Department of

Mechanical Engineering

LAB MANUAL

TOM LAB

B.Tech– IV Semester

KCT College OF ENGG AND TECH.

VILLAGE FATEHGARH

DISTT.SANGRUR

INDEX

Sr.No:	Experiments
1	Determination of speed and sensitivity for watt governor.
2	Determination of speed and sensitivity for propel governor.
3	Determination of moment of inertia by oscillation method.
4	Cam study model.
5	Balancing of Rotating Mass.
6	Verification of Gyroscopic Relation.
7	Study on Balancing of Reciprocating Mass.

Experiment No:1

DETERMINATION OF SPEED AND SENSITIVITY FOR WATT GOVERNOR

Aim:

To determine the speed and sensitivity of the Watt Governor.

Apparatus Required:

1.Watt governor set up.
2.Tachometer
3.Dimmer

Formula:

1. Speed, N = √(895/h) rpm h-sleeve lift

2. Sensitivity= N/N2-N1 N2-Maximum speed N1-Minimum speed

N-Mean speed

Procedure:

1. The watt governor assembly is mounted over the spindle.
2. The motor is started and speed is adjusted. Speed is measured with the help of tachometer.
3. Due to this centrifugal force the sleeve will be rise, the speed and the sleeve height are noted.
4. By using the formula the speed of the governor is calculated.
5. The experiment is repeated at different speed and force.

Tabulation:

Sl.no	Motor speed (rpm)	Sleeve lift (h) (mm)	Governor speed (N) (rpm)

Calculation

Result:

At different motor speed the sleeve lift are noted and corresponding governor speed and sensitivity are calculated.

Experiment No:2

DETERMINATION OF SPEED AND SENSITIVITY FOR PROELL GOVERNOR

Aim:

To determine the speed and sensitivity of the propel Governor.

Apparatus Required:

1.Proell governor.
2.Tachometer.
3.Dimmer.

Formula:

$N = \sqrt{FM/BM} \times (m+M/m) \times 895/h.$

Where,

FM/BM-proell link ratio =0.57. M-mass of the sleeve assembly=2.25kg

m-mass of the ball = 0.092 kg. h-sleeve lift

Sensitivity=N/N2-N1 N2-Maximum speed N1-Minimum speed

N-Mean speed

Procedure:

1. The proell governor assembly is mounted over the spindle.
2. The motor is started and speed is adjusted. Speed is measured with the help of tachometer.
3. Due to this centrifugal force the sleeve will be rise, the speed and the sleeve height are noted.
4. By using the formula the speed of the governor is calculated.
5. The experiment is repeated at different speed and force.

Tabulation:

Sl.NO	MOTOR SPEED (rpm)	SLEEVE LIFT(h) (mm)	GOVERNORSPEED(N) rpm

Calculation:

Result:

At different motor speed the sleeve lift are noted and corresponding governor speed and sensitivity are calculated.

Experiment No:3

DETERMINATION OF MOMENT OF INERTIA BY OSCILATION

Aim:

To determine the moment of inertia by oscillation method.

Apparatus Required:

1. Fly wheel
2. Chucks
3. Main Frame
4. Connecting rod.

Formula Used:

1. Polar moment of inertia (J) = $/32xd^4$ m^4

   d-dia of the connecting rod ends

2. Torsional Rigidity (q) =GJ/l N-M

   G-Modulus of rigidity of material=$0.79x10^{11}$

   l-Length of the connecting rod

3. Moment of Inertia (I) =$4q/ {}^2f^2 = 4qt^2p/ {}^2$ kg-m^2

Procedure:

1. The connecting rod for which the moment of inertia is to be found is fixed the inner diameter of the rod is measured by various points.
2. The mean diameter is taken as the diameter of the rod.
3. The rod is fixed at both at the top of the chuck and the flywheel and the length between two points is measured then a small twist is given to the flywheel and is released.
4. The time taken for the 5 oscillation is noted in the tabular column.
5. The same experiment is repeated for various lengths and at different diameter the experiment is done by adding the weight of flywheel and the reading are noted down.

Tabulation:

Sl.no	End position	N	T (sec)	tp = t/n	Length of rod (mm)	Diameter of rod (mm)	Moment of inertia Kg-m^2

Calculation:

Result:

Thus the moment of inertia of the given rod is calculated and tabulated.

Experiment No:4

CAM STUDY MODEL

AIM:

To draw the displacement diagram for various cam profile and various followers.

APPARATUS REQUIRED:

1) Experimental setup 2) Flat, Roller, Knife edge follower 3) Cams

PROCEDURE:

1.Taka a paper of size 40cm x 15cm, use scale for x-axis as 1cm = 10 of rotation of cam.
2.Take height of lift as10cm.
3. Plot displacement diagram for given cam profile.
4.Fit graph paper on drum. set '0' as a starting point to lift.
5.Give gradual rotation to complot displacement diagram on graph.
6.Compare solution obtained by graphical. Do this for other cam profile and follower.

Tabulation:

Roller follower		Mushroom follower		Knife edge follower	
Degree	Displacement	Degree	Displacement	Degree	Displacement

Calculation:

RESULT:

Thus the displacement diagrams are drawn for the given follower and various cams

Experiment No:5

BALANCING OF ROTATING MASS

Aim:

To verify the balancing using the rotating machine element.

Apparatus required:

1. Balancing rotary system 2. Masses.

Procedure:

1.To order of the basic operation involved with respect to static balancing as following
2.Then the mass should be fixed in one side of the stud and its angle to be adjusted with the help of angular scale and its radil can be corrected with the help of vernier caliper.
3.Angular displacement between the masses Is calculated by force diagram through known value of mass and radil.
4.Fix the masses to the calculated angular displacement using angular scale.
5.Now switch on the motor.
6.By changing the sped of the motor, check it out for vibration for running
7.Add by changing the mass with different radil and find out the angular displacement among the mass for balancing the system

Tabulation:

Sl.No	Plane	A	B	C	D
	Mass Radius θ				

Calculation:

Result:

Thus the Balancing Of Rotating Machine Was Verified.

Experiment No:6

VERIFICATION OF GYROSCOPIC RELATION

Aim:

To analysis the gyroscopic effect using the test setup and verify the gyroscopic rules of plane disc.

Apparatus Required:

1. Gyroscopic setup. 2. Weight 3. Tachometer

Technical Data:

1.Rotor diameter (d) = 30 cm.
2.Rotor thickness (t) = 8cm.
3.Distance of weight pan bolt centre to disc center (l) = 260 mm.
4.Weight of the rotor = 7kg.

Formula Used:

1. Precision ratio (wp) = 2 n/60 rad/ sec.
2. Angular velocity (w)=dØ/dt X /180 rad/sec
   dØ-change in degree dt-time taken in sec

3. Gyroscopic effect (c) = I.ω.ωP
4. Torque, t = wxr
   Where,

   w = weight of the rotor.

   r = distance between weight pan centre to disc centre.

5. $I = mr^2/2$ Kg-m^2. m-mass of the rotor kg

6. Percentage of error = (T-C)/T X 100.

Procedure:

1.Switch on the supply.
2.Set they require speed of the regulator as constant.
3.Add the load as ½ kg, 1kg etc.
4.Angle of precision d i.e. Measured.
5.Loose the lock screw, start the stop watch and note down.
6.Watch the particular interval and time.
7.Take the reading n different load.
8.Repeat the equipment maintaining load as constant and varying the speed.
9.Do the calculation.

Tabulation:

Speed Of Disc (rpm)	Added weight (gm)	dθ (degree)	dt (sec)

Angular velocity rad/sec (ω)	Applied couple on tachometer (Tact)	Precision ratio (ωp) rad/sec	Gyroscopic Effect c N-m

Calculation:

Result:

Thus the Gyroscopic relation was verified.

Experiment No:7

STUDY ON BALANCING OF RECIPROCATING MASS

Aim:

To study the behavior of vibration due to the unbalanced mass in reciprocating parts.

Apparatus required:

Balancing of reciprocating mass system masses.

Procedure:

1. Initially all weights and bolts are removed then the motor is started. The speed of the motor is increased due to the unbalanced masses, the vibration will be created. The vibration Is observed.
2. The speed is noted down. Now the speed is increased and the vibrations are all so noted down. The motor is switched off then some weights added on the piston top. The weights may be added on the piston top. The weights may be added either eccentrically (or) co-axially. Now the motor is started the vibrations are observed at the tested speed noted in the previous case. If still the vibration are observed. One of the following has to be done to eliminate the unbalance forces
3. Some weights are added in opposites direction of crank and the engine run and the vibration, are observed at the tested speed.
4. Combination of both the above cases. The speeds, the weight added on piston, diameter at which the weights are added are noted down at different case.

Result:

The vibrations due the unbalanced forces in the reciprocating masses are studied.