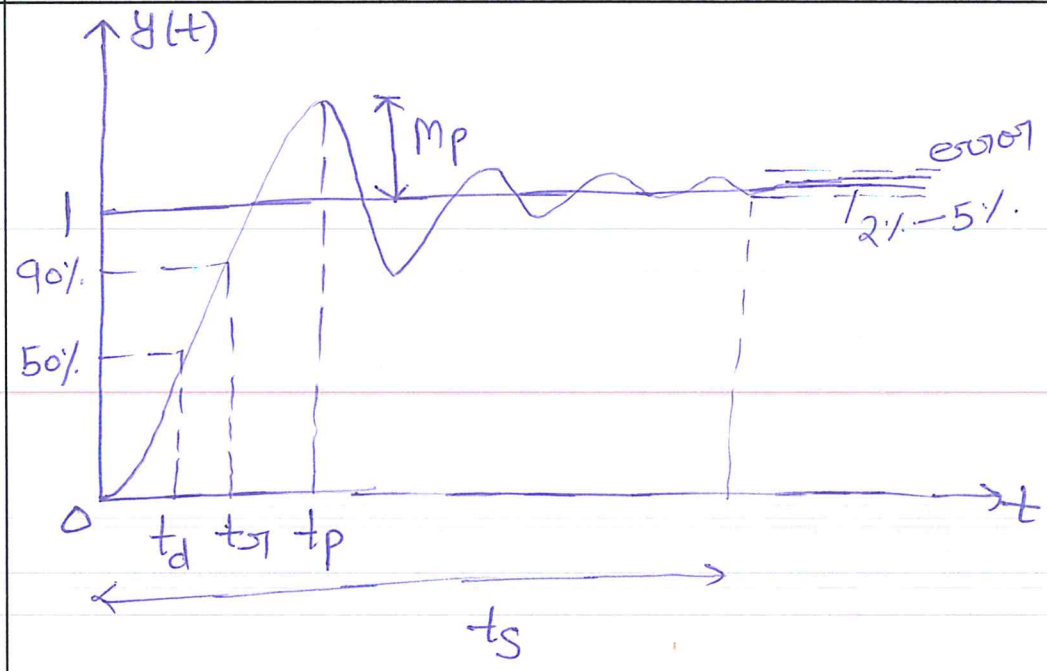
$$P(t) = \begin{cases} \frac{t^2}{2}, & t \geq 0 \\ 0, & t < 0 \end{cases}$$

$$\left\{ P(t) \xrightarrow{L} \frac{1}{s^3} \right\}$$

(END)

Q. NO.	ANSWER	MARKS
2)	delay time:- (t_d) is the time taken by the System to Reach the 50% of its final Value. Rise time:- (t_r) is the time taken by the system to Reach the 90% of its final Value & in Some Cases (10% → 90%) of its final Value. Settling time:- (t_s) is the time taken by the System to settle down in (95% → 98%) of its final Value. Settling time is inversely proportional to the Response of System. Maximum peak overshoot:- It is the maximum peak Value from its final Value. It is generally More significant in underdamped Systems. $\{M_p\% = e^{-\pi\xi/\sqrt{1-\xi^2}} \times 100\}$ Peak time(t_p):- is the time taken to get Maximum peak overShoot Position. Bandwidth:- It is the total freq Range of any Instrument for which the System Responds Smoothly.	(6)

Q. NO.	ANSWER	MARKS



(END)

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Q. NO.	ANSWER	MARKS

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School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 26. 02. 2018

Subject : **Fluid Mechanics (Th)** Batch : AE-10,11 & MT-2

Faculty Name : Mr. K. Vivek Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Explain in detail the different types of fluid flow. (9)	Unit No.: Topic Name: Source:
2.	Explain in detail the different types of flow lines. (9)	Unit No.: Topic Name: Source:
3.	Derive continuity equation in 3-D. (9)	Unit No.: Topic Name: Source:
4.	The velocity along the centerline of a nozzle of length l is given byV=2t((1-(x/2l)^2) where V=velocity in m/s ,t-time in sec. from commencement of flow, x=distance from inlet to nozzle. Calculate the local acceleration, convective acceleration and the total acceleration when t=6sec,x=1m and l=1.6 m. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Derive Bernoullis equation of motion. (9)	Unit No.: Topic Name: Source:
6.	Derive Eulers Equation of motion. (9)	Unit No.: Topic Name: Source:
7.	The water is flowing through a tapering pipe having diameters 300mm and 150 mm at sections 1 & 2 respectively. The discharge through the pipe is 40 lit/sec. The section 1 is 10m above datum and section 2 is 6m above datum. Find the intensity of pressure at section 2 if the intensity at 1 is 400 KN/m^2. (9)	Unit No.: Topic Name: Source:
8.	A conical tube is fixed vertically with its smaller end upwards and it forms a part of pipeline. The velocity at the smaller end is 4.5 m/s and at the larger end is 1.5 m/s. Length of conical tube is 1.5m. The pressure at the upper end is equivalent to a head of 10 m of water. i) Neglection friction, determine the pressure at the lower end of the tube. Ii) If head loss in the tube is 0.3*(V1-V2)^2/2g, where V1-velocity at the smaller end,V2-velocity at the larger end, determine the pressure at the lower end(larger cross-section). (9)	Unit No. Topic Name: Source:

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I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: MID TERM-I Date of Examination: 26.02.2018

Subject FLUID MECHANICS Batch AE-10,11 1MT-2 Semester 04

Q. NO.	ANSWER	MARKS

1) TYPES OF FLUID FLOW

i) Steady & unsteady flow
ii) uniform & Non-uniform flow
iii) one, two & three dimensional flows
iv) Rotational & Irrotational ,,
v) Laminar & Turbulent ,,
vi) Compressible & incompressible ,,

i) STEADY & UNSTEADY FLOWS:

STEADY FLOW :- Type of flow in which fluid characteristics like pressure, velocity & density at a pt. do not change with time is called STEADY FLOW.

$$\left(\frac{du}{dt}\right)_{x_0,y_0,z_0}=0 \quad \left(\frac{\partial v}{\partial t}\right)_{x_0,y_0,z_0}=0 \quad \left(\frac{dw}{dt}\right)_{x_0,y_0,z_0}=0$$

$$\left(\frac{\partial p}{\partial t}\right)_{x_0,y_0,z_0}=0 \quad \left(\frac{\partial \rho}{\partial t}\right)_{x_0,y_0,z_0}=0$$

Ex. Flow through prismatic conduit at a constant flow rate Q m^3/s is steady flow.

UNSTEADY FLOW :- Type of flow in which velocity, pressure & density at a point change with time is called UNSTEADY FLOW.

$$\left(\frac{\partial u}{\partial t}\right)_{x_0,y_0,z_0}\neq 0 \quad \left(\frac{\partial v}{\partial t}\right)_{x_0,y_0,z_0}\neq 0 \quad \left(\frac{dw}{dt}\right)_{x_0,y_0,z_0}\neq 0$$

$$\left(\frac{\partial \rho}{\partial t}\right)_{x_0,y_0,z_0}\neq 0 \quad \left(\frac{\partial p}{\partial t}\right)_{x_0,y_0,z_0}\neq 0$$

Ex. flow in a pipe whose valve is closed or opened gradually

Q. NO.	ANSWER	MARKS

(i) UNIFORM & NON-UNIFORM FLOWS :-

UNIFORM FLOW :- The type of flow in which velocity at any given time does not change w.r.t. Space is called UNIFORM FLOW.

$$\left(\frac{\partial V}{\partial S}\right)_{t=\text{const.}} = 0$$

∂V - Change in vel.

∂S - Disp. t - time.

Ex. Flow through a straight prismatic conduit.

NON-UNIFORM FLOW: The type of flow in which velocity at any given time does changes with respect to Space is called NON-UNIFORM FLOW.

$$\left(\frac{\partial V}{\partial S}\right)_{t=\text{const}} = 0$$

Ex. Flow through uniform diameter pipe bend.

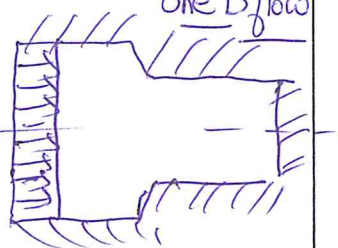
(ii) ONE, TWO & THREE DIMENSIONAL FLOWS:

ONE DIMENSIONAL FLOW :- Type of flow in which flow parameter is a function of time & one Space coordinate only, is called ONE DIMENSIONAL FLOW

$u = f(x)$ $v = 0$ $w = 0$

u, v, w - Vel. components in x, y & z dir.

Ex. Flow in a pipe where average flow parameters are considered for analysis.



TWO DIMENSIONAL FLOW :- Type of flow in which velocity is a function of time & 2 rectangular Space coordinates is called TWO-DIMENSIONAL FLOW.

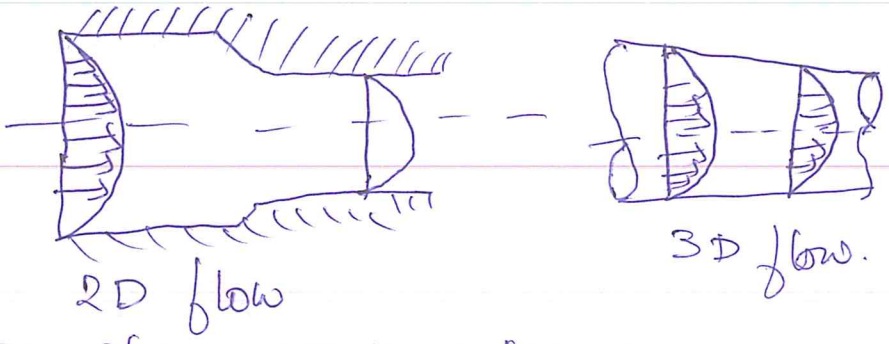
$u = f_1(x, y)$ $v = f_2(x, y)$ $w = 0$

Ex. Flow in Main Stream of wide river.

Q. NO.	ANSWER	MARKS

iii) THREE DIMENSIONAL FLOW:- Type of flow velocity is a function of time & 3 three mutually ⊥ directions

$u = f_1(x, y, z)$ $v = f_2(x, y, z)$ $w = f_3(x, y, z)$



2D flow

3D flow.

Ex. Flow in a converging or diverging pipe.

iv) ROTATIONAL & IRROTATIONAL FLOWS:

ROTATIONAL FLOW :- A flow is said to be rotational if fluid particles while moving in direction of flow rotate about their mass centres.

EX. Motion of liquid in rotating tank.

IRROTATIONAL FLOW :- A flow is said to be irrotational if fluid particles while moving in direction of flow does not rotate about their mass centres.

Ex. Flow above a drain hole of stationary tank.

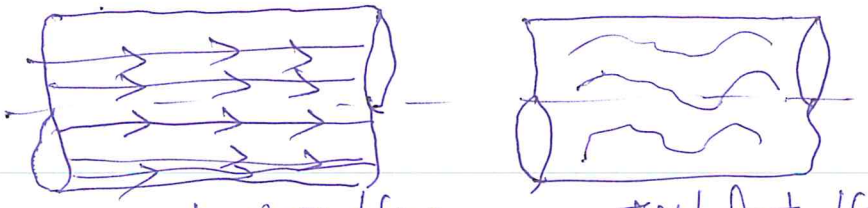
v). LAMINAR & TURBULENT FLOWS:

LAMINAR FLOW :- A flow in which paths taken by individual particles do not cross one another & move along well defined paths. Ex. Flow through a capillary tube, Flow of blood in veins.

TURBULENT FLOW:- A flow in which fluid particles move in a zig-zag way.

Q. NO.	ANSWER	MARKS

Ex. High velocity in a conduit of large size.



Laminar flow — Turbulent flow

Based Reynold no. Re < 2000 Laminar
> 4000 Turbulent
Re — 2000 to 4000 Laminar or Turbulent

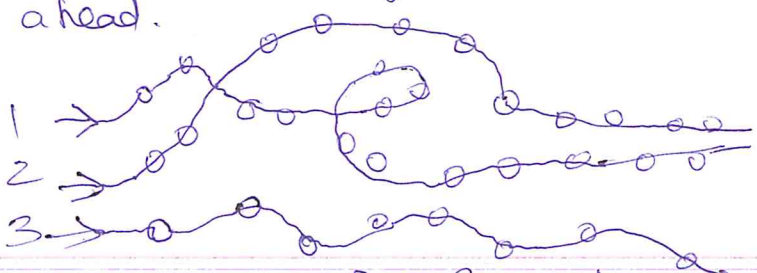
vi) COMPRESSIBLE & INCOMPRESSIBLE FLOWS

COMPRESSIBLE FLOWS :- Type of flow in which the density of fluid (ρ) changes from point to point.
Ex. Flow of gases through orifices, nozzles,

INCOMPRESSIBLE FLOW :- Type of flow in which density (ρ) is constant.
Ex. Subsonic aerodynamics.

2) TYPES OF FLOW LINES:

i) PATH LINE :- *The path followed by a fluid particle in motion.
* Shows direction of particular particle as it moves ahead.



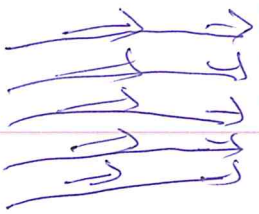
* Above is a 3-D Space. If conditions are such that the flow is 2-D, the curve — 2 Dimensional.

Q. NO.	ANSWER	MARKS

(i) STREAM LINE :- An imaginary line within the flow so that tangent at any point on it indicates velocity at that point.

Equation of Stream line in a 3-D.

$$\frac{dx}{u} = \frac{dy}{v} = \frac{dz}{w}$$



a) Stream lines cannot intersect itself, nor two Streamlines can cross.

b). There cannot be any movement of fluid mass across the Streamlines.

c) Stream lines spacing varies inversely as velocity, Converging of Stream line in any particular direction shows accelerated flow

d) In Steady flow, pattern of Streamlines remains invariant with time.

e) In unsteady flow, pattern of Streamlines may or may not remain same.

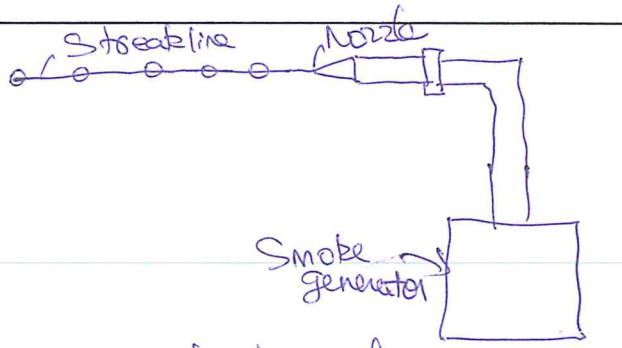
(ii) STREAM TUBE :- fluid mass bounded by a group of Stream lines.

Ex: pipes and nozzles.

iv) STREAK LINE :- curve giving an instantaneous picture of the location of fluid particles passed through given point.

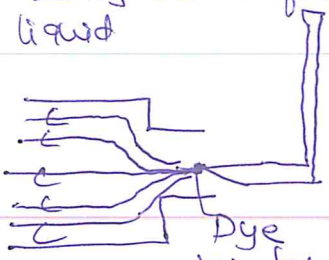
Ex. The path taken by a smoke emergent of chimney.

Q. NO.	ANSWER	MARKS



Streakline of Smoke issuing from a nozzle.

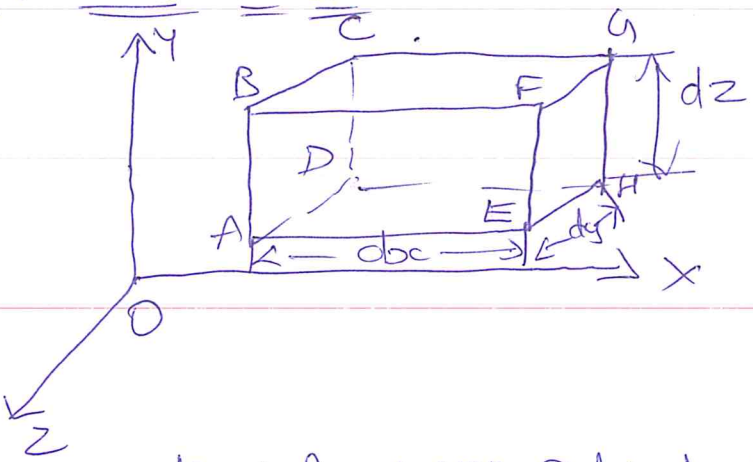
Experimental work to trace motion of fluid particles a coloured dye may be injected into flowing liquid



Streaklines at $t = t_1$

3) ~~CONTINUITY EQUATION IN 3D~~ from a nozzle.

3) CONTINUITY EQUATION IN 3D



* consider a fluid element with sides dx, dy & dz.

* Let ρ - mass density of fluid

u, v, w - Component of velocity of flow entering three faces

Rate of mass of fluid entering face ABCD
$= \rho \times$ velocity in x dir. $\times$ Area of ABCD
$= \rho u dy dz$

Rate of mass of fluid leaving face EFGH
$= \rho u dy dz + \frac{\partial}{\partial x}(\rho u dy dz) dx$

Q. NO.	ANSWER	MARKS

Gain in mass/unit time due to flow in x-direction given by = Fluid influx − efflux.

* Mass accumulated per unit time

$$= \rho u\,dy\,dz - \left[\rho u + \frac{\partial}{\partial x}(\rho u)dx\right] dy\,dz$$

$$= -\frac{\partial}{\partial x}(\rho u)\,dx\,dy\,dz$$

Gain in fluid mass / unit time in y-direction

$$= -\frac{\partial}{\partial y}(\rho v)\,dx\,dy\,dz$$

" " " " z-dir.

$$= -\frac{\partial}{\partial z}(\rho w)\,dx\,dy\,dz \quad (A)$$

Net Gain $= -\left[\frac{\partial}{\partial x}(\rho u) + \frac{\partial}{\partial y}(\rho v) + \frac{\partial}{\partial z}(\rho w)\right] dx\,dy\,dz$

Rate of change of mass $= \frac{\partial}{\partial t}(\rho\,dx\,dy\,dz)$ (B)

eq. (A) & (B)

$$-\left[\frac{\partial}{\partial x}(\rho u) + \frac{\partial}{\partial y}(\rho v) + \frac{\partial}{\partial z}(\rho w)\right] dx\,dy\,dz = \frac{\partial}{\partial t}(\rho\,dx\,dy\,dz)$$

$$\boxed{\frac{\partial}{\partial x}(\rho u) + \frac{\partial}{\partial y}(\rho v) + \frac{\partial}{\partial z}(\rho w) + \frac{\partial \rho}{\partial t} = 0}$$

unsteady flow

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$$ steady flow incompressible fluid

3-D

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$ — 2D

A)

$$V = 2t\left(1 - \frac{x}{2L}\right)^2$$

Local acceleration $= \frac{\partial V}{\partial t} = 2\left(1 - \frac{x}{2L}\right)^2$

$L = 1.6\,m$

at $t = 6s$ & $x = 1m$

$$\frac{\partial V}{\partial t} = 2\left(1 - \frac{1}{2\times 1.6}\right)^2 = 0.945\,m/s^2$$

Q. NO.	ANSWER	MARKS

Convective acceleration $= V\frac{\partial V}{\partial x}$

$$= 2t\left(1-\frac{x}{2l}\right)^2 \times 2t \times 2\left(1-\frac{x}{2l}\right)\left(\frac{-1}{2l}\right)$$

$$= -\frac{4t^2}{l}\left(1-\frac{x}{2l}\right)^3$$

$t = 0.5$, $x = 1m$, $l = 1.6m$

Convective acceleration $= -\frac{4\times 0.5^2}{1.6}\left(1-\frac{1}{2\times 1.6}\right)^3$

$$= -29.24 m/s^2$$

Total acceleration = Local acceleration + convective "

$$= 0.945 - 29.24 = -28.295 m/s^2$$

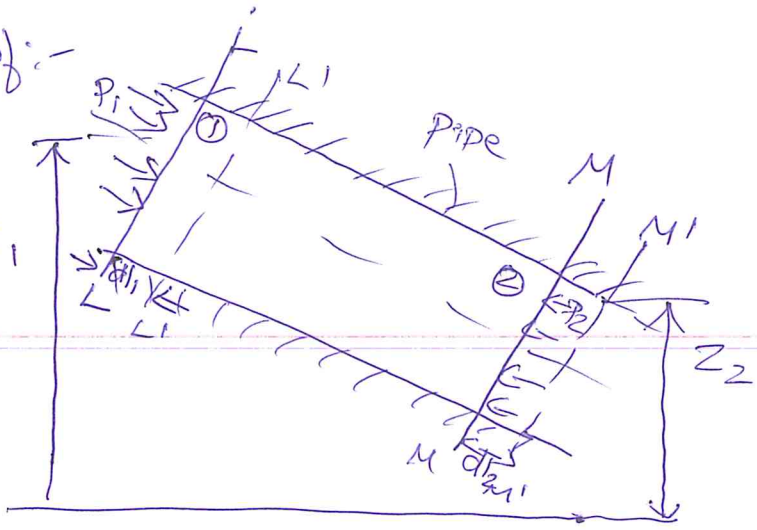
5) BERNOUILLI'S EQUATION:

* In an ideal incompressible fluid, when flow is steady & continuous, the pressure energy, kinetic energy & potential energy (datum energy) is constant along a stream line.

$$\frac{P}{w} + \frac{V^2}{2g} + Z = \text{constant}$$

Pressure energy, kinetic energy, potential energy

Proof:-



School of Aeronautics (Neemrana)
I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: MID TERM-I Date of Examination: _____

Subject FLUID MECHANICS Batch AE-10,11 &MT-2 Semester 04

Q. NO.	ANSWER	MARKS

*Consider an ideal incompressible liquid through a nonuniform pipe.

* 2 sections LL & MM.

* P_1 – Pr. at LL, V_1 – velocity at LL, Z_1 – height of LL above datum, A_1 – Area of pipe at LL.

P_2, V_2, Z_2, A_2 – corresponding values at MM.

* Liquid between 2 sections LL & MM move to L'L' & M'M' thru small length dl_1 & dl_2.

* Movement of liquid between LL & MM = movement of liquid b/w LL & L'L' & MM & MM'.

W – weight of liquid b/w LL & L'L'

Since flow is continuous,

$$W = wA_1dl_1 = wA_2dl_2$$

$$A_1dl_1 = \frac{W}{w} \qquad A_2dl_2 = \frac{W}{w}$$

$$\therefore A_1dl_1 = A_2dl_2$$

Workdone by pr. at LL $= f \times D = P_1A_1dl_1$

" " " " MM $= -P_2A_2dl_2$

Total Workdone by pressure $= P_1A_1dl_1 - P_2A_2dl_2$

$\because A_1dl_1 = A_2dl_2$ $\quad = A_1dl_1[P_1 - P_2]$

$$= \frac{W}{w}[P_1 - P_2]$$

Loss of potential energy $= W(Z_1 - Z_2)$

Gain in kinetic " $= W\left[\frac{V_2^2}{2g} - \frac{V_1^2}{2g}\right]$

$$= \frac{W}{2g}[V_2^2 - V_1^2]$$

Q. NO.	ANSWER	MARKS

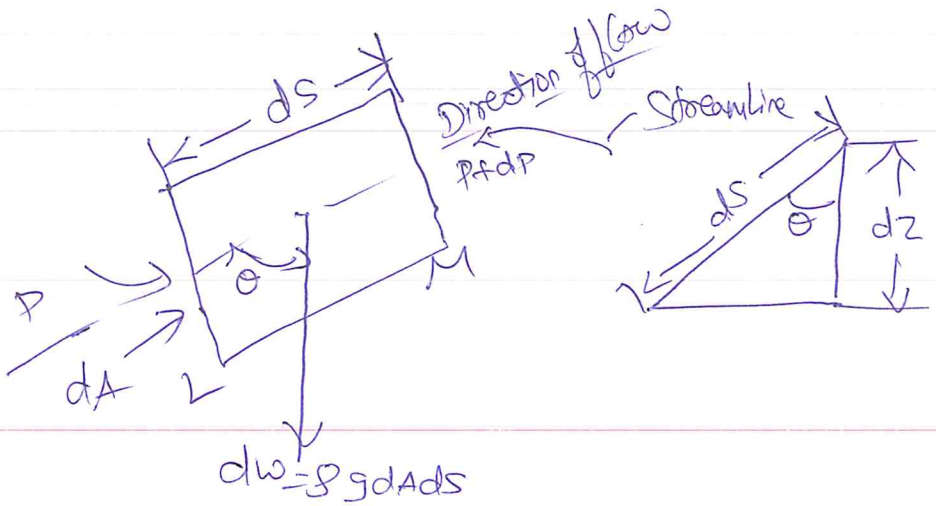
$\therefore$ Loss of P.E. + W.D. = Gain in K.E.

$$W(Z_1 - Z_2) + \frac{W}{w}(P_1 - P_2) = \frac{W}{2g}(V_2^2 - V_1^2)$$

$$(Z_1 - Z_2) + \left(\frac{P_1}{w} - \frac{P_2}{w}\right) = \frac{V_2^2}{2g} - \frac{V_1^2}{2g}$$

$$\frac{P_1}{w} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{V_2^2}{2g} + Z_2$$

6) EULER'S EQUATION



Proof:-

* Consider steady flow of an ideal fluid along stream tube.

* Separate out small fluid of area dA & length ds. from stream tube.

* Fig. Shows small element LM of fluid of cross-section area dA & length ds.

* Let P be the pr. on element at L

P+dP — " " " " M

V — vel. of fluid element.

Q. NO.	ANSWER	MARKS

Net pressure force $= P.dA - (P+dP)dA$

$= -dP\,dA$

Component of weight of fluid element in direction of flow $= -\rho g\,dA\,ds\cos\theta$

$= -\rho g\,dA\,ds\,\frac{dz}{ds}$

$= -\rho g\,dA\,dz$

Mass of fluid element $= \rho\,dA\,ds$

acceleration " " " $a = \frac{dv}{dt} = \frac{dv}{ds}\frac{ds}{dt}$

$= v\frac{dv}{ds}$

By Newton's 2nd law of motion

Force = mass × acceleration

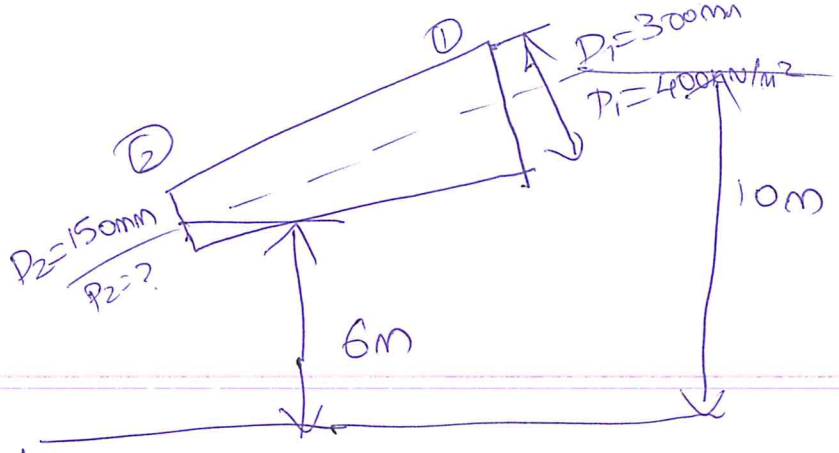
$-dP\,dA - \rho g\,dA\,dz = \rho\,dA\,ds\,v\frac{dv}{ds}$

$\div \rho\,dA$ throughout

$-\frac{dP}{\rho} - g\,dz = v\,dv$

$$\boxed{\frac{dP}{\rho} + v\,dv + g\,dz = 0}$$

7).



Given data:

At section 1 $D_1 = 300mm = 0.3m$

Q. NO.	ANSWER	MARKS

Area $A_1 = \frac{\pi}{4} d_1^2 = \frac{\pi}{4}(0.3)^2 = 0.0707 m^2$

Pressure of upperend $P_1 = 400 KN/m^2$

Height above datum $Z_1 = 10m$

Section 2:

Diameter $D_2 = 150mm = 0.15m$

Area $A_2 = \frac{\pi}{4}(0.15^2) = 0.01767 m^2$

Height of lower end above datum $= Z_2 = 6m$

$Q = 40 lit/s = \frac{40 \times 10^3}{10^6} = 0.04 m^3/s$

To find:- $P_2 = ?$

But $Q = A_1 V_1 = A_2 V_2$

$V_1 = \frac{Q}{A_1} = \frac{0.04}{0.0707} = 0.566 m/s$

So $V_2 = \frac{Q}{A_2} = \frac{0.04}{0.01767} = 2.264 m/s$

By Bernoulli's eq. ① & ②

$$\frac{P_1}{w} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{V_2^2}{2g} + Z_2$$

$$\frac{P_2}{w} = \frac{P_1}{w} + \left(\frac{V_1^2}{2g} - \frac{V_2^2}{2g}\right) + (Z_1 - Z_2)$$

$$= \frac{400}{9.81} + \left(\frac{(0.566)^2}{2 \times 9.81} - \frac{2.264^2}{2 \times 9.81}\right) + (10 - 6)$$

$$\frac{P_2}{w} = 40.77 - 0.245 + 4 = 44.525 m$$

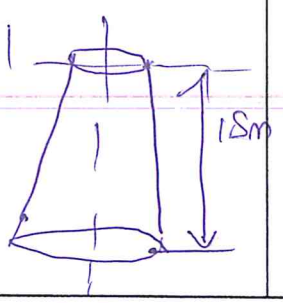
$$P_2 = 44.525 \times 9.81 = 436.8 KN/m^2$$

8). Given data:

$V_1 = 4.5 m/s \quad V_2 = 1.5 m/s$

$L = Z_1 - Z_2 = 1.5m$

$\frac{P_1}{w} = 10m$ of water



$h_f = 0.3\frac{(V_1 - V_2)^2}{2g}$

Q. NO.	ANSWER	MARKS

d. ~~(1) STREAM~~ TO find P_2 = ?

Sol.

(i) Neglecting friction. –

Apply Bernoulli's eq. b/w 1 & 2

$$\frac{P_1}{w} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{V_2^2}{2g} + Z_2$$

$$\frac{P_2}{w} = \frac{P_1}{w} + \frac{1}{2g}(V_1^2 - V_2^2) + (Z_1 - Z_2)$$

$$= 10 + \frac{1}{2\times 9.81}(4.5^2 - 1.5^2) + 1.5$$

$$= 12.42 \text{ m of water}$$

$$P_2 = 12.42 \times w = 12.42 \times 1000 \times 9.81$$

$w = Sg$

$$P_2 = 1.218 \text{ bar}$$

(ii) Considering head loss (h_f) in tube:

$$h_f = 0.3\frac{(V_1 - V_2)^2}{2g}$$

By Bernoulli's eq.

$$\frac{P_1}{w} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{V_2^2}{2g} + Z_2 + h_f$$

$$\frac{P_2}{w} = \frac{P_1}{w} + \frac{V_1^2}{2g} - \frac{V_2^2}{2g} + (Z_1 - Z_2) - h_f$$

$$= 10 + \frac{4.5^2}{2\times 9.81} - \frac{1.5^2}{2\times 9.81} + 1.5 - \frac{0.3(4.5-1.5)^2}{2\times 9.81}$$

$$P_2 = 1.204 \text{ bar}$$

Note

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Dated 22/03/18 .

Signature of Paper Setter

Signature of Principal/HOD

School of Aeronautics(Neemrana)

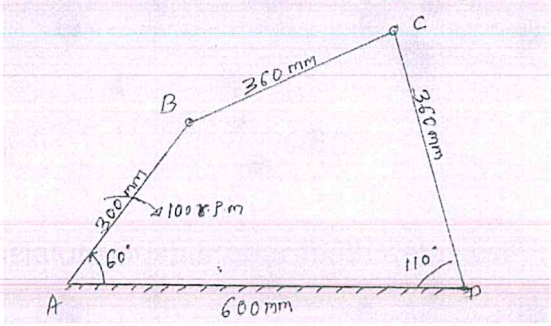
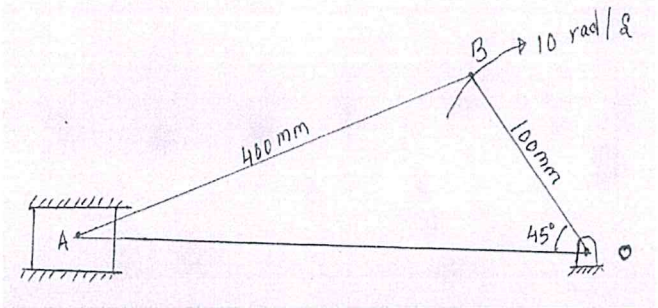
I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 26. 02. 2018

Subject : **Theory of Machine (Th)** Batch : AE - 10 & 11

Faculty Name : Mr. S. K. Tripathy Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	In a pin joined four bar mechanism the crank rotates uniformly at 100 r.p.m lacate all the instantaneous centre and find the angular velocity of link BC.  (9)	Unit No.: Topic Name: Source:
2.	In slider crank mechanism if the rotates clockwise with an angular velocity of 10 rad/s. Find i) The velocity of connecting rod AB.  (9)	Unit No.: Topic Name: Source:
3.	Explain with classification of toothed wheel gears. (9)	Unit No.: Topic Name: Source:
4.	Explain the nomenclature of spur gear teeth detail with neat labeled diagram. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Derive the length of path of contact and length of Art of contact for given pair of gear. (9)	Unit No.: Topic Name: Source:
6.	For a given pair of gear meshing T = t = 40 , ϕ = 20^0, m = 6mm length of are of contact = 1.75 times of circular pitch. find the adden dum. (9)	Unit No.: Topic Name: Source:
7.	For a given pair of gear meshing t = 30, t = 80, ϕ= 20 , m = 12mm, addendum = 10mm. Find length of path of contact and contact ratio. (9)	Unit No.: Topic Name: Source:
8.	For a given pair of gear meshing ϕ = 20^o, t = 20, gear ratio = 2 m = 5mm, v = 1.2 m/s , addendum = 5mm Find- i) angle turned by the pinion ii) Maximum velocity of sliding (9)	Unit No. Topic Name: Source:

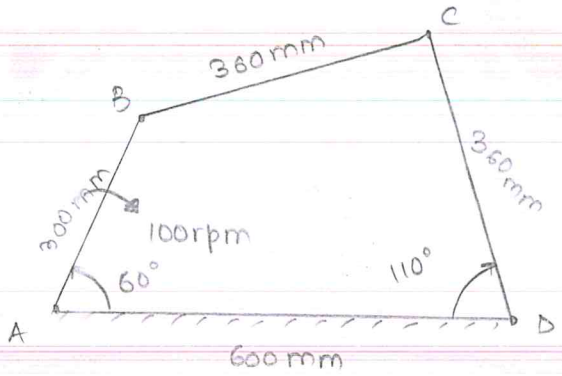
School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: MT-1 Date of Examination: 26/2/18

Subject THEORY OF MACHINE Batch 10, 11 Semester IV

Q. NO.	ANSWER	MARKS
1.	In a pin joined four bar mechanism the crank rotates uniformly at 100 r.p.m. Locate all the instantaneous centre and find the angular velocity of link BC. 	
→	Given: $N_{AB} = 100$ rpm or $\omega_{AB} = 2\pi \times 100/60 = 10.47$ rad/s	
	Since the length of crank AB = 300 mm = 0.3 m	
	therfore velocity of point B on link AB,	
	Location of Instantaneous centres :	
	The instantaneous centres are located as discussed below :	
1)	Since the mechanism consists of four links (i.e n=4)	

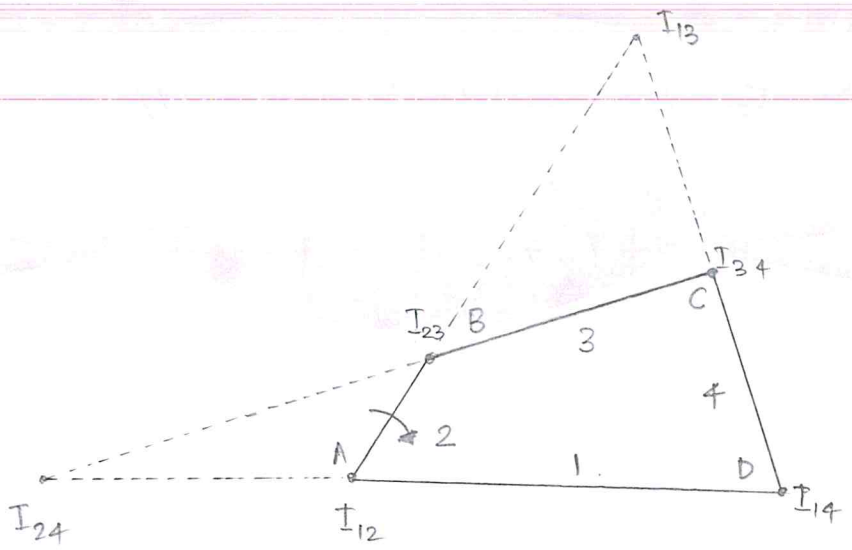
Q. NO.	ANSWER	MARKS

$$\therefore \quad N = \frac{n(n-1)}{2} = \frac{4(4-1)}{2} = \underline{6}$$

2. For a four bar mechanism, the book keeping table may be drawn

3. Locate the fixed and permanent instantaneous centres by inspection. These centres are I_{12}, I_{23}, I_{34} and I_{41}.

4. Locate the remaining neither fixed nor permanent instantaneous centres by Aronhold Kennedy's th^{m}.



Angular velocity of the link BC

Let ω_{BC} = Angular velocity of the link BC

Q. NO.	ANSWER	MARKS

Since B is also a point on link BC, therefore velocity of point B on link BC,

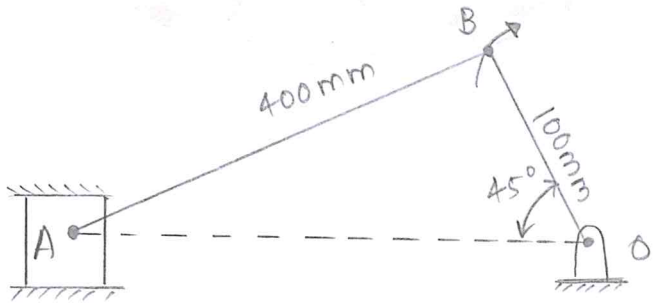
$$V_B = \omega_{BC} \times I_{13}B$$

By measurement, we find that;

$$I_{13}B = 500mm = 0.5m$$

$$\omega_{BC} = \frac{V_B}{I_{13}B} = \frac{3.141}{0.5} = 6.282 \text{ rad/s}.$$

Q2.) In slider crank mechanism if the rotates clockwise with an angular velocity of 10 rad/s. find i) The velocity of connecting rod AB.



→ Given: $\omega_{OB} = 10$ rad/s ; $OB = 100mm = 0.1m$

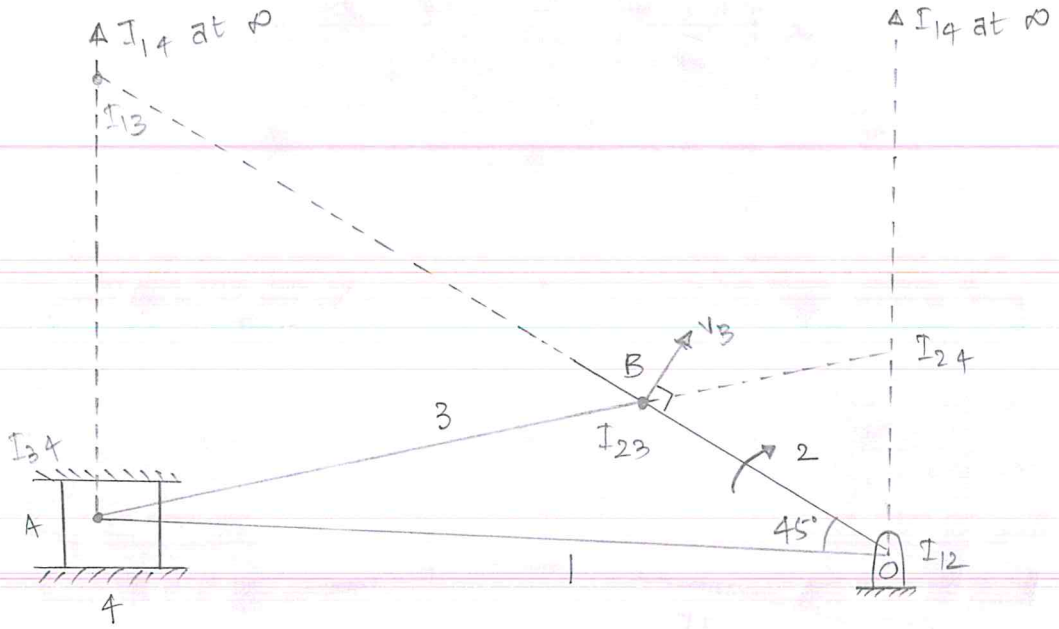
We know that linear velocity of the crank OB,

Q. NO.	ANSWER	MARKS

$\therefore V_{OB} = V_B = \omega_{OB} \times OB = 10 \times 0.1 = 1 m/s.$

Location of instantaneous centres :

$$N = \frac{n(n-1)}{2} = \frac{4(4-1)}{2} = 6$$



1.) Velocity of slider A :

Let V_A = Velocity of the slider A.

We know that ; $\frac{V_A}{I_{13}A} = \frac{V_B}{I_{13}B}$

$$\Rightarrow V_A = V_B \times \frac{I_{13}A}{I_{13}B} = 1 \times \frac{0.46}{0.56} = 0.82 m/s$$

2.) Angular velocity of connecting rod AB

Let, ω_{AB} = Angular velocity of connecting rod AB

Q. NO.	ANSWER	MARKS

$$\omega_{AB} = \frac{V_B}{I_{AB}} = \frac{1}{0.56} = 1.78 \text{ rad/s}$$

Q3.) Explain with classification of toothed wheel gears.

→ The gears or toothed wheels may be classified as follows :-

1) According to the position of axes of the shafts :-

a.) Parallel, b.) Intersecting, and c.) Non intersecting and non-parallel.

a.) Parallel :- when two parallel and co-planar shafts are connected by the gears. These gears are called as spur gears, and the arrangement is known as spur gearing.

b) Intersecting :- the two non parallel or intersecting, but coplanar shafts connected by gears. These gears are called bevel gears and the arrangement is known as bevel gearing

c.) Non Intersecting :- The two non- intersecting and

Q. NO.	ANSWER	MARKS
	non-parallel i.e. non-coplanar shaft connected by gears. These gears are called skew bevel gears or spiral gears. and the arrangement is known as skew bevel gearing or spiral gearing.	
2.)	According to the peripheral velocity of the gears:	
a)	low velocity, b) Medium velocity, and c) High velocity. The gears having velocity less than 3 m/s are termed as low velocity gears and gears having velocity b/w 3 and 15 m/s are known as medium velocity gears. If the velocity of gears is more than 15 m/s, then these are called as high speed gears.	
3.)	According to the type of gearing :-	
a)	External gearing, b) Internal gearing, c) Rack and pinion.	
	In external gearing, the gears of the two shafts mesh externally with each other. The larger of these two wheels is called spur wheel and smaller wheel is called pinion.	

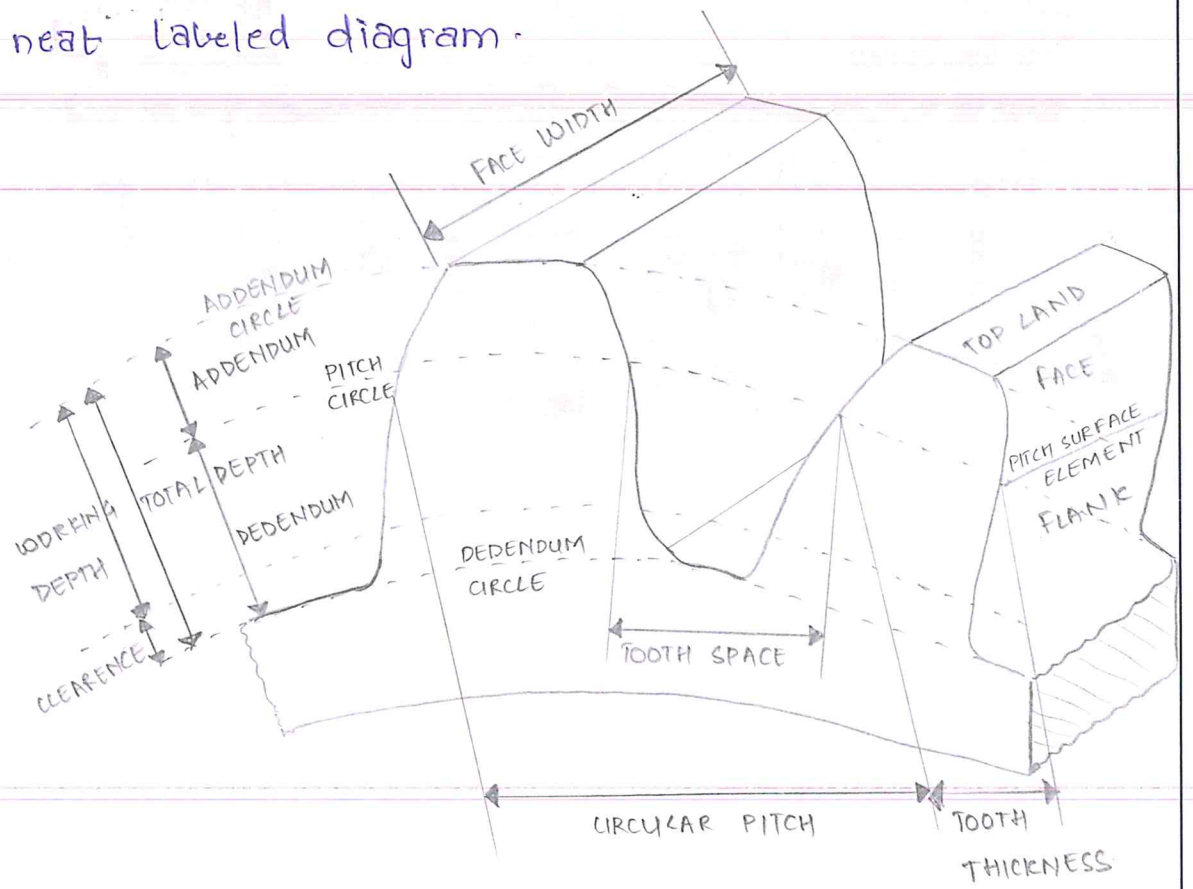
Q. NO.	ANSWER	MARKS

In Internal gearing, the gears of the two shafts mesh internally with each other. The larger of these two wheels is called annular and the smaller wheel is called pinion.

4. According to position of teeth on the gear surface: The teeth on the gear syrface may be

a) straight, b) inclined, and c) curved.

Q4) Explain the nomenclature of spur gear teeth with neat labeled diagram.



Q. NO.	ANSWER	MARKS
A.	Pitch Circle: It is an imaginary circle which by pure rolling action, would give the same motion as the actual gear.	
B.	Pitch circle diameter: It is the diameter of the pitch circle	
C.	Pitch point: It is a common point of contact b/w two circles.	
D.	Pitch Surface: It is the surface of the rolling discs which the meshing gears have replaced at p.c.	
E)	Pressure Angle or angle of obliquity: It is the angle b/w common normal to two gear teeth at the point of contact and the common tangent at the pitch point. $\phi = 14\frac{1}{2}$ to 20°	
F)	Addendum: Radial distance of a tooth from the p.c. to top of the tooth.	
G)	Dedendum: Radial distance of a tooth from the p.c. to bottom of the tooth	
H)	Circular Pitch: It is the distance measured on the circumference of the p.c from a pt of one tooth to	

Q. NO.	ANSWER	MARKS

the corresponding point of the next tooth. Denoted by P_c

Circular Pitch = $P_c = \pi D / T$

D = Diameter of the pitch circle,

T = Number of teeth on wheel.

I) Module: It is the ratio of the pitch circle diameter in millimeters to the number of teeth It is usually denoted by 'm'. Mathematically,

$$\text{Module} = m = \frac{D}{T}$$

J) Clearence: It is the radial distance from the top of the tooth to the bottom of the tooth, in a meshing gear. A circle passing through the top of the meshing gear is known as clearence circle.

K) Working depth: It is the radial distance from the addendum circle to the clearence circle.

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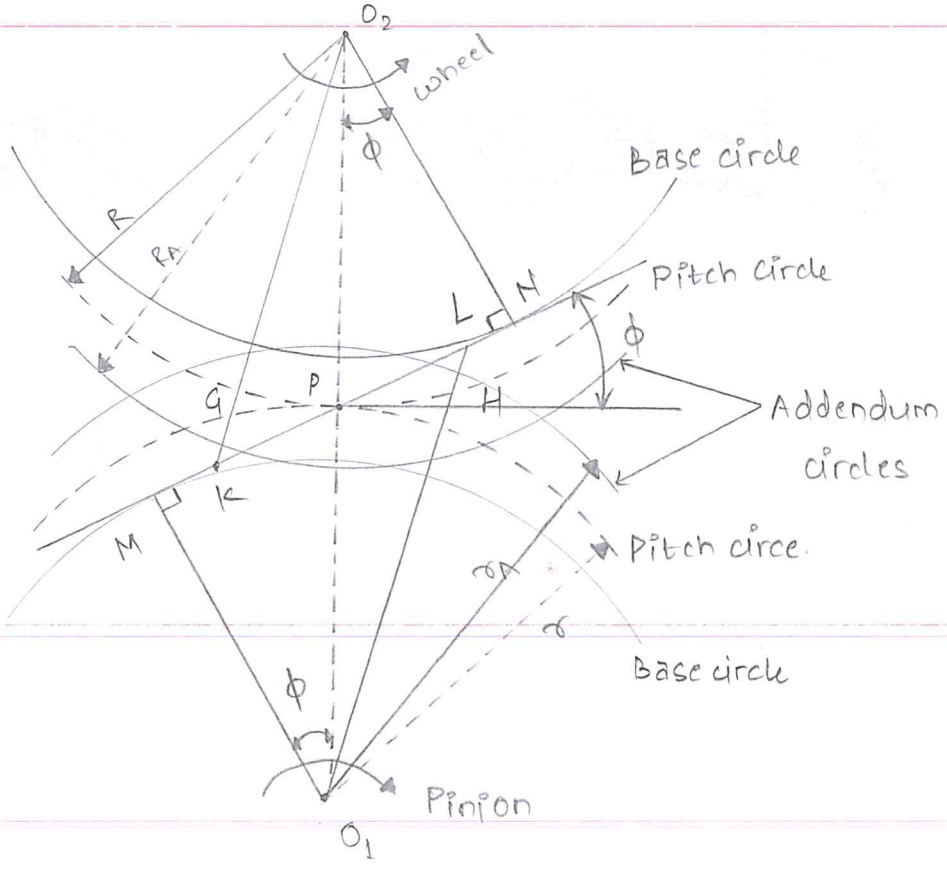
Dated _____ . **Signature of Paper Setter** **Signature of Principal/HOD**

Q. NO.	ANSWER	MARKS
L)	Tooth Thickness : It is the width of the tooth measured along the pitch circle.	
M)	Tooth space : It is the width of the tooth measured along, space b/w the two adjacent teeth measured along the pitch circle.	
N)	Backlash : It is the difference b/w the tooth space and the tooth thickness, as measured along the pitch circle.	
Q5)	Derive the length of path of contact and length of Arc of contact for a given pair of gear.	



Q. NO.	ANSWER	MARKS

Consider a pinion driving the wheel. The length of path of contact is the length of common normal cut-off by the addendum circles of the wheel and the pinion. KL is the length of path of contact. KP is known as path of approach, PL is known as path of recess.

Let, $r_A = O_1L$ = Radius of addendum circle of pinion,

$R_A = O_2K$ = Radius of addendum circle of wheel

$r = O_1P$ = Radius of pitch circle of pinion,

$R = O_2P$ = Radius of pitch circle of wheel.

$\Rightarrow O_1M = O_1P\cos\phi = r\cos\phi$

$\Rightarrow O_2N = O_2P\cos\phi = R\cos\phi$

In ΔO_2KN

$$KN = \sqrt{(O_2K)^2 - (O_2N)^2} = \sqrt{R_A^2 - R^2\cos^2\phi}$$

$$PN = O_2P\sin\phi = R\sin\phi$$

And

$$KP = KN - PN = \sqrt{R_A^2 - R^2\cos^2\phi} - R\sin\phi$$

Similarly from ΔO_1ML;

Q. NO.	ANSWER	MARKS

$$ML = \sqrt{(O_1L)^2 - (O_1M)^2} = \sqrt{r_A^2 - r^2\cos^2\phi}$$

$$MP = O_1P\sin\phi = r\sin\phi$$

and $$PL = ML - MP = \sqrt{r_A^2 - r^2\cos^2\phi} - r\sin\phi$$

$$\boxed{KL = KP + PL = \sqrt{(R_A)^2 - R^2\cos^2\phi} + \sqrt{r_A^2 - r^2\cos^2\phi} - (R+r)\sin\phi}$$

LAC - Length of arc of contact here is GPH or EPF. considering the arc of contact GPH, it is divided into two parts, i.e. arc GP and arc PH

GP → arc of approach ; PH = Arc of recess.

→ The length of the arc of approach (arc GP)

$$= \frac{\text{Length of path of approach}}{\cos\phi} = \frac{KP}{\cos\phi}$$

→ Length of the are of recess (arc PH)

$$= \frac{\text{length of path of recess}}{\cos\phi} = \frac{PL}{\cos\phi}$$

$$\therefore \boxed{LAC = \frac{LPC}{\cos\phi}}$$

Q. NO.	ANSWER	MARKS

Q6) For a given pair of gear meshing $T = t = 40$; $\phi = 20°$, $m = 6mm$ and $LAC = 1.75 P_c$. find the addendum

→ Given :- $T = t = 40$; $\phi = 20°$, $m = 6mm$

we know,

$$P_c = \pi m = 18.85 mm$$

$$\therefore LAC = 1.75 \times 18.85 = 33 mm$$

$$LPC = LAC \times \cos\phi = 33 \times \cos 20° = 31 mm$$

$$R = r = mT/2 = \frac{6 \times 40}{2} = 120 mm$$

$$31 = \sqrt{R_A^2 - R^2\cos^2\phi} + \sqrt{r_A^2 - r^2\cos^2\phi} - (R + r)\sin\phi$$

$$= 2\left[\sqrt{R_A^2 - R^2\cos^2\phi} - R\sin\phi\right]$$

$$\therefore \frac{31}{2} = \sqrt{R_A^2 - (120)^2\cos^2 20} - 120\sin 120$$

$$\therefore R_A = 126.12 mm$$

$\therefore$ Addendum $= R_A - R$

$$= 126.12 - 120 = 6.12 mm$$

Q. NO.	ANSWER	MARKS

Q7) For a given pair of gear meshing $t = 30$, $t = 80$, $\phi = 20$, $m = 12\,mm$, addendum $= 10\,mm$. Find LPC and contact ratio.

→ Given:- $t = 30$; $T = 80$; $\phi = 20^\circ$; $m = 12\,mm$.

LPC:

We know that, pc of pinion;

$$r = mt/2 = \frac{12 \times 30}{2} = \underline{180mm}$$

and P.C. radius of gear,

$$R = mT/2 = \frac{12 \times 80}{2} = \underline{480mm}$$

$$R_A = R + \text{Addendum} = 480 + 10 = \underline{490mm}$$

$$KP = \sqrt{(R_A^2) - R^2\cos^2\phi} - R\sin\phi = \sqrt{(490)^2 - (480)^2\cos^2 20^\circ} - 480\sin 20^\circ$$

$$= \underline{97.3\,mm}$$

LP of recess:

$$PL = \sqrt{(190^2) - (180)^2\cos^2 20} - 180\sin 20^\circ$$

$$= \underline{25mm}$$

$$\underline{LPC = 52.3mm}$$

Q. NO.	ANSWER	MARKS

$$LAC = \frac{LPC}{\cos\phi} = \frac{52.3}{\cos 20} = 55.66 \text{ mm}$$

$$CR = \frac{LAC}{P_c} = \frac{55.66}{37.7} = 1.5 \text{mm}$$

Q8) for a given pair of gear meshing $\phi = 20°$, $t = 20$, gear ratio = 2, $m = 5$mm, $v = 1.2$m/s addendum = 5mm.

Find - i) Angle turned by the pinion.

ii) Maximum velocity of sliding

→ Given: $\phi = 20°$; $t = 20$; $G = T/t = 2$; $m = 5$mm; $v = 1.2$m/s; addendum = 1 module = 5mm.

I) Angle turned through by pinion when one pair of teeth is in mesh;

$$r = mt/2 = 5 \times 20/2 = 50\text{mm}$$

Pitch circle of wheel;

$$R = m.T/2 = mG.t/2 = 100\text{mm}$$

$$\therefore r_A = r + \text{Addendum} = 50 + 5 = 55\text{mm}$$

$$R_A = R + \text{Addendum} = 100 + 5 = 105\text{mm}$$

$$KP = \sqrt{R_A^2 - R^2\cos^2\phi} - R\sin\phi$$

Q. NO.	ANSWER	MARKS

$$= 46.85 - 34.2 = 12.65 \text{ mm}$$

$$PL = \sqrt{r_A^2 - r^2\cos^2\phi} - r\sin\phi$$

$$= 28.6 - 17.1 = 11.5 \text{ mm}$$

$$KL = 12.65 + 11.5 = 24.15 \text{ mm}$$

$$LAC = \frac{LPC}{\cos\phi} = \frac{24.15}{\cos 20} = 25.7 \text{ mm}$$

We know that angle turned through by pinion

$$= \frac{LAC \times 360^\circ}{\text{Circumference of pinion}} = \frac{25.7 \times 360^\circ}{2\pi \times 50} = 29.45^\circ$$

2. Maximum velocity of sliding :

Let ω_1 = Angular speed of pinion, and

ω_2 = Angular speed of wheel.

$$V = \omega_1 r = \omega_2 R$$

$$\omega_1 = v/r = 120/5 = 24 \text{ rad/s.}$$

$$\omega_2 = v/R = 120/10 = 12 \text{ rad/s.}$$

$$\text{Max}^m \text{ velocity} = V_s = (\omega_1 + \omega_2) KP$$

$$= (24+12)\ 12.65 = 455.4 \text{ mm/s}$$

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Q. NO.	ANSWER	MARKS

Note

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Dated 12/3/14 . **Signature of Paper Setter** **Signature of Principal/HOD**

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 27. 02. 2018

Subject : **Aircraft Materials (Th)** Batch : AE - 10 & 11

Faculty Name : Mr. Arjun Singh Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Explain what are the heat treatment performed on titanium? (9)	Unit No.: Topic Name: Source:
2.	How to perform the heat treatments on magnesium alloy? (9)	Unit No.: Topic Name: Source:
3.	What are the methods to identity the metals and how to identity the high carbon steel? (9)	Unit No.: Topic Name: Source:
4.	Briefly explain about Nickel alloys i.e. Inconel monal and K- monal. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Explain about the impact tests and what is the difference between izod and charpy impact test. (9)	Unit No.: Topic Name: Source:
6.	Briefly explain about brinells hardness test. (9)	Unit No.: Topic Name: Source:
7.	Explain about the Rock well hardness test. (9)	Unit No.: Topic Name: Source:
8.	Briefly explain about: a. Proportional limit b. Elastic limit c. Yield point (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: 1st Mid Term Date of Examination: _____

Subject Aircraft Materials Batch 10&11 Semester IV

Q. NO.	ANSWER	MARKS
1.	**Stress Relieving** – It is generally used to remove stress concentrations resulting from forming. It is performed at temperature from 650°F to 1000°F. The time at varies from few minutes for very thin sheet to an hour or more for heavy sections. A typical stress relieving treatment is 900°f for 30 minutes followed by air cool. **Full Annealing** – The full anneal is called for further working. It is performed at 1200°F to 1650°F. The time at temperature varies from 16 minutes to several hours depending upon the thickness of material and amount of cold work to be performed. The commonly used treatment is 1300°F for one hour and followed by air cool. **Thermal Hardening** – Unalloyed titanium cannot be heat treated but alloys can be strengthened by thermal treatment at some sacrifice in ductility. For best results, a water quench from 1450°F followed by re-heating to 900°F for 8 hours is recommended.	7½ 9
2.	There are two heat treatments are performed on magnesium alloys i.e. solution heat treatment and precipitation heat treatment.	

Q. NO.	ANSWER	MARKS
	Solution Heat Treatment – Magnesium alloy castings are solution heat treated to improve tensile strength, ductility and shock resistance. Magnesium alloy castings are heated between 730°F to 780°F as per the type of alloy. The soaking time ranging from 10 to 18 hours. More then 18 hours may be needed for castings over two inches in thickness Caution – Magnesium alloys must never be heated in salt bath, this may result in explosion. Temperature must not be exceeded the limit, casting may ignite and burn freely. Some magnesium alloy may need the almosphere of sulphur dio-oxide to prevent fire hazard. Air quenching is used after solution heat treatment Precipitation Heat Treatment – This is the treatment given to the magnesium alloys to increase the hardness and yield strength also corrosion resistance is also improved. Precipitation temperature are considerably lesser and ranges from 325°F to 500°F soaking time ranges from 4 to 18 hours. It is also known as Artificial age hardening.	9
3.	To identify the high carbon steel at first it should be dropped on anvil and observe it, there the metal rings. If it's high carbon steel it will sound high pitch ring. Secondly try to chip the metal. Usually high carbon steel is harder to chip and chippings bend without breaking.	2½

Q. NO.	ANSWER	MARKS
	It can be filed but tougher than mild steel if it is cooled in air from red-heat. If it is quenched in water from red heat, it becomes very hard and can not be filed. Its appearance at fracture is pale gray and the crystals appear very fine. If it is grinded against the grind wheel its spark from the rotor will be bright yellow and all the sparks will be bursting.	9.
4.	Nickle is the chief constituent of non-ferrous alloys which are used in special applications in aircraft work. There Nickle alloys are of specied interest these are Inconel, Monel and K Monel. Inconel - Inconel is a nickle chromium alloy classified as non ferrous because the iron content is negligible. Inconel is a heat and corrosion resisting steel. It is used specially for exhaust collector of aircraft engines. Inconel consists of Nickle 79.5%, Chromium 13%, Iron 6.5% and manganese 0.25%. Monel - Monel is a high Nickle-Copper alloy. It has high strength and excellent resistance for corrosion. It can not be hardened by heat treatment but only by cold working. It is not used for aircraft	

Q. NO.	ANSWER	MARKS

construction but used for industries and chemical applications. It contains Nickle 67%, Copper 30%, Iron 1.4%, Manganese 1.0% Silicon 0.1% and Car 0.15%.

K. Monel - K monel is the non ferrous alloy composed mainly of Nickle, Copper and aluminium. It produced by addition of small amount of aluminium to Monel. It is corrosion resistant and can be hardened by heat treatment K Monel is successfully used for gears, chains, and structural members in air craft. K Monel being non-magnetic some time used in the vicinity of compass. 4

5. → The impact tests are performed to determine resistance to fracture of a material under impact loading i.e. under suddenly applied dynamic load. The impact test measure the fracture energy, it is measured on a scale provided on the machine. The two most commonly performed tests are Izod and charpy impact test.

For both these tests a standard pendulam type impact testing machine is used. The standard specimens are prepared. The specimen is held in the specimen sport and struck by a load attached to the pendulam, breaks suddenly by releasing the pendulam from its stationary position The pendulam swings further after breaking the specimen. At the end of the swing is measured.

Q. NO.	ANSWER	MARKS
5.	By this data, energy consumed in breaking can be calculated. The specimen used for Izod impact test held in the support in cantilever position and knotched at 1/3 length which is facing toward pendulam. Striking load strikes near its upper end and breaks it. speciman for charpy test is shorter in length and knotched in centre. Support as simply supported beam.. knotch faces opposite to pendulam. The test is performed same way as izod impact test.	4
6.	There are several designs of Brinells hardness testing machines but the simplest design have a manual loading and unloading but the basic peinciple of this test is common to all. It involves making a prismatic test block of the metal being tested. Placing the test sample at the table and raising the table in such a position that the top surface of specimen is just touch the ball. The ball is a hardened steel ball usually of 10 mm ± 0.01 mm diameter. The ball is pressed into specimen by gradually applying the load either mechanically or hydraulically. The load is maintained for about 10–15 seconds and then withdrawn. In the meanwhile the spherical ball has made an indention the test piece. The diameter of the indent is measured and Brinell's hardness number is calculated from the following relation: $BHN = \frac{\text{Load applied (in kgs)}}{\text{Area of the ball impression in mm}^2}$	

Q. NO.	ANSWER	MARKS
	The load applied varies from 500kg to 3000kgs according to material hardness. The magnitude of BHN is indicative of the relative hardness of the material. The higher this number, the harder the material.	4
7	Rockwell hardness test is widely used because of its speed and free from errors. For indentation test it works like Brinell's test but differ from it as it employs much smaller indenters (Penetraters) and application of much smaller loads. The penetrater can be in shape of a small ~~ball~~ ball or a diomand cone, known as brale. The test is carried out in two stages. First the penetrater is set firmly against specimen by applying small enough (10kg) load called minor load. This result in a very small penetration in to surface. A dial indicater provided on machine is to be brought to 'zero' after small penetration, and a heavy load is applied which is called the major load. After penetration is made the major load is removed and note the dial indicator reading. The increament in the depth is measured and RHN is determined mathematically i.e. $R = 100 - 500t$ (t - depth of penetration)	9

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Dated _____ . **Signature of Paper Setter** **Signature of Principal/HOD**

Q. NO.	ANSWER	MARKS
9.	During tensile test a graph is plotted between the different values of applied loads (stresses) and the corresponding values of resulting strain. Proportional Limit — The material elongates elastically in the beginning of test. The strain increases directly in proportion to the applied stress. If the load is removed during this range the specimen returns to its original length. The material will obey the Hooks Law. This state will continue till the stress and strain value reaches, to limit of proportionality is called proportional limit. Elastic Limit — If the material is loaded beyond the elastic limit, the applied load causes the plastic deformation, the material fails to return to its original shape and size. Beyond the elastic limit strain increases more then the corresponding stress. Yield Point — Beyond the elastic limit strain increases rapidly, strain even increases without any further increase in stress. At this point the material is found stretch suddenly. This point is known as yield point. There are two distinct yield point called the upper yield point and the lower yield point the upper yield point correspond maximum stress and lower yield point following the strain.	9

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School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

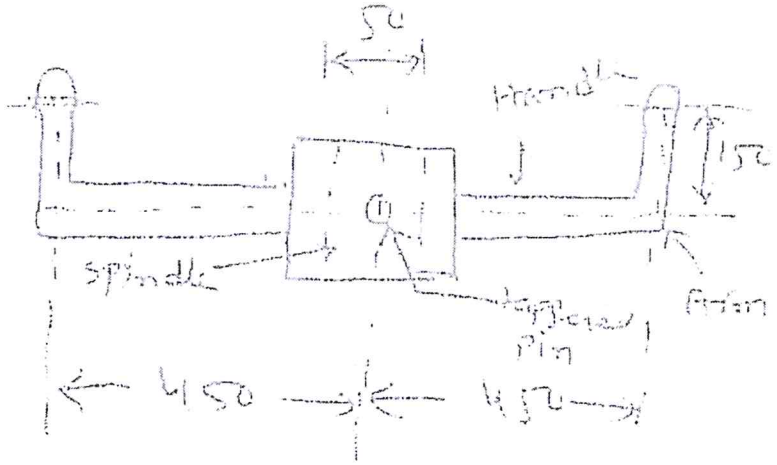
Fortnightly/Term : Mid Term -1 Date : 27. 02. 2018

Subject : **Machine Design (Th)** Batch : AE - 10 & 11

Faculty Name : Mr. Naresh Kumar Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	What are the flexible couplings and what are their applications? Illustrate your answer with suitable examples and sketches. (9)	Unit No.: Topic Name: Source:
2.	Explain the various forms of screw threads with neat sketches. (9)	Unit No.: Topic Name: Source:
3.	Explain the followings terms used in screw threads with neat sketches: a. Pitch b. Root c. Flank d. Lead (9)	Unit No.: Topic Name: Source:
4.	Two machine parts are fastened together tightly by means of a 24 mm tap bolt. If the load tending to separate these parts is neglected , find stress that is setup in the bolt by the initial tightening. (take core diameter 20.32mm) (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Design a clamp coupling to transmit 30kW at 100 rpm. The allowable shear stress for the shaft and key is 40Mpa and the number of bolts connecting the two halves are six.the permissible tensile stress for the bolts is 70Mpa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3. (9)	Unit No.: Topic Name: Source:
6.	Design the rectangular key for a shaft of 50mm diameter. The shearing and crushing stresses for the key material are 42Mpa and 70 Mpa. (9)	Unit No.: Topic Name: Source:
7.	A handle for turning the spindle of a large valve is shown in figA. The length of the handle from the centre of the spindle is 450 mm. the handle is attached to the spindle by means of a round tapered pin. If an effort of 400 N is applied at the end of the handle, find 1. Mean diameter of the tapered pin and 2. Diameter of the handle. The allowable stresses for the handle and pin are 100 Mpa in tension and 55 Mpa in shear (9	Unit No.: Topic Name: Source:
8.	What is a Lever ? Explain the Principle on which it works. Explain Leverage.  (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: MT-I Date of Examination: _____

Subject Machine Design Batch 10th & 11th Semester 4th

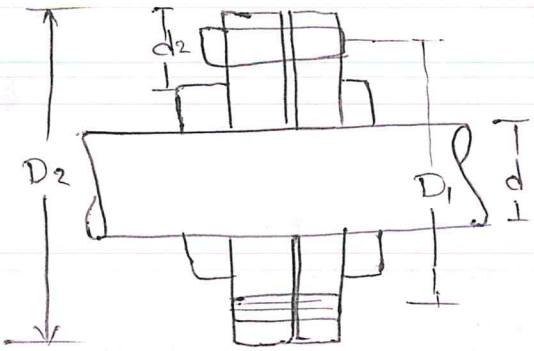
Q. NO.	ANSWER	MARKS
01.	What are the flexible coupling and what are their applications? Illustreate youre answere with suitable examples and sketches.	
Ans-	Flexible coupling are usually lesed to transmit torque from one shaft to another when the two shafts are slightly misaligned. They can accommodate varying degrees of misalignment up to 3° and some parallel misalignment. In addition, they can also be used for vibration damping are noise reduction. In rotating shaft application a flexiable coupling can protect the driving and driven shaft component (such as bearing) from the harmful effects of condition such as misaligned shafts, vibration, shock loads and thermal expansion of the shafts are other component. Some of the flexiable copuling → Beam coupling → Elastic coupling → Constant velosity coupling → Geare coupling → Flange coupling. i) Bushed pin flex. coupling ii) Oldham's coupling iii) Univercial coupling • Beam coupling :- A beam coupling, also known as helical coupling, is a flexiable coupling fore transmitting torque between two shafts while allowing fore angulare misalignment, parallel offset and even	

Q. NO.	ANSWER	MARKS

axial motion of one shafts relative to other. This design utilize a single piece of material and become flexiable by removal of material along a spiral path resulting in a curved flexiable beam of helical space.

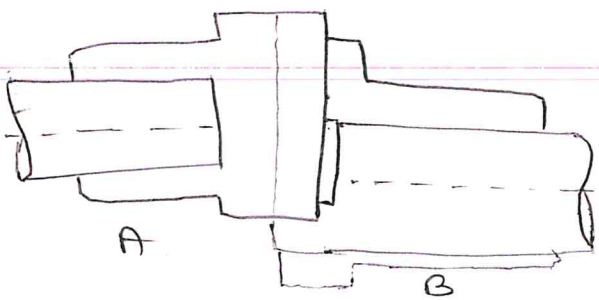
1. Bushed pin flexiable coupling

A bushed-pin flexiable coupling is a modification of rigid type of flange coupling. The coupling bolts are known as pins. The rubbere are leadere bushes are used overe the b/w the face coupling are dissimilare in construction.



2. Oldham Coupling

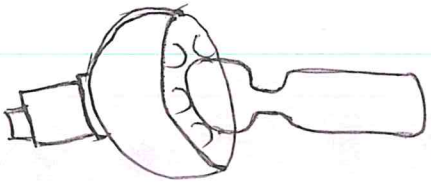
It is used to joint two shafts which have lateral mis-alignment. It consists of two flanges A and B slots and a central floating patch E with two tongues T_1 and T_2 at right angles as shown in fig. The central floating parct is held by means of a pin passing through the flanges and the floating parct. The torque T_1 fits into the slot of flangle A and allowas fore "to and fro" relative motion.



Q. NO.	ANSWER	MARKS

3. Universal or Hook's Coupling

A universal coupling is used to connect two shafts whose axes intersects at a small angle. The inclination of the two shafts may be constant, but in actual practice, it varies when the motion is transmitted from one shaft to another.



Q2) Explain the various forms of screw threads with neat sketches.

A thread is a ridge of uniform section in the form of helix on the internal or external surface of a cylinder (or) it could be described as a sloping plane curled around cylinder.

External threads are on bolts or screw.

Internal threads are on nuts.

There are many forms of threads but two types are in common use on fasteners.

Machine screw threads:- Use on bolts, setscrews, machine screw and designed to mate with performed threads in nuts are tapped holes.

Exceptions may be thread following screw like Taplite or Slef drilling screw like ~~Tel~~ Klore thread cutters like type 23 which forms or cuts their own screw thread.

Spaced Threads

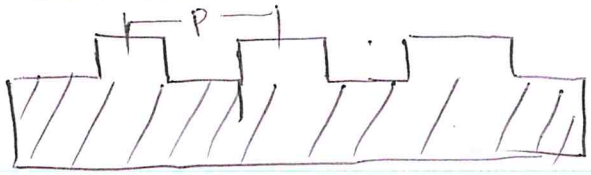
used on woodscrew, self-tapping screws, coach screw and type 25 thread cutters.

Designing to form its own thread, usually in a predrilled holes.

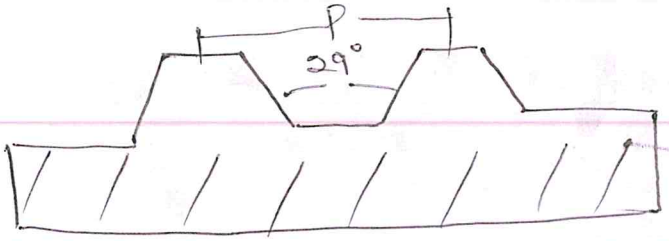
Q. NO.	ANSWER	MARKS

Types of screw thread

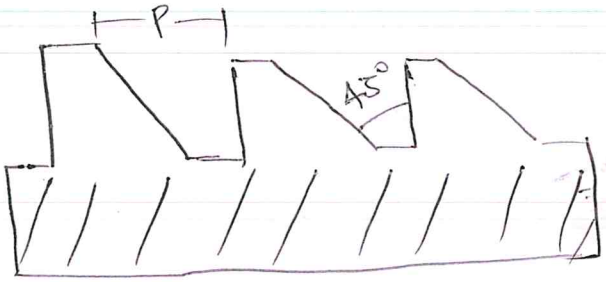
1) Squre thread
2) Acme thread
3) Buttress thread.



squre thread



Acme thread

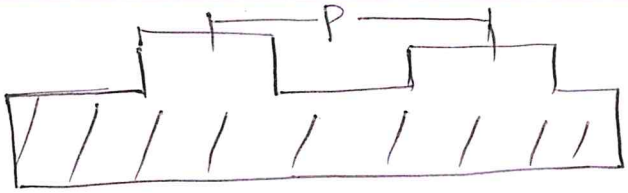


Buttress thread

Q3) Explain the fallowing terms useing in screw thread with neat sketches.
(a) Pitch (b) Root (c) Flank (d) Lead

Ans- Pitch

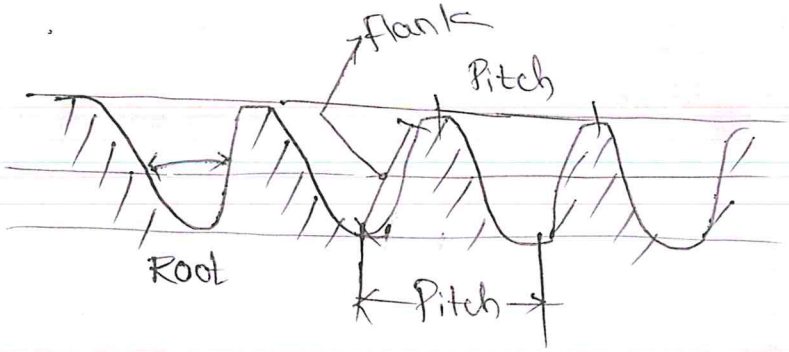
Metric fasteners are specified with a thread pitch instead of thread count. The thread pitch is the distance b/w threads expressed in milimetere. For example a pitch 1.5 mean that the distance between one thread and the next is 1.5 mm.



P = Pitch.

Q. NO.	ANSWER	MARKS

Root - The flanks of a thread are the straight sides that connect the crest and the root. The angle of thread is the angle between the flanks, measured in a axial plance section. The pitch of a thread is the distance measured parallel to its axis between correcesponding points on adjectent sureface, in the same axial plane.



Q4) Two machine parcts arce Fastened togethere tightly by means of 24 mm tap bolt. If the load tending to separate these parcts is neglected. Find the stress that is set up in the bolt by the initial tightening.

Ans Given data,

$d = 24mm$

From tabe, we find that the coree dia of the thread corecesponding to M24 is $d_c = 20.32mm$.

Let σ_t = stress set up in the bolt

We know that initial tension in the bot

$P = 2840d = 2840 \times 24 = 68160N$.

Q. NO.	ANSWER	MARKS

We also known that initial tension in the bolt (P)

$$68160 = \frac{\pi}{4}(dc)^2 \sigma_t$$
$$= \frac{\pi}{4}(20.30)^2 \sigma_t$$
$$= 324 \sigma_t$$
$$\sigma_t = \frac{68160}{324} = 210 \text{ N/mm}^2$$
$$= 210 \text{ MPa (Ans)}$$

Q.5) Design a clamp coupling to transmit 30kW at 100 rpm. The allowable sheare stress for the shaft and ~~the~~ key is 40MPa and the numbere of bolts connecting the two halves aree six. the peremissible tensile stress for the bolts is 70MPa. The coefficient of friction between the muff and the shaft sureface may be taken as 0.3.

Sol- Given, $P = 30\text{kW} = 30 \times 10^3 \text{ W}$.

$N = 100 \text{ rpm}$

$\tau = 40 \text{ MPa} = 40 \text{ N/mm}^2$

$n = 6$

$\sigma_t = 70 \text{ MPa} = 70 \text{ N/mm}^2$

$\mu = 0.3$

1. Design fore shaft

d = dia of shaft

We know that toreque transmitting by the shaft.

Q. NO.	ANSWER	MARKS

$$T = \frac{P \times 60}{2\pi N} = \frac{30 \times 10^3 \times 60}{2\pi \times 100} = 2865 \text{ N-m}$$

$$= 2865 \times 10^3 \text{ N-mm.}$$

We also know that the toreque treansmitting by the shaft (T)

$$2865 \times 10^3 = \frac{\pi}{16} \times \tau \times d^3$$

$$= \frac{\pi}{16} \times 40 \times d^3 = 7.86\, d^3$$

$$d^3 = \frac{2865 \times 10^3}{7.86}$$

$$= 365 \times 10^3 \text{ orc}$$

$$d = 71.4 \text{ say } 75 \text{ mm}$$

2. Design forc muff

We know that diameter of muff

$$D = 2d + 13 \text{ mm}$$

$$= 2 \times 75 + 13$$

$$= 163 \text{ say } 165 \text{ mm}$$

and total length of muff

$$L = 3.5\, d$$

$$= 3.5 \times 75$$

$$= 262.5 \text{ mm}$$

3. Design of key

Width of key $= w = 22$ mm

Thickness of key $t = 14$ mm

Length of key = total length of muff = 262.5 mm.

Q. NO.	ANSWER	MARKS

4. Design fore bolt

Let d_b = Root or corce dia.

torque (T)

$2865 \times 10^3 = \frac{\pi}{16} \times \mu (d_b)^3 \sigma_t \times n \times d$

$= \frac{\pi}{16} \times 0.3 (d_b)^3 70 \times 6 \times 75$

$= 5830 (d_b)^3$

$(d_b) = 2865 \times 10^3 / 5830$

$= 492$

$d_b = 22.2$ mm.

Q.6) Design the rectangulare key fore a shaft of 50 mm diameter. The shearing and crushing stresses fore the key material are 42 MPa and 70 MPa.

Given data, $d = 50$mm

$\tau = 42$MPa $= 42$ N/mm^2

$\sigma_c = 70$MPa $= 70$ N/mm^2

The rectangulare key is designed as discoursed below

width of key $w = 16$mm

$l = 10$ mm

considering shearing of key. We know that shearing streength

$T = l \times w \times \tau \times d/2 = l \times 16 \times 42 \times \frac{50}{2}$

$= 16800$ l N-mm —(i)

torsional shearing streength

$T = \frac{\pi}{16} \times \tau \times d^3$

$= \frac{\pi}{16} \times 42 (50)^3$

$= 1.03 \times 10^6$ N-mm —(ii)

Q. NO.	ANSWER	MARKS

From (i) and (ii)

$L = 10.8 \times 10^6 / 16800 = 61.31$ mm

torque $T = L \times t/2 \times 6c \times d/2$

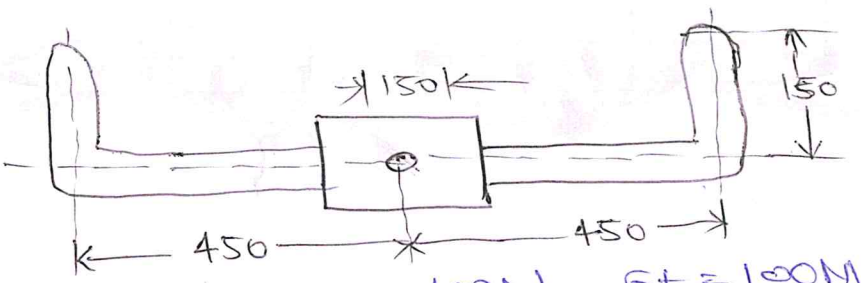
$= L \times \frac{10}{2} \times 70 \times \frac{50}{2} = 8750\ L$ N-mm

(ii) and (iii) $L = 1.03 \times 10^6 / 8750 = 117.7$ mm.

Taking large value

$L = 117.7$ say 120 mm.

Q7) A handle for turning the spindle of a large valve is shown in fig. The Length of handle from centre of the spindle is 450mm. the handle is attached to the spindle by means of a round tapered pin. If an effort of 400N is applied at the end of the handle, find 1. Mean dia of the tappered pin and 2. Diameter of the handle. The allowable stresses for the handle and pin are 100 MPa in tension and 55 MPa in sheare.



Given $L = 450$ mm $P = 400$N $6t = 100$MPa $= 100$N/mm^2

$z = 55$ MPa $= 55$ N/mm^2

d_1 = mean dia of taped pin

d = dia of spindle $= 50$

$T = P \times 2L = 400 \times 2 \times 450 = 360 \times 10^3$ N-mm

$T = 2 \times \frac{\pi}{4} (d_1)^2 z \times \frac{d}{2}$

$= 2 \times \frac{\pi}{4} (d_1)^2 \times 55 \times \frac{50}{2}$

$= 2160\ (d_1)^2$ N-mm.

Q. NO.	ANSWER	MARKS

(i) and (ii)

$(d_1)^3 = 360 \times 10^3 / 2160$

$= 166.7$

$d_1 = 12.9$. Say 13

2.) Dia of handle

$M = PL = 400 \times 450 = 180 \times 10^3$ N-mm

$T = 400 \times 100 = 40 \times 10^3$ N-mm

$Te = \sqrt{M^2 + T^2} = 184.4 \times 10^3$ N-m

$Te = 184.10^3 \times \frac{\pi}{16} \times C \times D^3 = \frac{\pi}{16} \times 55 \times D^3 = 10.8 D^3$

$D^3 = 184.4 \times 10^3 / 10.8 = 17.1 \times 10^3$

$D = 25.7$ mm

$Me = 182.2 \times 10^3$

$D^3 = 26.5$ mm

Taking large of two vale

$D = 26.5$ mm (Ans.)

Q.5) What is levere ? Pinciple on which it worek leverage.

Levere –

→ rigid rood ore bare capable to turening about the falcream

→ lift load by application of small efford.

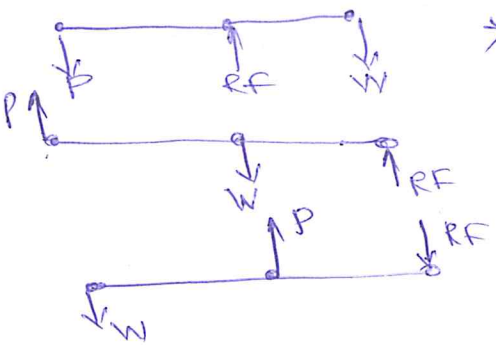
→ mechanical advantage

Application

1st type

2nd type

3rd type



Leverage

→ exertion of force by means of a levere.

Note

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2. For any discripencies found in answers, paper setter will be held responsible for playing with the career of the students,and doing breach of trust with them, and accordingly action can be taken by the disiplinary committee in this regard.
3. Principal before signing for the correctness of the answer shall ensure the same from relevant books. Point No. 1 & 2 above are applicable to Principal also in case any discripencies are found in answers.

Dated 07/03/18 . **Signature of Paper Setter** **Signature of Principal/HOD**

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 24. 02. 2018

Subject : **Dynamics of Machinery (Th)** Batch : MT-2

Faculty Name : Mr. Naresh Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Why is balancing of rotating parts necessary for high speed engines ? (9)	Unit No.: Topic Name: Source:
2.	A vee-twin engine has the cylinder axes at right angles and the connecting rods operate a common crank. The reciprocating mass per cylinder is 11.5 kg and the crank radius is 75 mm. The length of the connecting rod is 0.3 m. Show that the engine may be balanced for primary forces by means of a revolving balance mass. If the engine speed is 500 r.p.m. What is the value of maximum resultant secondary force ? (9)	Unit No.: Topic Name: Source:
3.	The mass of flywheel of an engine is 6.5 tonnes and the radius of gyration is 1.8 metres. It is found from the turning moment diagram that the fluctuation of energy is 56 kN-m. If the mean speed of the engine is 120 r.p.m., find the maximum and minimum speeds. (9)	Unit No.: Topic Name: Source:
4.	Explain the terms 'fluctuation of energy' and 'fluctuation of speed' as applied to flywheels. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Four masses m_1, m_2, m_3, and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. (9)	Unit No.: Topic Name: Source:
6.	Explain clearly the terms 'static balancing' and 'dynamic balancing'. State the necessary conditions to achieve them. (9)	Unit No.: Topic Name: Source:
7.	Write a short note on primary and secondary balancing. (9)	Unit No.: Topic Name: Source:
8.	What are V - engines ? How are they balanced ? It is possible to balance them completely ? (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: MT-I Date of Examination: _____

Subject Dynamics of Machines Batch MT-2 Semester 4th

Q. NO.	ANSWER	MARKS
Q1	why is Balancing of rotating parts necessary for high speed engines.	
Ans	The high speed of engines and other machines is a common phenomenon now a days. so it is very important that all the rotating & reciprocating parts should be completely balanced as far as possible. These forces not only increase the loads on bearings and stresses in various members, but also produce unpleasant & dangerous vibrations which are needed to be sated out. unbalance is caused by the displacement of the mass centerline from the rotor's axis by an eccentricity in disturbing of rotor masses. In simpler terms due to centrifugal force, the "heavy" point of a rotor exceeds the centrifugal force exerted by the light side of the rotor and pulls the entire rotor in the dir^{n} of heavy point Balancing is the correction of this phenomenon by the removal or addition of mass to the component to compulsation for centerline error.	

Q. NO.	ANSWER	MARKS

Q.2 A Vee-twin engine has the cylinder axes at angles and the connecting rods operate a common crank. The reciprocating mass per cylinder is 11.5 Kg and the crank radius is 75mm. The length of the connecting rod is 0.3 m. Show that the engine may be balanced for primary forces by means of a revolving balance mass. If the engine speed is 500 r.p.m. What is the value of maximum resultant secondary force?

Soln Given: $2\alpha = 90^\circ$ or $\alpha = 45^\circ$; $m = 11.5$ kg; $r = 75$ mm.
$l = 0.3$ m; $N = 500$ rpm or $\omega = 2\pi \times 500/60 = 52.37$ rad/s

We know that resultant primary force

$$F_p = 2m.\omega^2.r\sqrt{(\cos^2\alpha\cos\theta)^2 + (\sin^2\alpha\sin\theta)^2}$$

$$= 2m.\omega^2.r\sqrt{(\cos^2 45^\circ\cos\theta)^2 + (\sin^2 45^\circ\sin\theta)^2}$$

$$= 2m.\omega^2.r\sqrt{\left[\frac{\cos\theta}{2}\right]^2 + \left[\frac{\sin\theta}{2}\right]^2} = m.\omega^2.r$$

Since the resultant primary force $m.\omega^2.r$ is the centrifugal force of a mass m at the crank radius r when rotating at ω rad/s, therefore the engine may be balanced by a rotating balance mass.

Max. resultant secondary force.

We know that resultant secondary force,

$$F_s = \sqrt{2} \times \frac{m}{4} \times \omega^2.r\sin 2\theta \quad (\text{when } 2\alpha = 90^\circ)$$

This is maximum when $\sin 2\theta$ is maximum i.e. when $\sin 2\theta = \pm 1$ or $\theta = 45^\circ$ or 135°

Q. NO.	ANSWER	MARKS

∴ maximum resultant secondary force,

$$F_{S_{max}} = \sqrt{2} \times \frac{m}{n} \times \omega^2 . r \quad \text{.. (Substituting } \theta = 45^\circ)$$

$$= \sqrt{2} \times \frac{11.5}{0.3/0.075} (52.37)^2 0.075 = 836 N \text{ Ans}$$

Q.3 The mass of flywheel of an engine is 6.5 tonnes and the radius of gyration is 1.8 m It is found from the turning moment diagram that the fluctuation of energy is 56 KN-M. If the mean speed of the engine is 120 r.p.m. find the maximum & minimum speeds.

Soln Given : $m = 6.5\,t = 6500\,kg$, $K = 1.8\,m$; $\Delta E = 56\,KN\text{-}m$

$N = 120$ r.p.m.

let N_1 & N_2 = max. & min. speed respectively

we know that fluctuation of energy (ΔE)

$$56 \times 10^3 = \frac{\pi^2}{900} \times m.K^2.N(N_1 - N_2) = \frac{\pi^2}{900} \times 6500 (1.8)^2 120 (N_1 - N_2)$$

$$= 27715 (N_1 - N_2)$$

$$\therefore N_1 - N_2 = 56 \times 10^3 / 27715 = 2 \text{ r.p.m.} \quad \text{—(1)}$$

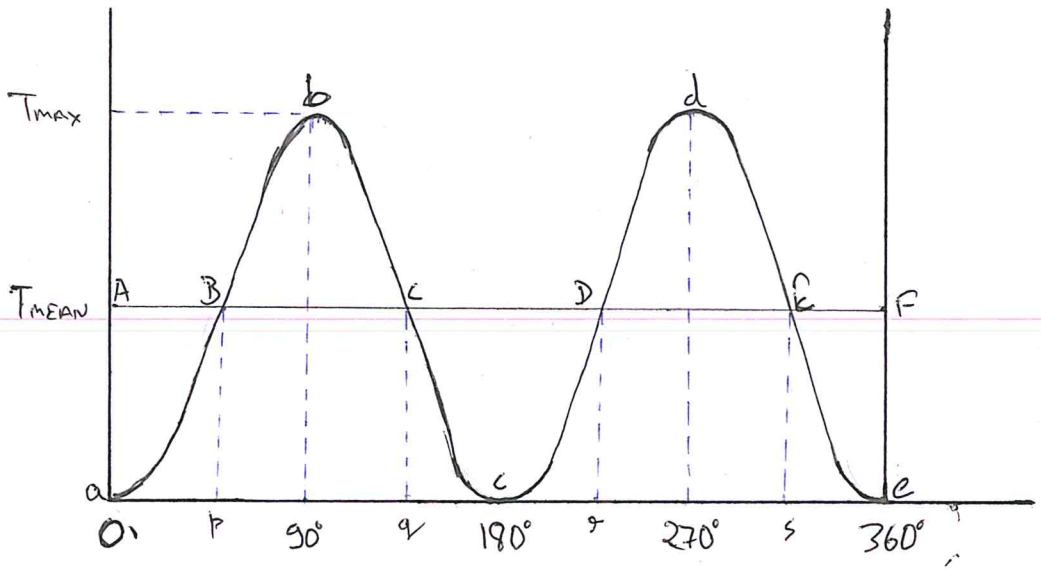
we also know that mean speed (N),

$$120 = \frac{N_1 + N_2}{2} \text{ or } N_1 + N_2 = 120 \times 2 = 240 \text{ r.p.m.} \quad \text{—(2)}$$

from eq (1) & (2)

$N_1 = 121$ r.p.m & $N_2 = 119$ r.p.m.

Q. NO.	ANSWER	MARKS
Q.4 (i)	Explain the terms 'fluctuation of energy' as applied to flywheels. and fluctuation of speed	
Ans	The fluctuation of energy may be determined by the turning moment diagram for one complete cycle of operation. Consider the turning moment diagram for a single cylinder double acting steam engine when the crank moves from q to r, more work is taken from the engine than is developed This loss of work is represented by the area C C D. to supply this loss, the flywheel gives up some of its energy and thus the speed decreases while the crank moves from q to r. As the crank moves from r to s, excess energy is again developed given by area D d E and the speed again increases As the piston moves from s to e again there is a loss of work and the speed decreases. the variation of energy above and below the mean resisting torque line are called fluctuations of energy.	



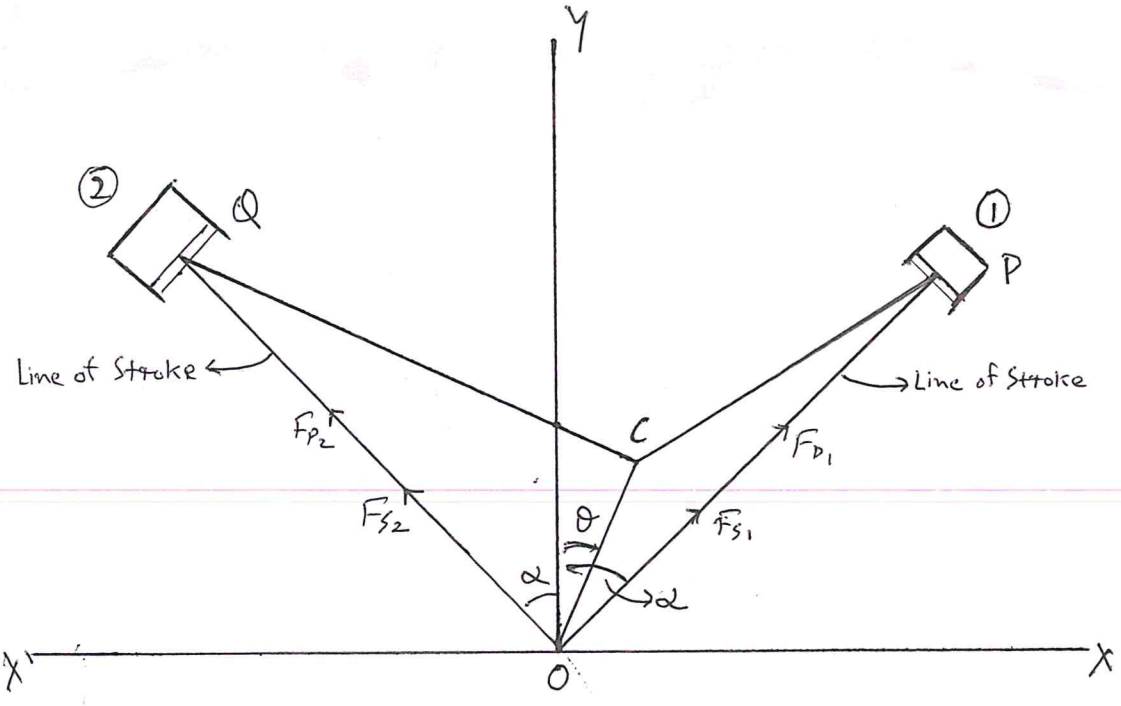
Q. NO.	ANSWER	MARKS
(11)	When energy is given by the flywheel, its speed decreases. the difference between the maximum and minimum speed during a cycle is called maximum fluctuation of speed. The ratio of the maximum fluctuation of speed to the mean speed is called the coefficient of fluctuation of ~~the~~ speed.	
Q.5	Four masses m_1, m_2, m_3 & m_4 are 200kg, 300kg, 240kg & 260kg respectively the corresponding radii of rotation are 0.2m, 0.15m & 0.3m respectively and the angles between successive masses are 45°, 75° & 135° find the position & magnitude of the balance mass required. if its radius of rotation is 0.2m.	
Ans	Given $m_1 = 200\,kg$; $m_2 = 300\,kg$; $m_3 = 240\,kg$; $m_4 = 260\,kg$ $r_1 = 0.2m$; $r_2 = 0.15m$; $r_3 = 0.25m$; $r_4 = 0.3m$; $\theta_1 = 0°$; $\theta_2 = 45°$; $\theta_3 = 45° + 75° = 120°$; $\theta_4 = 45° + 75° + 135° = 255°$ $r = 0.2m$. let m = Balancing mass & θ = The angle which the balancing mass makes with m_L Since the magnitude of centrifugal forces are proportional to the product of each mass and its radius, therefore $m_1 \cdot r_1 = 200 \times 0.2 = 40\,kg \cdot m$ $m_2 \cdot r_2 = 300 \times 0.15 = 45\,kg \cdot m$ $m_3 \cdot r_3 = 240 \times 0.25 = 60\,kg \cdot m$ $m_4 \cdot r_4 = 260 \times 0.3 = 78\,kg \cdot m$	

Q. NO.	ANSWER	MARKS
Q.6	Explain clearly the terms 'Static balancing' and dynamic balancing state the necessary conditions to achieve them.	
Ans	There are two general forms of balancing "static" & "Dynamic" static Balancing involves installing the component into a balancing machine & measuring the "heavy" point in relation to the centerline, while the part is rotating. if the required balance correction is at a single axial point on the rotor the balance is said to be "single-plane" single plane balancing is adequate for rotor which are short in length, such as pulleys and fans. Dynamic or "Dual-plane" balancing is required for components or assemblies of significant length Rotors with some axial length can have two "heavy" points at opposing ends of the component, acting independently on the mass centerline in order to balance the component, both planes must be corrected for center line error. Dynamic balancing is required for components such as shafts & multi rotor assemblies.	

Q. NO.	ANSWER	MARKS
Q. 7	Write short notes on primary and secondary balancing.	
Ans	Primary balancing :- The term "primary balance" is a major source of confusion in the discussion of engine balance. See the below secondary balance section for the underlying meaning and how this terminology came into popular use. primary "first order" or "first harmonic" balance is supposed to indicate the balancing of items that could shake an engine once in every rotation of the Crankshaft. i.e. having the frequency equal to one Crank rotation. Secondary balancing :- an ordinary inline 4 cylinder engine with 180 degrees up-down down-up Crank throws may look like Cancelling the upward inertia created by the #1-#4 piston pair and vice versa but in fact the upward inertia is always stronger and the vibration caused by this imbalance is traditionally called the secondary vibration	

Q. NO.	ANSWER	MARKS
Q.(8)	What are V- engines? How are they balanced? It is possible to balance them completely?	
Ans	A V-engine is a common configuration for an internal combustion engine the cylinders and pistons are aligned in two separate planes or 'banks' so that they appear to be in a "V" when viewed along the axis of the Crankshaft.	

→ The balancing of V engines is only considered for primary and secondary forces



Q. NO.	ANSWER	MARKS

Consider a symmetrical two cylinder V-engine.

M = mass of reciprocating parts per cylinder

l = length of connecting rod,

r = radius of crank,

n = ratio of length of connecting rod to crank radius $= l/r$

θ = inclination of crank to the vertical at any instat

ω = Angular velocity of crank.

We know that inertia force due to reciprocating parts of cylinder 1, along the line of stroke

$$= m.\omega^2.r\left[\cos(\alpha-\theta) + \frac{\cos 2(\alpha-\theta)}{n}\right]$$

Same as cylinder 2 $= m.\omega^2.r\left[\cos(\alpha+\theta) + \frac{\cos 2(\alpha+\theta)}{n}\right]$

Considering primary force

$$= 2m.\omega^2.r\sqrt{(\cos^2\alpha.\cos\theta)^2 + (\sin^2\alpha.\sin\theta)^2}$$

Considering secondary force

$$= \frac{2m}{n} \times \omega^2.r\sqrt{(\cos\alpha.\cos 2\alpha.\cos 2\theta)^2 + (\sin\alpha.\sin 2\alpha.\sin 2\theta)^2}$$

Note

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Dated _____ . **Signature of Paper Setter** **Signature of Principal/HOD**

Annexure No. SA/14

School of Aeronautics(Neemrana)

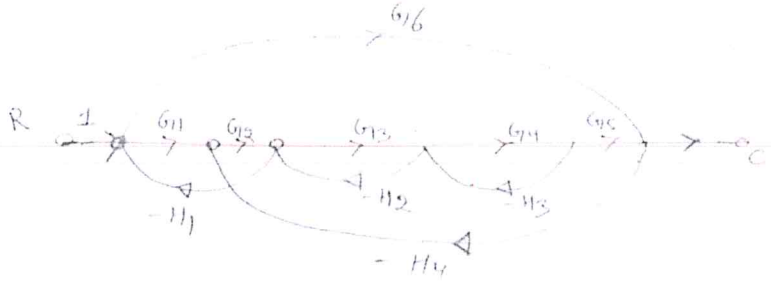
I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 26. 02. 2018

Subject : **Measurement & Control Engg.(Th)** Batch : MT-2

Faculty Name : Mr. Manbeer Singh Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Obtain the transfer for the system as shown below fig no. 1  (9)	Unit No.: Topic Name: Source:
2.	Define the signal flow graph and discuss mason's gain formula . (9)	Unit No.: Topic Name: Source:
3.	Write the constructional rule for signal flow graph. (9)	Unit No.: Topic Name: Source:
4.	What are the difference between static characteristic and dynamic characteristic. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Explain the following 1. Accuracy , 2. Precision , 3. Sensitivity and 4. Repeatibility. (9)	Unit No.: Topic Name: Source:
6.	Explain the static characteristic such as 1. Range or span , 2. Stability , 3. Threshold and 4. Resolution. (9)	Unit No.: Topic Name: Source:
7.	Explain the concept of servomechanism and discuss its purposes. (9)	Unit No.: Topic Name: Source:
8.	Define the following term 1. Node , 2. Transmittance , 3. Forward path and 4. Loop gain. (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: Mid Term 1st Date of Examination: _____

Subject Measurement and control Batch MT-2 Semester IV th

Q. NO.	ANSWER	MARKS
1.	There are two forward path. with path gains. $P_1 = G_1G_2G_3G_4G_5$, $P_2 = G_6$. There are five individual loops. $L_1 = -G_1G_2H_1$, $L_2 = -G_3H_2$ $L_3 = -G_4H_3$, $L_4 = -G_2G_3G_4G_5H_4$ $L_5 = G_6H_4G_2H_1$. Non-Touching loops $L_1L_3 = G_1G_2G_4H_1H_3$ $L_3L_5 = -G_6H_4G_2H_1G_4H_3$. First forward path touches to all loops $\Delta_1 = 1$ Second forward path does not touches to loops $-G_3H_2$ and $-G_4H_3$. $\Delta_2 = 1 + G_3H_2 + G_4H_3$. $\Delta = 1 - (L_1 + L_2 + L_3 + L_4 + L_5) + L_1L_3 + L_3L_5$ The Transfer function C/R is given by $\frac{C}{R} = \frac{G_1G_2G_3G_4G_5 + G_6(1 + G_3H_2 + G_4H_3)}{1 + G_1G_2H_1 + G_3H_2 + G_4H_3 + G_2G_3G_4G_5H_4 - G_1H_4G_2H_1}$	

Q. NO.	ANSWER	MARKS

$+G_1G_2G_4H_1H_3 - G_6H_4G_2H_1G_4H_3$.

Ans

Q.2 Ans Constructional rule for signal flow graph.

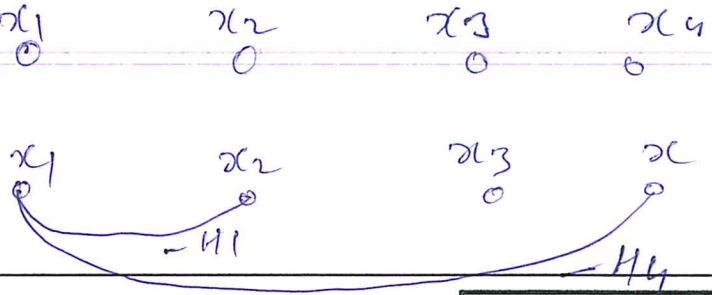
Let us consider a set of simultaneous linear equations and develope a signal flow graph for that set. The same procedure with same additional pre steps can be used to develope a signal flow graph of physical system.

$$x_1 = I_1x_1 - H_2x_4$$

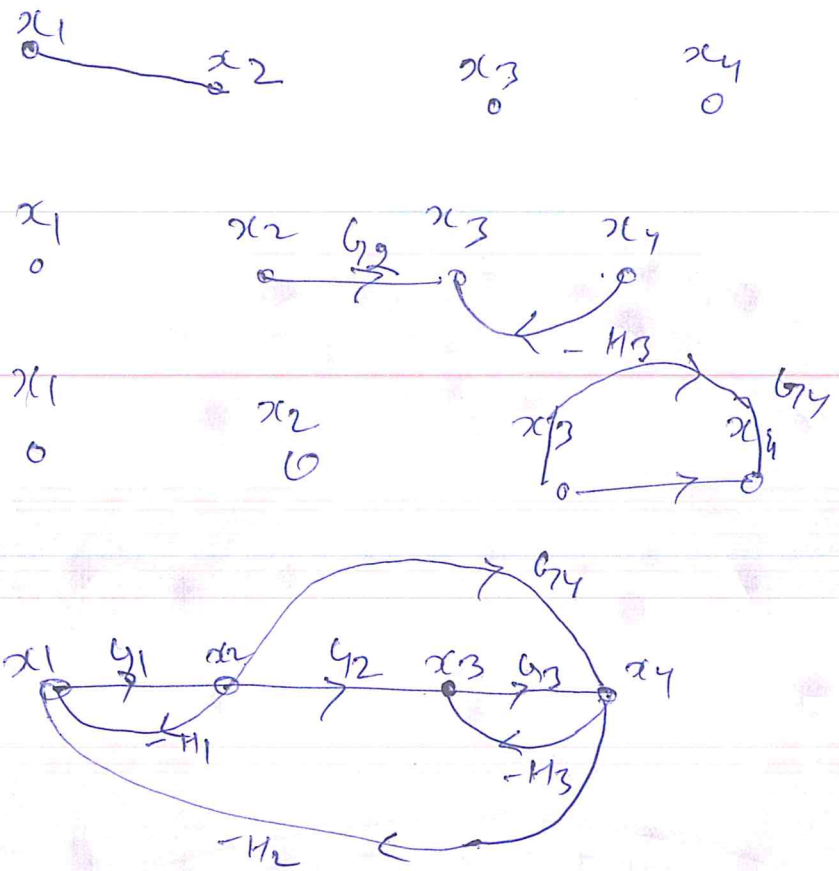
$$x_2 = G_1x_1 \quad , \quad x_3 = G_2x_2 - H_3x_4$$

$$x_4 = G_3x_3 + G_4x_2$$

A set of four equation consists of 4 variables, x_1, x_2, x_3 and x_4 first locate the four node then represent the equation. and finally Combine all 4 equations to get ~~comp~~ Complete signal flow graph.



Q. NO.	ANSWER	MARKS



Q.3 Ans

Difference between static and dynamic characteristics.

① It describe the performance of a device at room temp with minute changes in the already measured	① It relates the performance of a device to the variations of that measured with time
② The input output relationship is independent with respect to the rate of change of input	② The input output relation ship is dependent with respect to the rate of change of input

Q. NO.	ANSWER	MARKS
contd Q. 3	③ It is characterized by span or range ④ e.g. are accuracy, Precision linearity and drifts etc.	③ characterized by defferential equations ④ eg are fidelity, log Speed response etc.
Q. 4	Ans Accuracy :- It is defined as the degree of closeness with which the value read matches the true value of the quantity measured It is accuracy as point of scale, percentage of scale span & accuracy as percentage of True value. Precision :- It is the measure of reproductibility where a given fixed value of a quantity is ~~are~~ already given and we precisely measure the degree of agreement within a group of measurements. Sensitivity :- It is expressed as the smallest change in the measured variable to which the instrument actually responds. It is the ratio of changes occured in the output of an Instrument to a change in the value of quantity that need to measured.	

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: _____ Date of Examination: _____

Subject _____ Batch _____ Semester _____

Q. NO.	ANSWER	MARKS
Q. 4	Ans Repeatibility :- It is defined as the defference between the scale reading and those reading that are random in Nature	
Q. 5	Ans. Static characteristics: ① Range or Span.: The maximum and minimum values of a quantity for which an instrument is designed to measure is defined as its range or span. ② Stability:- The ability of an instrument to retain its overall performance is specified as the operating life or the stability of the system. ③ Threshold:- when the input of an instrument is increased very gradually from zero then there will be some minimum value below which there ~~would~~ would be no output change that is detected. This minimum value is defined as threshold of the instrument.	

Q. NO.	ANSWER	MARKS

Q.5 Resolution :- When the input is slowly increased from any arbitrary or random input value, then it will be found that the output does not change at all until and unless a certain increment is exceed.

Q.6 Ans Servomechanism A Servo system consists of three basic components such as a controlled device, an output sensor and a feedback system. This is basically an automatic closed loop control system. In which error signal is given by difference in reference input and output signal

~~Purposes~~ Purposes :- (1) Without any Human attendant we can have an automatic control of motion

(2) We can maintain accuracy with the mechanical load variation, also environment changes, fluctuation in Power supply, aging and corrosion of components.

(3) It also Helps in power amplification.

Q. NO.	ANSWER	MARKS

Q.7 Ans Signal flow graph:- It is a pictorial or graphical representation of a set of simultaneous linear algebraic equations. and it is another method to represent the systems which is an alternative approach to block diagrams.

Masons gain formula:-

Masons gain formula is given by

$$G(s) = \frac{\sum P_K \Delta_K}{\Delta}$$

where, G(s) is the Transfer function.

Δ is the determinant of a signal flow graph

Δ = 1 − Sum of product of all individual loop gain + sum of product of all possible combinations of two non touching loops − Sum of product of all possible combination of three non touching loops + . . .

P_K is the gain of K^{th} forward path.

Q. NO.	ANSWER	MARKS
Q.8	Ans **Node** :- A point representing a signal is called as node. These are input node, output node and mixed node. **Transmittance** :- It is a branch of real or complex gain of a branch connecting two nodes for example Transmittance of branch AB is 1 that of branch CD is G_2. **forward path** :- A forward path is a path from input node to output node in the signal flow graph and forward path gain is the product of the branch Transmittances in the particular forward path e.g. $P_1 = G_1 G_2 G_3 G_4 G_5 G_6$. $P_2 = G_7$.	

Note

1. Paper Setter is required to carefully write the answers for the questions, after consulting all the relevant books.
2. For any discripencies found in answers, paper setter will be held responsible for playing with the career of the students,and doing breach of trust with them, and accordingly action can be taken by the disiplinary committee in this regard.
3. Principal before signing for the correctness of the answer shall ensure the same from relevant books. Point No. 1 & 2 above are applicable to Principal also in case any discripencies are found in answers

Dated 20/02/18. Signature of Paper Setter Signature of Principal/HOD

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 27`. 02. 2018

Subject : **Engg. Metrology (Th)** Batch : MT - 2

Faculty Name : Mr. K . Vivek Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Explain in detail autocollimator. (9)	Unit No.: Topic Name: Source:
2.	Explain optical projector. (9)	Unit No.: Topic Name: Source:
3.	Explain sine bar. (9)	Unit No.: Topic Name: Source:
4.	Explain in detail gauge block. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Explain Toolmakers microscope (9)	Unit No.: Topic Name: Source:
6.	Explain in detail Profile projector (9)	Unit No.: Topic Name: Source:
7.	Explain in detail stylus probe instrument (9)	Unit No.: Topic Name: Source:
8.	Write the different terminology used in surface finish (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

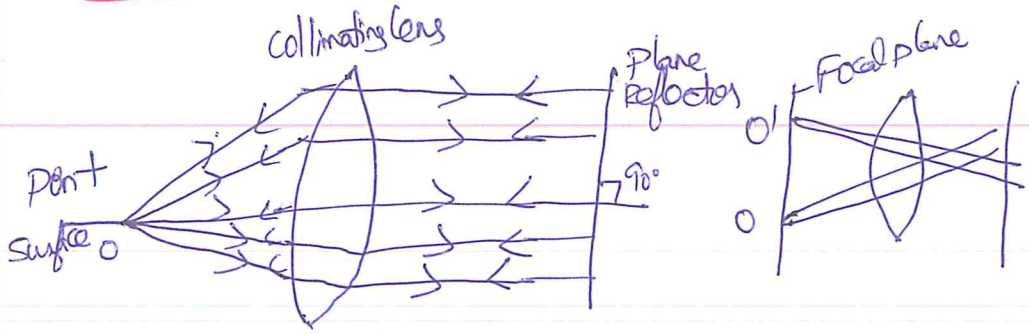
MODEL ANSWER PAPER

Name of Examination: MID TERM-I Date of Examination: 27.02.2018

Subject ENGINEERING METROLOGY Batch MT-II Semester 04

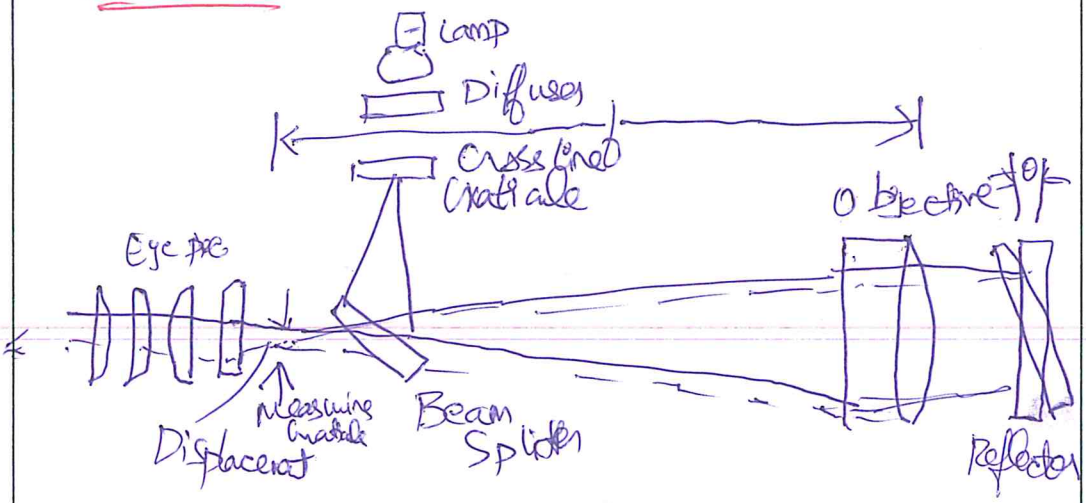
Q. NO.	ANSWER	MARKS

1) AUTOCOLLIMATOR:



* optical instrument used for measurement of small angular distance.
* Infinity telescope - collimator combined.
* O-pt source of light placed at principal focus of collimating lens.
* Rays of light from O incident on lens will travel as a parallel beam of light.

PRINCIPLE:-



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Q. NO.	ANSWER	MARKS

* A Crossline target graticule - positioned at focal plane of telescope objective system with intersection of cross-line on optical axis.

* When target graticule - positioned & illuminated, rays of light diverging from intersection point reach objective via a beam splitter

CONSTRUCTION:

* A flat reflector placed in front of objective and exactly normal to optical axis reflects the parallel pencils of light back along their original paths.

* Reflector - brought to focus in plane of target graticule. & coincide with intersection

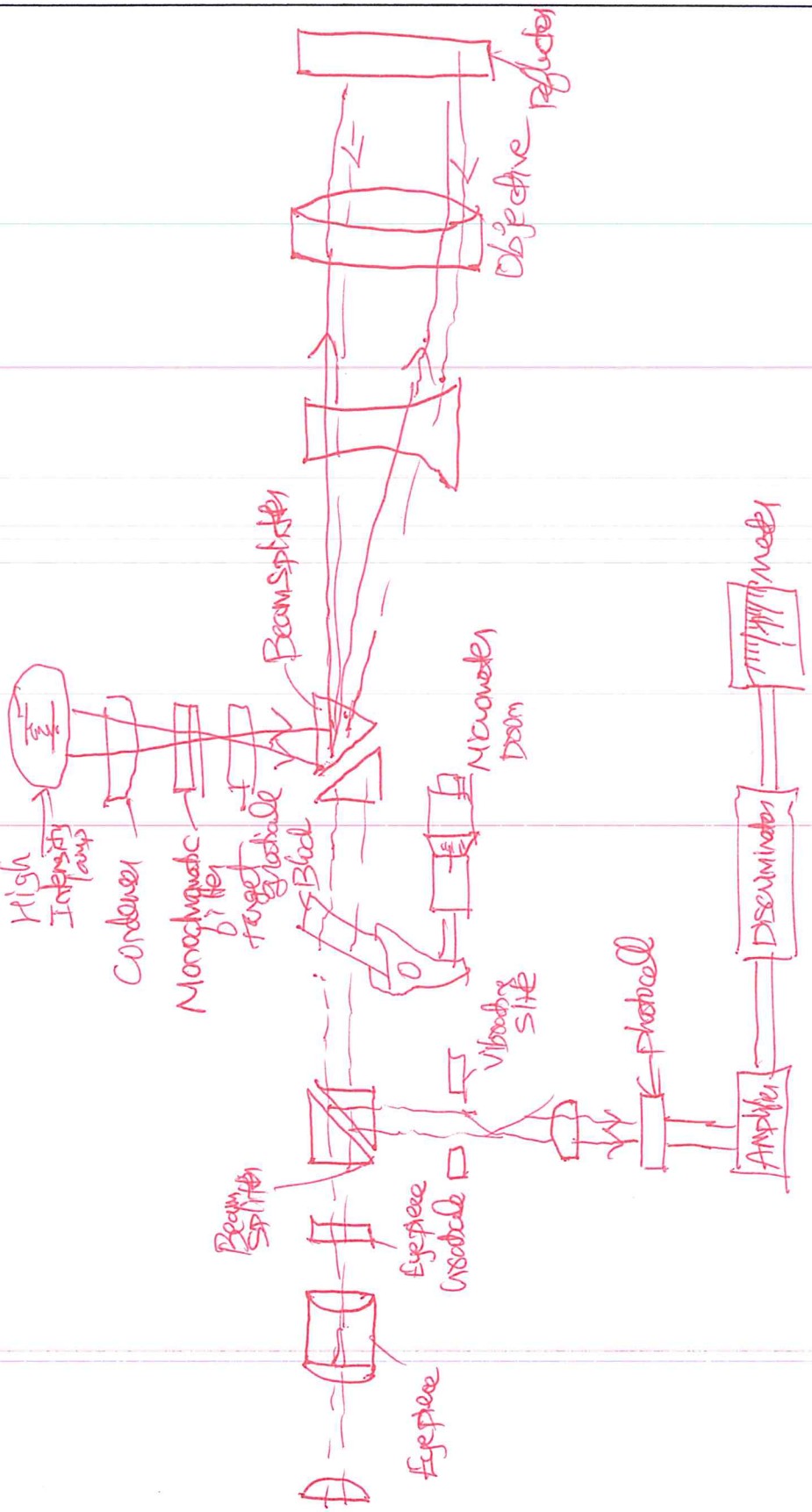
* Reflector - tilted through a small angle reflected pencil of light will be deflected by twice angle of tilt. & brought to focus in plane of target graticule.

* Linear displacement of graticule image in the plane of eyepiece is directly proportional to reflector tilt & can be measured by an eyepiece graticule.

* Factors governing specification :- focal length, effective aperture.

* The focal length determines sensitivity & angular measuring range.

Q. NO.	ANSWER	MARKS



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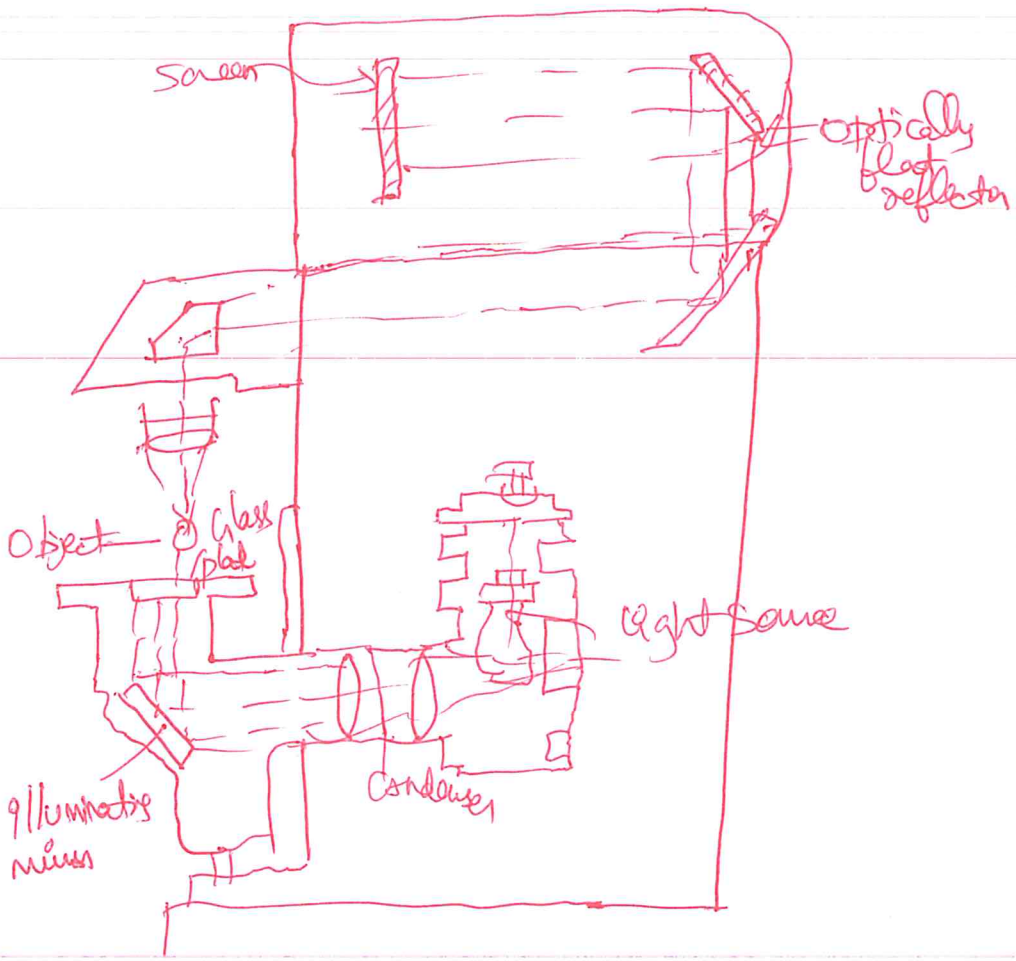
Q. NO.	ANSWER	MARKS

* Longer the focal length larger - linear displacement.
* Maximum Separation b/w reflector & autocollimator is governed by effective aperture of objective.

APPLICATIONS :-

* Measurement of Straightness & flatness.
* comparative measurement

2). OPTICAL PROJECTOR:



* PRINCIPLE:-

*Measuring instrument projects an enlarged shadow of part being measured on screen.

Q. NO.	ANSWER	MARKS

* purpose of collimating lens - to render the beam of light from point source parallel.

CONSTRUCTION:-

* Consist of base casting.
* Lens system & sliding carriage carry object to be projected are mounted on base.
* carriage slides - parallel to optical axis & enables object to be focused.
* Lamp housing & collimating lens carried on two bars arranged to pivot axis passing through projection lens to enable collimated beam.
* Two system heads - Illuminated System & projection System.
* The Illuminating System - Consists of a light source, tungsten arc lamp.
* Glowing element in lamp is a small cylinder of tungsten heated to incandescence by electron bombardment.
* Illuminating system enclosed - ventilated lamphouse.
* Light from lamp passes to a system of lens called "achromatic condenser".
* parallel beam of light from condenser - transmit to illumination mirror.

WORKING:-

* projection system consists of projection lens, roof prism pair of image reflectors & Screen.

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Q. NO.	ANSWER	MARKS

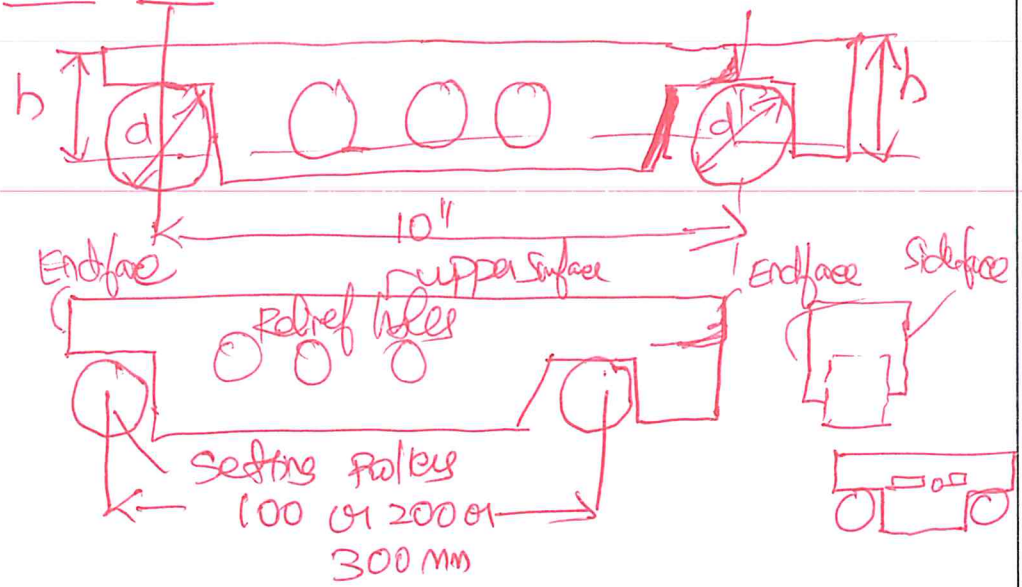
2) ~~** projection~~ * The magnification of projector - adjusted by changing projection lens assembly.

* the adjustments - easy.

* the light travels past object to projection lens from which it passes upward to roof prism.

* the function of roof prism - direct beam of light horizontally towards back of projector to assist on projection of image.

3) SINE BAR:-



PRINCIPLE:-

* Sine principle uses the ratio of length of two sides of right △ in deriving a given angle.

* Devices operating on Sine principle - capable of self generation.

Q. NO.	ANSWER	MARKS

* Measurement - limited to 45°.
* Sine bar used on Slip gauges - good device for precise measurement of angles.

CONSTRUCTION:

* Sine bars - either used to measure angles very accurately for locating any work to a given angle.
* Two cylinders of equal diameter are attached at ends.
* Sine bars - made from high carbon, high chromium, corrosion resistance steel.
* The accuracy of Sine bar depends on its construction features:-

i) The two rollers have equal diameter & be true cylinders.

ii) The rollers must be set || to each other & to upper face.

* The various parts are hardened & stabilised before grinding & lapping.
* All working surfaces & cylindrical surfaces of rollers are finished to surface finish of 0.2 μm

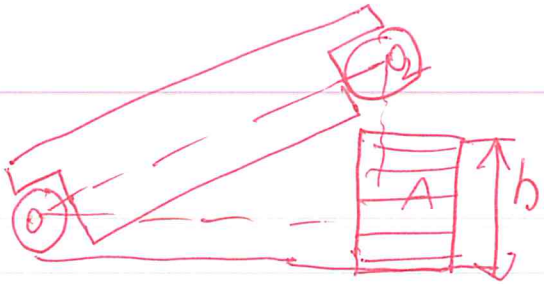
USES:-

i) MEASURING KNOWN ANGLES OR LOCATING ANY WORK TO A GIVEN ANGLE :- * Surface plate assumed to be

Q. NO.	ANSWER	MARKS

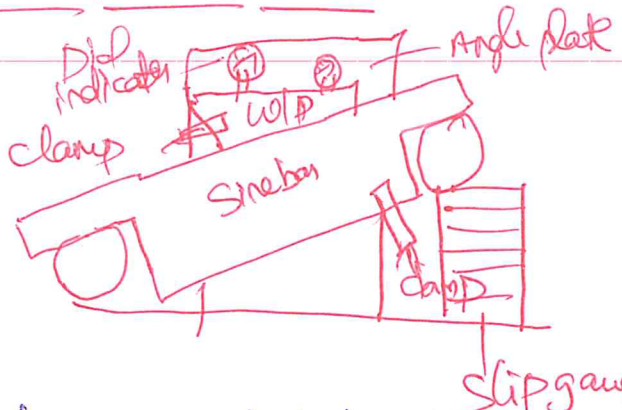
perfectly flat surface, So surface could be treated horizontal.

* one of cylinders is placed on surface plate & other is placed on slip.



* Let Sine bar be set an angle θ.
* $\sin\theta = h/l$, Where l - dist. b/w centre of rollers.

2) CHECKING UNKNOWN ANGLES



* A component to be checked is unknown.
* It is necessary to find angle approximately with help of bevel protractor.
* Let angle θ. Sine bar is set an angle θ & clamped to an angle plate.
* Work is placed on Sine bar & clamped to an angle plate. & dial indicator is set at one end of work & moved to other.

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School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

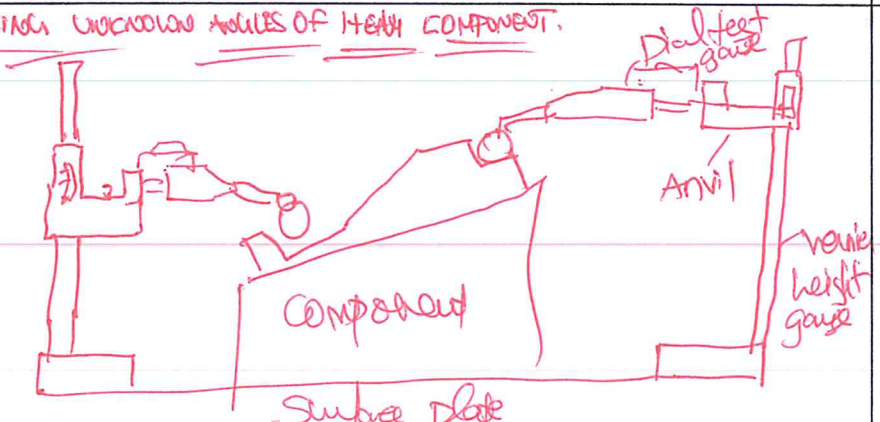
MODEL ANSWER PAPER

Name of Examination: _____ Date of Examination: _____

Subject _____ Batch _____ Semester _____

Q. NO.	ANSWER	MARKS

* CHECKING INCLINATION ANGLES OF HEAVY COMPONENT.



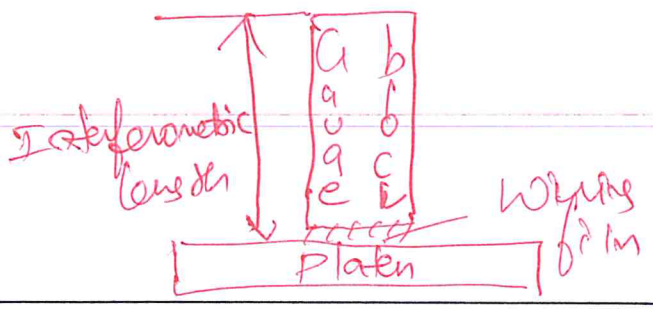
* components are heavy & can't be mounted on Sine bar. then Sine bar - mounted on Component.

* the anvil of height gauge - adjusted with probe of dial test gauge showing some reading for topmost position of rollers.

LIMITATIONS:

* physically dimpsy to hold in position
* body of Sine bar obstructs gauge block
* Slight errors of Sine bar cause large angular errors.
* Temperature variation - critical.

4) GAUGE BLOCK:



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School of Aeronautics (Neemrana)
I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: _____ Date of Examination: _____

Subject _____ Batch _____ Semester _____

Q. NO.	ANSWER	MARKS

PRINCIPLE :- * System of producing precision lengths.

* Gauge blocks comes in sets of blocks with range of standard length.

CONSTRUCTION :-

* Feature is that gauge blocks can be joined together with very little dimensional.

* blocks - joined by a sliding process called WRINGING.

* A small number of gauge blocks are used to create accurate lengths within a range.

* By using 3 blocks from a set of 30 blocks, we can create any of 1000 lengths

* block of metal or ceramic with two opposing faces ground ||.

* Gauge blocks comes in set of blocks of varying lengths.

* The length of each block is slightly shorter than nominal length.

* The thickness of one wring film, a film of lubricant seperates adjacent block faces.

Q. NO.	ANSWER	MARKS

WORKING:-

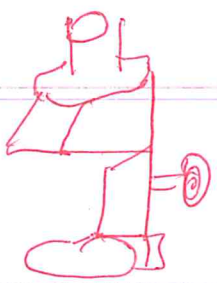
WRINGING:

* It is the process of sliding two blocks together so that their faces bond.
* Because of ultraflat surfaces, when wringing, gauge blocks adhere to each other.
* Atm pressure applies pressure between the blocks because air is squeezed out of joint.

Process involves four steps:

* Wiping a clean gauge block across an oiled pad.
* Wiping any extra oil off gauge block using a dry pad.
* Block is then slid perpendicularly across other block while applying moderate pressure.
* Finally block is rotated.

5). TOOL MAKERS MICROSCOPE



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School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: _____ Date of Examination: _____

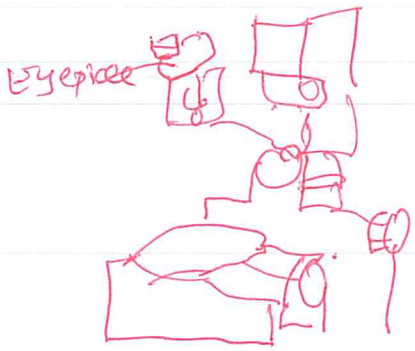
Subject _____ Batch _____ Semester _____

Q. NO.	ANSWER	MARKS

PRINCIPLE:-

* Measuring device used to measure upto 1/100th mm.
* principle of Screw gauge.
* Light focuses on object and through lens we can see shadow of object.

CONSTRUCTION:



* It has got a robust and strong base which can bear & withstand sudden loads.
* A column with track is present to carry lens along with illuminating sources.
* Lens has two perpendicular straight lines marked as reference lines.
* Object to be measured placed on glass table.
* Glass table - 3 scales :- Two scales - Measuring in x & y direction.
* other side for rotation.

WORKING:-

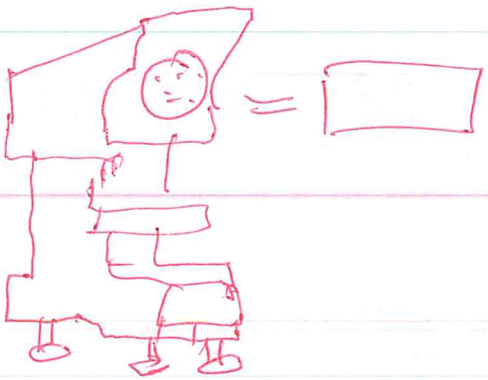
* object to be measured gets placed on glass table, illuminator is turned on.

Q. NO.	ANSWER	MARKS

APPLICATIONS:-

* Length measurement in cartesian & polar coordinates.
* Angular measurement of tools.

6) PROFILE PROJECTOR:



WORKING PRINCIPLE:-

* Optical instrument used for measuring quality.
* Projector magnifies profile of specimen
* on this screen there is typically a grid rotated through 360°.
* projector screen displays profile of specimen
* An edge of specimen to examine may be lined up with grid on screen.
* This projection screen is magnified for both ease of calculating linear measurement.
* An edge of specimen to examine - is lined up with grid on screen.
* Typical method of lighting is diascopic illumination.
* Type of lighting called transmitted illumination when specimen and light pass through it.

Q. NO.	ANSWER	MARKS

HORIZONTAL PROJECTOR:- * The main axis is perpendicular to plane of Screen. Medium and large size suitable for shop

VERTICAL PROJECTOR:- Main axis is parallel to plane of screen.

SELECT POSITIVE IMAGE:-

* For simplest profile projector, product's inverted image will be displayed on Screen.

SELECT SCREEN SIZE:-

* Consider whether entire part appeared on Screen.

CHOOSE MAGNIFICATION:

* The magnification of lens fixed.
* Different part of measured piece require different magnification

SELECT APPROPRIATE WORK TABLE & ACCESSORIES:

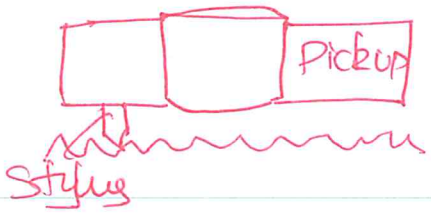
* Work table - used to place & hold measured piece.
* Its own volume, x, y, travel & carrying capacity - critical.
* This projector have a flexible & stable focusing mechanism.

SELECT APPROPRIATE PRECISION:-

* Commercially available optical measuring projectors theory accuracy, because optical lens and gratings are similar.

Q. NO.	ANSWER	MARKS

7) STYLUS PROBE INSTRUMENT:



* WORKING PRINCIPLE & CONSTRUCTION:-

* A skid or shoe is drawn slowly over the surface either by hand

* The skid when moved over surface, follows its general contours & provides datum for measurement.

* a skid is not used and a probe will be used to trace the actual profile, but upward & downward movement of probe will be depend upon setting of work under probe.

* A line touching crest of profile, that is the envelope line defines macro-geometrical form is chosen as datum line and this is obtained by using a skid

* A lot of work is done on shape of skid & different types of skids are available for different purposes

* A stylus or probe which moves over surface with skid.

Q. NO.	ANSWER	MARKS

* the Stylus for Ra measurement on new instrument have a radius of 10 microns
* When in use, a tip radius allowed to vary ± 50%.
* However for calibration purpose, stylus should have 10 μm nominal size radius.
* Stylus records macrogeometrical form of surface
* Stylus moves vertically up & down relative to skid movement due to roughness of surface.
* Amplifying device for magnifying Stylus movement & an indicator.
* Recording device for magnifying and producing a trace or record of surface profile.
* vertical movement - magnified more in comparison to horizontal movement, thus record will not give actual picture of surface roughness.
* A means for analysing trace.

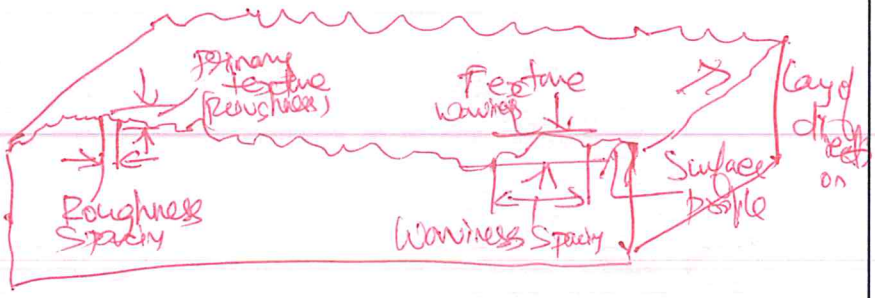
8) TERMINOLOGY USED IN SURFACE FINISH

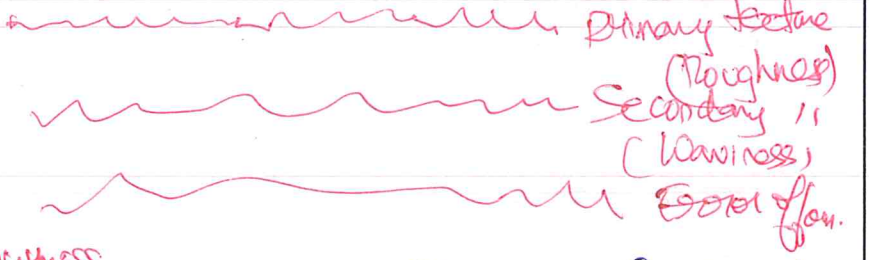
* REAL SURFACE:- It is the surface limiting the body & seperating it from surrounding surface
* GEOMETRICAL SURFACE:- surface obtained by design or by process of manufacture.

Q. NO.	ANSWER	MARKS

SURFACE TEXTURE:- Repetitive or random deviations from nominal surface which form pattern of surface.

EFFECTIVE SURFACE:- close representation of real surface obtained by instrument means.





SURFACE ~~TEXTURE~~ ROUGHNESS:- ~~Say~~ concerns all irregularities forming surface relief and are defined within area.

PRIMARY TEXTURE (ROUGHNESS)- * caused due to irregularities in surface roughness which result from inherent action of production process.

SECONDARY TEXTURE (WAVINESS): It results from factors such as machine or work deflections, vibration, chatter.

FLAWS :- They are irregularities occuring at one place or at relatively infrequent.

CENTRELINE:- line about which roughness is measured.

Q. NO.	ANSWER	MARKS

LAY :- It is the direction of predominant surface pattern ordinarily determined by method of production.

TRAVERSING LENGTH :- Length of profile necessary for evaluating surface roughness.

* This length includes one or more sampling lengths.

SAMPLING LENGTH (l) :- Length of profile necessary for evaluation of irregularities.

MEAN LINE OF PROFILE :- line having form of geometric profile & dividing effective profile so that within sampling length the sum of squares of distances b/w effective pts & mean line - minimum.

CENTRELINE OF PROFILE :- It is line parallel to general direction of profile for which areas enclosed by profile.

SPACING OF IRREGULARITIES :- Mean distance b/w more prominent irregularities in effective profile within sampling length.

Q. NO.	ANSWER	MARKS

ARITHMETIC MEAN DEVIATION FROM MEAN LINE OF PROFILE R_a

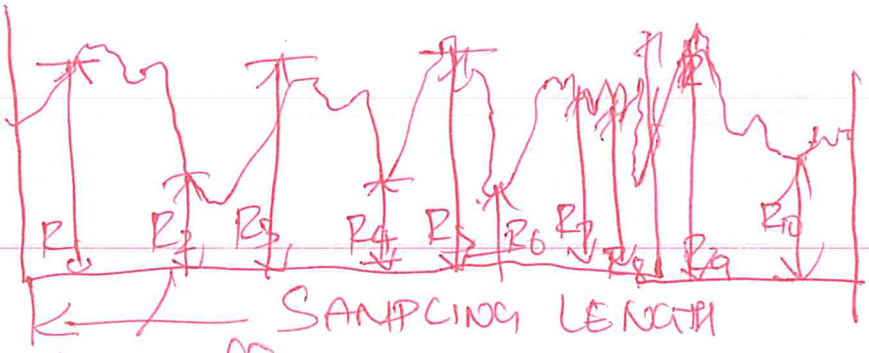
defined as average value of ordinates ($y_1, y_2 \ldots y_n$) from mean line.

$$R_a = \frac{\sum |y_i|}{n}$$

TENPOINT HEIGHT OF IRREGULARITIES:- average difference

$$R_z = \frac{(R_1+R_3+R_5+R_7+R_9) - (R_2+R_4+R_6+R_8+R_{10})}{5}$$

between five highest peak & five deepest peaks.



Line parallel to mean line

Note

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Dated 28/02/2018 **Signature of Paper Setter** **Signature of Principal/HOD**

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 27. 02. 2018

Subject : **Microprocessors & Applications (Th)** Batch : MT - 2

Faculty Name : Ms. Nivedita Kumari Semester: IV

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Draw the pin diagram of 8085 and explain the functions and How many interrupts are used in 8085 MP? (9)	Unit No.: Topic Name: Source:
2.	Explain the various memory classification in detail and what is register explain in brief? (9)	Unit No.: Topic Name: Source:
3.	What is interfacing? Give example with block diagram. (9)	Unit No.: Topic Name: Source:
4.	Explain DMA in brief. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Draw a neat and clean block diagram of 8085 and explain in brief each block functions. (9)	Unit No.: Topic Name: Source:
6.	Give format of SIM instruction and explain it and Distinguish between the memories mapped I/O peripheral I/O? (9)	Unit No.: Topic Name: Source:
7.	How information is saved on the stack of 8085? Mention the purpose of SID and SOD lines. What is ALE pin? (9)	Unit No.: Topic Name: Source:
8.	What is difference between RAM and ROM. (9)	Unit No. Topic Name: Source:

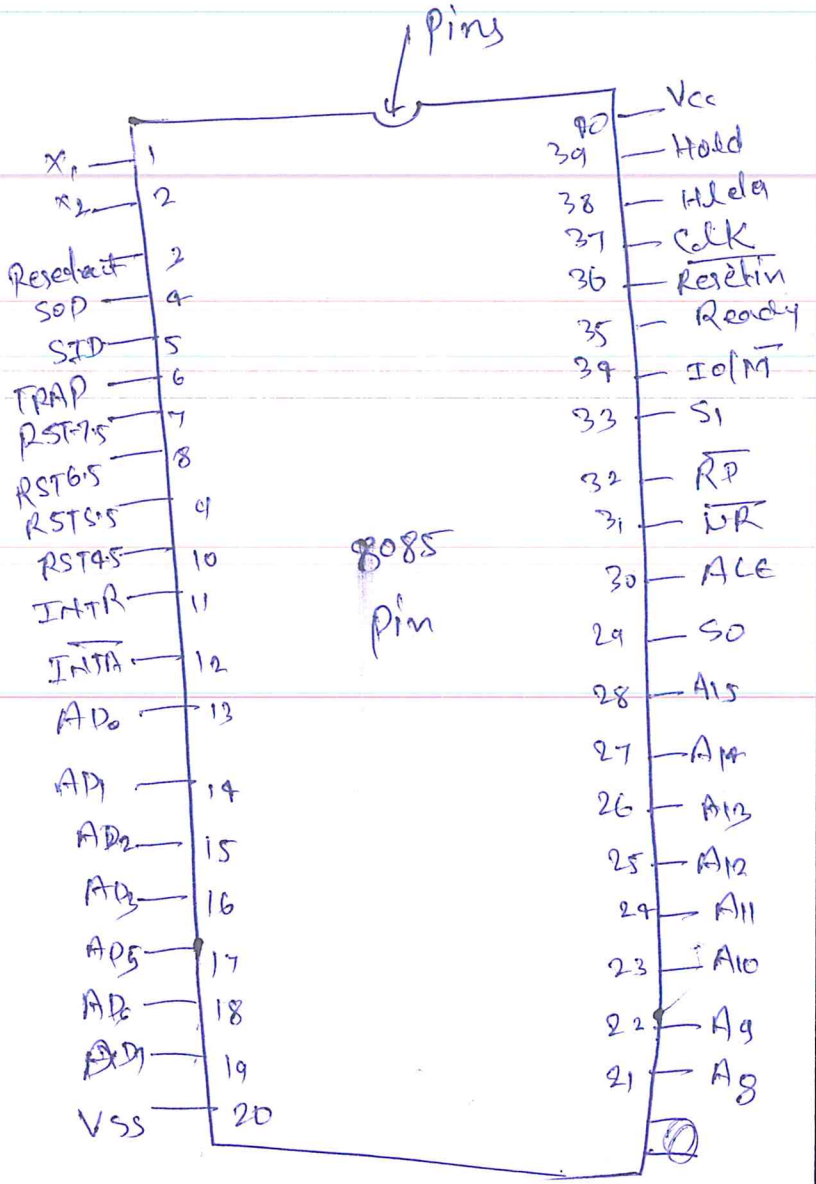
School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: Mid-term Date of Examination: _____

Subject Microprocessor & its applⁿ Batch MT-2 Semester 4th

Q. NO.	ANSWER	MARKS
1		

Pin(8085) Confⁿ.

Q. NO.	ANSWER	MARKS

According to pin Configuration! —
All the Signals Can be classified into Six groups.

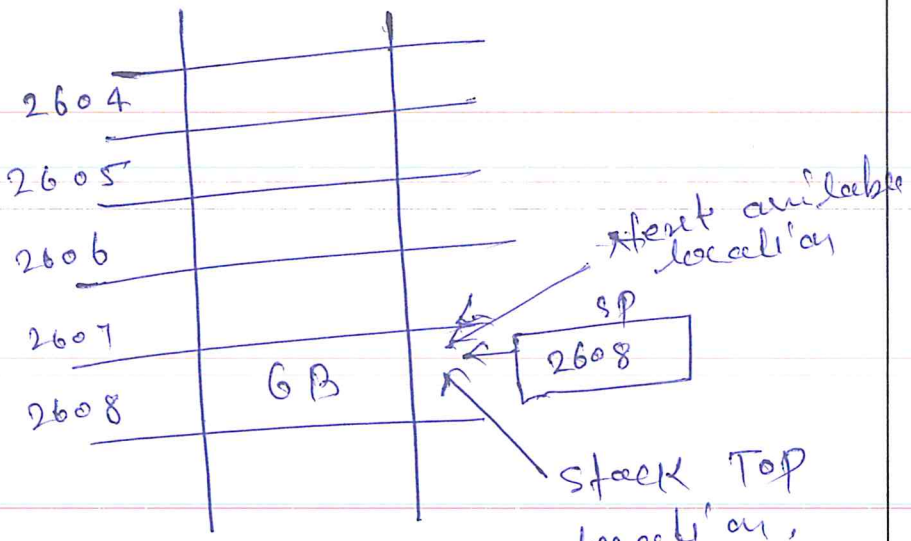
1. Address Bus
2. Data Bus
3. Control & Bus status signals.
4. power supply & frequency signals
5. Serial I/O ports.
6. Externally initiated Signals.

Key points of 8085 up! —

- It is an 8-bit up
- the device has 40 pins
- Requires power supply +5V.
- It Can operate with a 3MHz single phase Clock frequency.
- The 8085 is an upgraded version of 8080.

Q. NO.	ANSWER	MARKS

(2) During the execution of a program sometimes it becomes necessary to save the contents of certain registers bez the registers are required for some operation in subsequent steps.



- the last memory location of the occupied portion of the stack is called Stack top.

(6) Data are stored in the stack on last in first out (LIFO) principle.

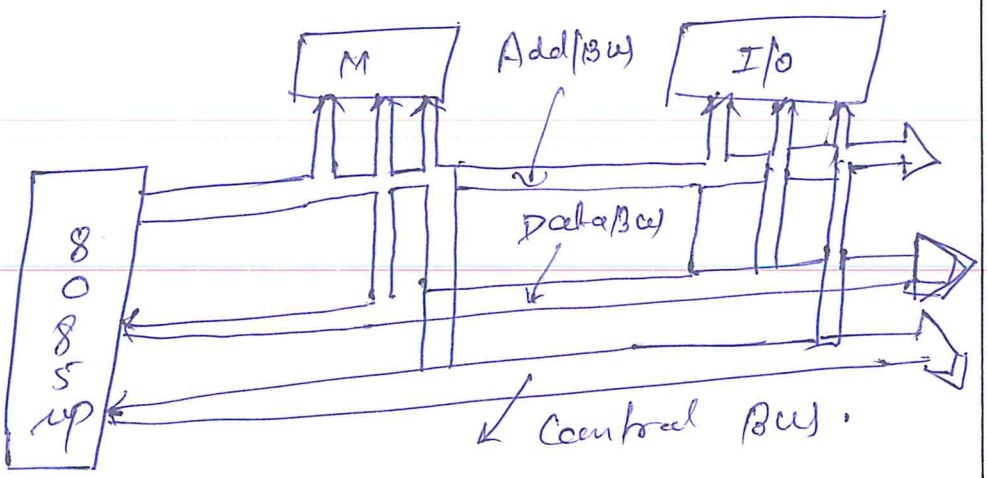
Any Area of RAM can be used as Stack.

Q. NO.	ANSWER	MARKS

(3)

Introduction -

In a up based sys the designer has to select suitable memories and I/O devices for performing his task & so, they interface them to the up. up has several memory chips & I/O devices are connected to a up.



→ In address decoding i/p employed to select the required I/O device of a memory chip.

- The given ckt i/p interfacing Block diagram of Memory.

Q. NO.	ANSWER	MARKS
9	In DMA transfer scheme CPU doesn't participate. Data are directly transfer from an I/O device to the memory or vice versa. The data transfer is controlled by the I/O device or a DMA Controller. This scheme is employed when large amount of data are to be performed. Bulk data are performed through the cpu, it takes appreciable time and the process becomes below. An I/O device HOLD signal from an I/O device the cpu has control of buses as soon as the current machine cycle is completed, DMA data transfer scheme is a faster scheme as compared to program data transfer.	

Note

1. Paper Setter is required to carefully write the answers for the questions, after consulting all the relevant books.
2. For any discripencies found in answers, paper setter will be held responsible for playing with the career of the students,and doing breach of trust with them, and accordingly action can be taken by the disiplinary committee in this regard.
3. Principal before signing for the correctness of the answer shall ensure the same from relevant books. Point No. 1 & 2 above are applicable to Principal also in case any discripencies are found in answers

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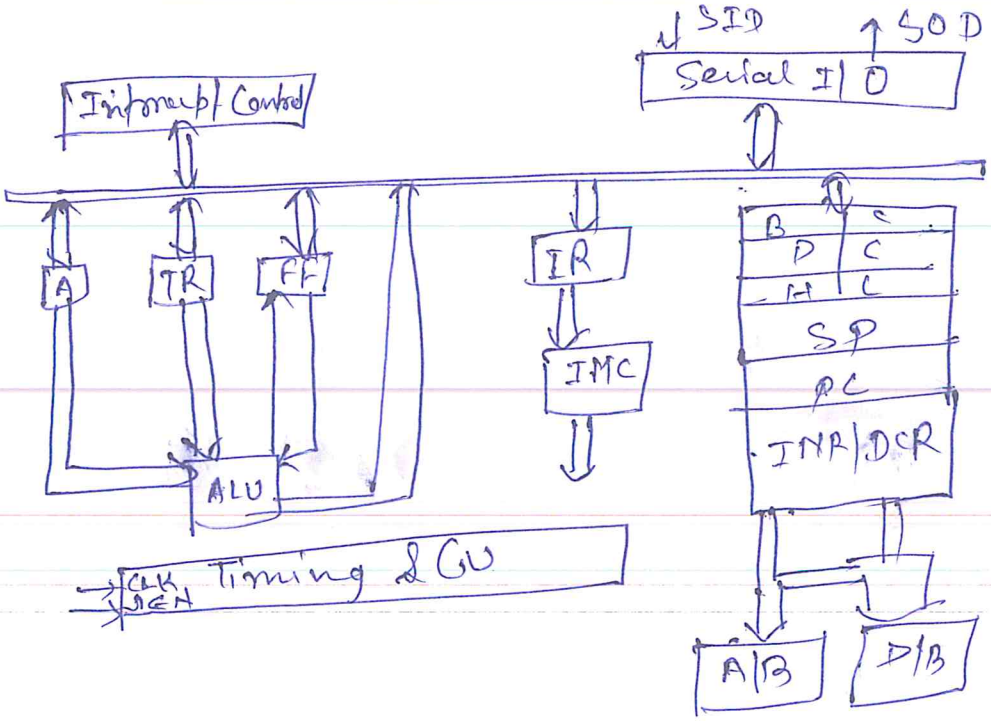
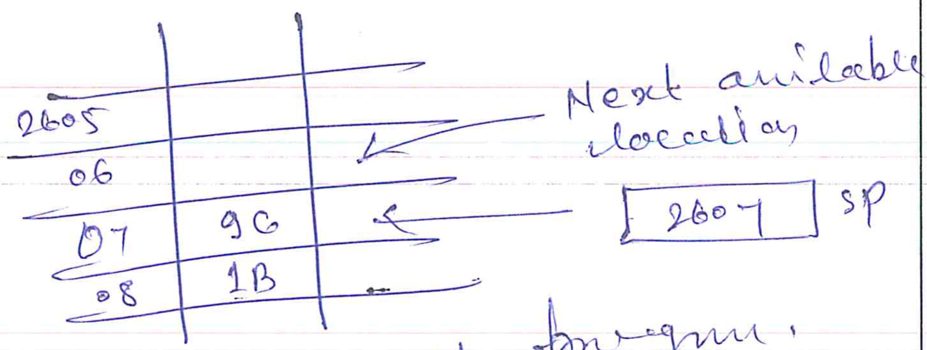
Q. NO.	ANSWER	MARKS
5		

- 8-bit general purpose µP.
- Capable of addressing 64K M.
- It has 40 pins
- Requires +5V power Supply.
- Can operate with 3MHz CLK
- 8085 upward Compatible.
- It has crystal freq.
- It's main brain is ALU.

Q. NO.	ANSWER	MARKS
(6)	During the execution of a program sometimes it becomes necessary to save the contents of certain registers because the registers are required for some other operation.	



Stack memory program.

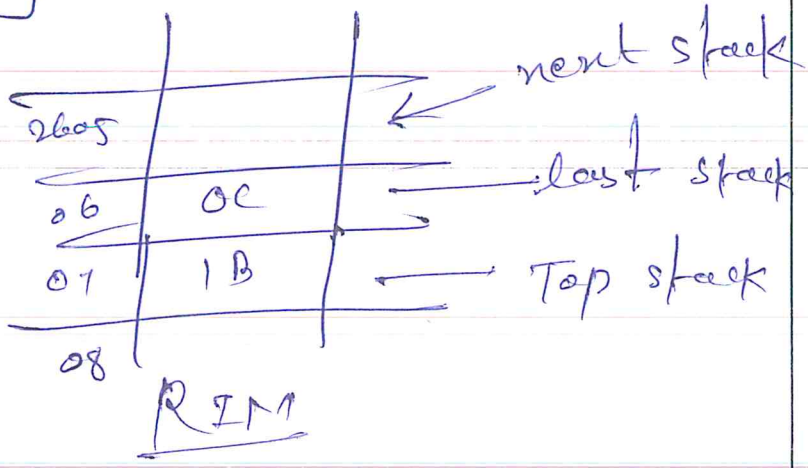
The last memory location of the occupied portion of the stack is called stack top. A special 16-bit register is known as stack pointer holds the address of stack top.

Data are stored in the stack on last in first out (LIFO) principle.

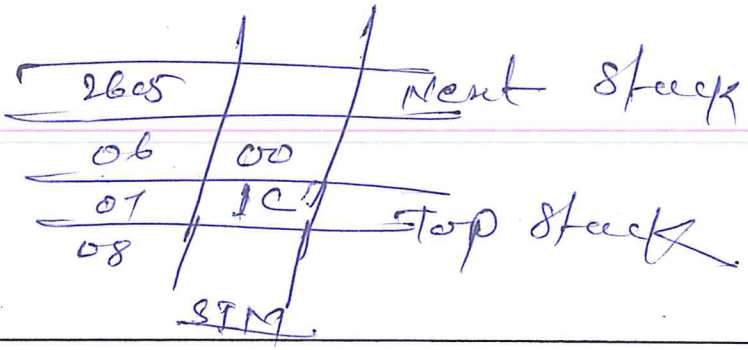
Q. NO.	ANSWER	MARKS

(7)

RIM – Read interacy Memory if i/p used for i/p data access into many or into memory.



SIM – Select I/p memory or from data can be access to many. It is called Selected memory chip



Q. NO.	ANSWER	MARKS
8	ROM — Read only memory. It is also called non-volatile type of memory or non-erasable type of memory. RAM - Random access memory it is also called volatile type or erasable type of memory. ROM - is called programm memory RAM - is called data memory. Ram - means Read Access Ram is linear access.	

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