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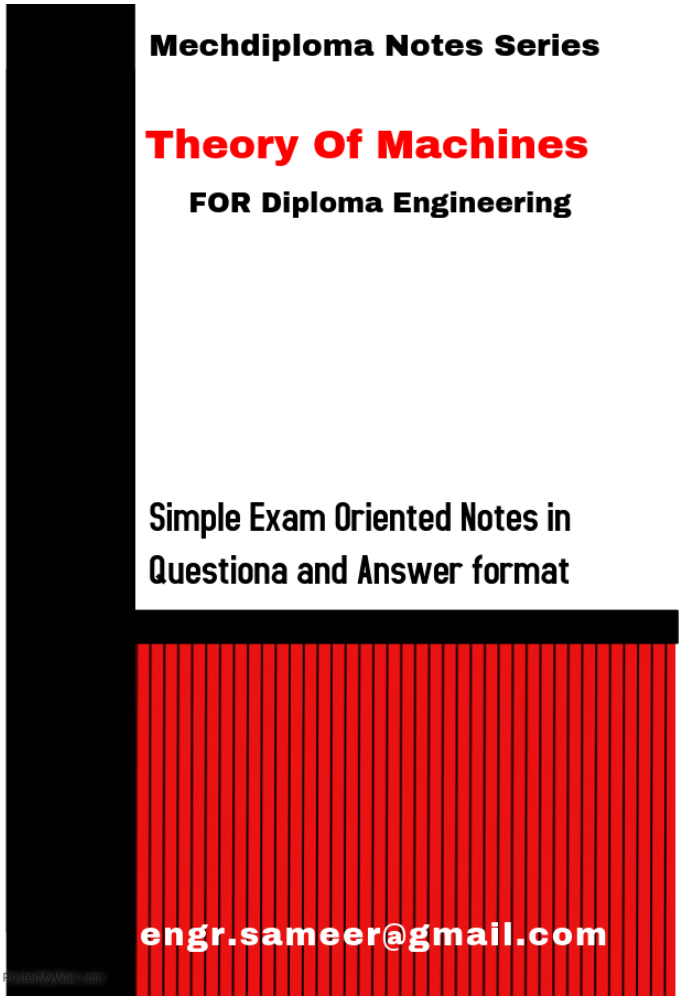
Theory of machines notes -diploma engineering

Theory of Machines Notes-diploma Engineering

Theory of machines notes-diploma engineering is prepared to meet the requirements of diploma students. The semester pattern makes it difficult to read the reference books. So students have to prepare in very short time. Notes are prepared in question and answer format. So that students get exact material for prepreation. It saves lot of time in searching various books and answer sheets.



Following are the salient features of these notes

1. Simple question and answer format.
2. Answers written in most easy english language.
3. Exact answers of the asked questions, without unnecessary description.
4. Covers all points in syllabus. Also questions asked in recent exams.
5. Simple and easy to remember formulas for the numerical problems.
6. Numerical problems arranged from simpler to toughter for getting confidence in solving.
7. Theory of machines notes-diploma engineering contain easy to reproduce diagrams.
8. Since the paper checking is done on the basis of keywords, in notes keywords are UNDERLINED.

Screenshots from the Notes

As shown in screen shot below the notes provide exact definitions with the underlined keywords.

1.1 : Kinematics of Machines

Q.1.Define Statics, Dynamics, Kinetics and kinematics.

Ans:

Statics *:- It is the branch of engineering which deals with study of forces and its effect on bodies at rest.*

Dynamics *:- It is the branch of engineering which deals with the study of forces and its effect on bodies in motion.*

Kinetics *:- It is the branch of dynamics which deals with study of forces and their effect on bodies in motion considering mass of the body.*

Kinematics *:- It is the branch of dynamics which deals with the study of forces and their effect on bodies in motion without considering mass.*

Q.2.Define Kinematic link,Kinematic pair, Kin chain,Mechanism & inversion

a] Kinematic link (or element) :

It is defined as a resistant body which has relative motion with some other element. e.g. crank, Piston, cylinder, frame

b] Kinematic pair :

When two links are connected in such a manner that relative motion between them take place in a definite way then it is called kinematic pair.

c] Kinematic chain :

When two or more kinematic pairs are joined together, they form kinematic chain.

d] Mechanism :

If one link of a kinematic chain is fixed it is called mechanism.

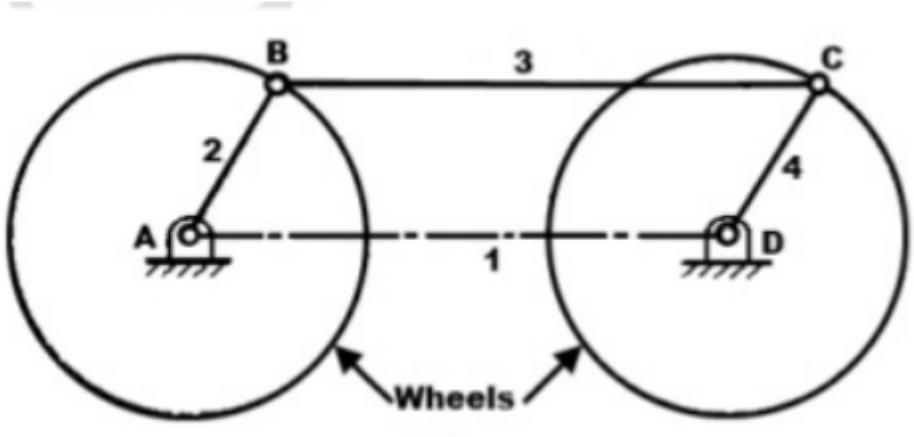
e] Inversion :

When different links of a kinematic chain are fixed we get different mechanisms, these mechanisms are called inversions of that kinematic chain. The number of inversions of a kinematic chain are equal to number of links in that chain.

As shown in figure below each mechanism has analysis of links and pairs . The notes also breaks the information into different categories such as construction, working and applications.

Q.1.Explain the coupled wheels of locomotive mechanism.

Ans.



Links -

link AD frame (Fixed)
link AB (Crank)
link BC (Coupling Rod)
link CD (Crank)

Pairs -

Turning Pair = AD (Frame) & AD (Crank)
Turning Pair = AD (Frame) & CD (Crank)
Turning Pair = AB (Crank) & BC (Connecting Rod)
Turning Pair = CD (Crank) & BC (Connecting Rod)

Links and Pairs anslysis of each mechanism

Information broken into categories for easy remembering

Construction:

This mechanism is an inversion four bar kinematic chain . This has four turning pairs. It is consists of frame AD which is fixed, on which two cranks AC & BD are fitted on it .The cranks are free to rotate about points A and D. Both the cranks have same lengths. Two cranks are connected to each other by means of coupling rod, which connects the other ends B and C of both cranks. At the connections B and C there is turning pair.

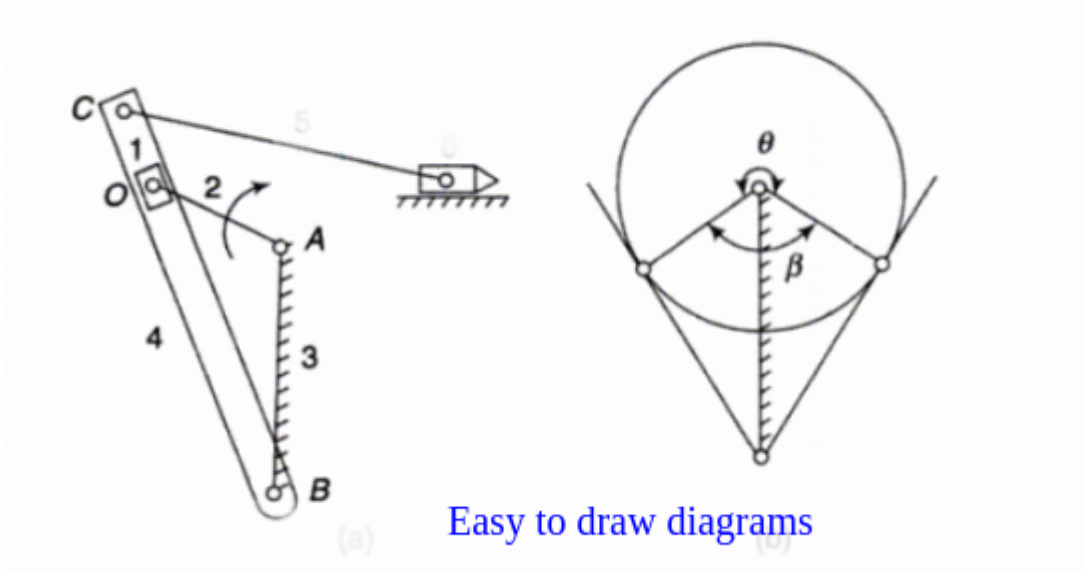
Working –

When link AB starts rotating about fixed point A. The rotary motion of wheel is transmitted to next wheel by means of coupling rod BC. As a result the other wheel also starts rotating in same direction and same speed, because both cranks have same radius of rotation.

Application –

The mechanism is used to connect driving & driven shaft of locomotive. Here both driving & driven wheels must rotate in same direction.

As shown below the diagrams in the notes are easy to draw. As compared to the diagrams in different textbooks.



Formulas are grouped and explained with each term to facilitiate the remembering.

Numerical Problems On belt Drives

Formulas On belt Drives

1.Length Of belt

$$L_o = 2C + \frac{\pi(D_2+D_1)}{2} + \frac{(D_2-D_1)^2}{4C}$$ .....For Open Belt

$$L_c = 2C + \frac{\pi(D_2+D_1)}{2} + \frac{(D_2+D_1)^2}{4C}$$ .....For Crossed Belt

Where , C= Central distance between pulleys, D1= Diameter of Smaller pulley
D2 = Diameter of Bigger pulley

2. Velocity of Belt

$$v = \frac{\pi D_1 N_1}{60} = \frac{\pi D_2 N_2}{60} \ldots\ldots m/sec$$

D1 and D2 are diameters of pulleys and N1 and N2 are speeds in rpm.

3.Angle of lap for smaller pulley of open belt

$sin\alpha = \frac{r_1 - r_2}{x}$ Angle of lap $\theta = 180 - 2\alpha$

4. Velocity ratio with Slip

$\frac{N_1}{N_2} = \frac{D_2}{D_1}$ .....Without slip

$\frac{N_1}{N_2} = \frac{D_2+t}{D_1+t}\left[1 - \frac{s}{100}\right]$ .....With slip {s= percentage slip,t=belt thickness}

5.Ratio Of Tensions In belts

$$\frac{T_1}{T_2} = e^{\mu.\theta}$$

$T_1 = Tension\ on\ Tight\ side$ ...N, $T_2 = Tension\ on\ slack\ side$ ...N

$\mu = Coefficient\ of\ Friction$ $\theta = Angle\ of\ Contact\ in\ radians$..$\left\{\theta = deg \times \frac{\pi}{180}\right\}$

Initial tension in the belt $T_0 = \frac{T_1+T_2}{2}$

Numerical problems in exercise have been provided with answers for verification .

A) Problems on Length of belt

1. Two Parallel shafts are provided with pulleys 480mm and 640 mm diameters and central distance is 3m. Find the length of 1) Crossed belt 2) Open belt.

{Lc=7.843 meters, Lo=7.761 meters}

2. Two pulleys having diameters 800mm and 600mm are 8m apart, are connected by crossed belt drive. Calculate the change in the length if direction of rotation of the driven pulley to be reversed.

{$\Delta l = 60\,mm$*}*

3.Two Shafts with centre to centre distance between them as 3.5 meters, are having two pulleys with radii equal to 640 mm and 370 mm respectively. Find the length of crossed belt.

{Lc=10.46 m }

B) Problems on slip in belts

4.Find the diameter of driven pulley rotating at 500 rpm if the driver pulley is 250mm in diameter and rotates at 100 rpm by using flat belt drive with 5% slip and the belt thickness is 5 mm.

{48.68 mm}

5. A shaft runs at 80 rpm and drives another shaft at 150 rpm through belt drive. the diameter of driving pulley is 600mm . Determine the diameter of the driven pulley taking belt thickness 5mm and slip 4%.

{0.3023 m or 302.3mm}

6. The speed of driving pulley is 600 rpm and that of driven pulley is 1800 rpm. If diameter of driving is 500 mm and that of driven is 155 mm. find % slip in belt if belt is 4 mm thick..

{s= 3.45 %}

C) Problems Without considering Centrifugal effect on Belt.

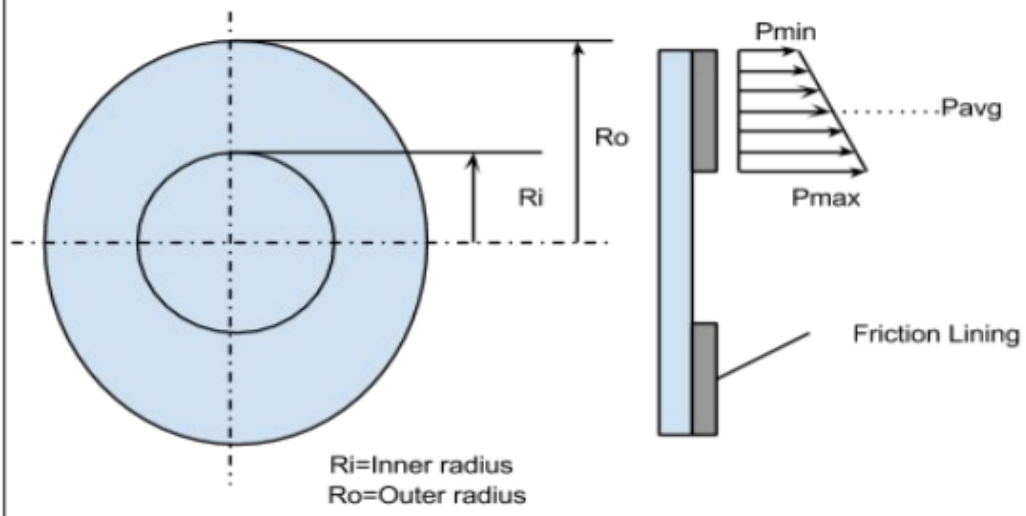
7) Find the power transmitted by the belt running over a pulley 600 mm diameter and running at 200 Rpm. if the coefficient of friction between belt and pulley is 0.25 and the angle of lap is given as 160 degrees. Take Maximum Tension in the belt as 2500 N.

{ans P=7881.33 Watts }

Formulas are simplified with easy to understand and remember notification.

Numerical problems on Clutch

Formulae:



Formulae Required

1) Pressure intensities at various points

$P_{max} = \frac{W}{2\pi R_i(R_0 - R_i)}$.....max pressure is on inner radius

$P_{min} = \frac{W}{2\pi R_o(R_0 - R_i)}$.....min pressure is on outer radius

$P_{avg} = \frac{W}{2\pi R_m(R_0 - R_i)}$.....Avg pressure is on mean radius

$Mean\ radius\ R_m = \frac{R_o + R_i}{2}$

2) Torque Transmitted by the clutch

$T = \mu.W.R_m.n$.....N-m

Where,

T=Torque transmitted in (N-m)

W= Axial Thrust provided (N)

Rm= Mean radius of clutch (m)

n= No of contacting surfaces of clutch

{for single plate clutch n=2 and for multiple plate clutch n=total plates -1}

Each chapter is provided with the analysis of the each years question asked. This is important because it gives idea about the weightage and the location of the question asked.

Also it provides the location where the questions from a particular chapter are asked.

Examination: 2017 SUMMER

Que.No	Question/Problem	marks
Q 3 e)	Explain the working of Watt governor with neat diagram.	4
Q 4 d)	Explain the working of flywheel with the help of turning moment diagram.	4
Q 6 b)	Define following terms Fluctuation of energy, co-efficient of fluctuation of energy, co-efficient of fluctuation speed, maximum fluctuation of energy	4

Examination: 2016 SUMMER

Que.No	Question/Problem	marks
Q 1a)(iv)	Define: (i) Coefficient of fluctuation of speed. (ii) Coefficient of fluctuation of energy.	2
Q 1a)(vi)	Draw line diagram of porter governor	2
Q 4 c)	Differentiate between flywheel and governor.	4
Q 6a)(ii)	Explain single cylinder 4-stroke I.C. engine using turning moment diagram.	4

Examination: 2016 WINTER

Que.No	Question/Problem	marks
Q 1a)(vii)	Define fluctuation of energy and coefficient of fluctuation of energy.	2
Q 4 c)	Distinguish between flywheel and governor.	4