



**DEPARTMENT OF MECHANICAL ENGINEERING
17MECC86: DYNAMICS AND METROLOGY LAB**

STANDARD OPERATING PROCEDURE

Name of the Lab/Facility	DYNAMICS AND METROLOGY LAB
Purpose	A governor, or speed limiter or controller, is a device used to measure and regulate the speed of a machine
Scope	Governor is the device used to control the speed in engines. Governors are used in automobiles
Responsibility	Faculty In-charge and HOD/MECH
STANDARD OPERATING PROCEDURE FOR GOVERNOR	
<ul style="list-style-type: none"> → Tighten the necessary bolts. → Start the motor and gradually increase the speed. → The flyweight will fly outward due to which the sleeve will rise. → Note down the speed and sleeve rise or calculate by theoretical method. → Repeat the experiment at different speeds till the balls fly to maximum position. → Bring back the sleeve down by reducing the speed gradually and stop 	
PRECAUTIONS TO BE FOLLOWED	
<ul style="list-style-type: none"> → Do not keep the mains on when trial is complete → Increase the speed gradually. → Take the sleeve displacement reading when the pointer remain steady → Measure the height of governor carefully 	
RECORD TO BE MAINTAINED	
<ul style="list-style-type: none"> → Laboratory Manual containing the experiments that can be performed with the equipments → Maintain Record 	

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Purpose	A gyroscopic couple is defined as the turning moment in which the changes are opposed by the inclination of the axis of rotation of the gyroscope.
Scope	Gyroscope finds applications in gyrocompass, used in aircraft, naval ship, control system of missiles and space shuttle
Responsibility	Faculty In-charge and HOD/MECH

STANDARD OPERATING PROCEDURE FOR GYROSCOPIC COUPLE

- The working principle of the mechanical gyroscope is based on the conservation of angular momentum.
- The mechanical gyroscope is dependent on the ball bearing to spin.
- Start the motor by increasing the voltage with the autotransformer and wait until it attains constant speed

Press the yoke frame No.2 about vertical axis by applying necessary force by hand to the same. {In the clockwise sense seen from above}.
- It will be observed that the rotor frame swings about the horizontal axis yy.Motor side is seen coming upward and the weight pan side going downwards
- Rotate the vertical yoke in the anti clockwise sense seen from above and observe that the rotor frame swings in the opposite sense

PRECAUTIONS TO BE FOLLOWED

- When rotating parts of the engine rotate in opposite directions, then negative sign is used.
- The reaction will be vertically downwards on the outer wheels and vertically upwards on the inner wheels.
- The gyroscopic couple will act over the vehicle outwards i.e. in the anticlockwise direction when seen from the front of the vehicle.

RECORD TO BE MAINTAINED

- Laboratory Manual containing the experiments that can be performed with the equipments
- Maintain Record

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Purpose	Tri-filar suspension system is used to find the moment of inertia by three fine vertical wires of equal length.
Scope	Tri-filar suspension system is used for find out the centering correction, Space applications etc.
Responsibility	Faculty In-charge and HOD/MECH
STANDARD OPERATING PROCEDURE FOR TRI-FILAR SUSPENSION SYSTEM	
<ul style="list-style-type: none"> → Select trifler plates. → With the help of string of chucks tighten at tops → Adjust length of string to desire values are measure length as it is → Give small horizontal twist → Start stop watch and note down time required for 5 or 10 oscillations → Repeat experiment by adding weight and changing length 	
PRECAUTIONS TO BE FOLLOWED	
<ul style="list-style-type: none"> → Use carefully the circular plate → Set the distance of threads equally 	
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Purpose	A compound pendulum has an extended mass, like a swinging bar, and is free to oscillate about a horizontal axis. The compound pendulum depends on the length of gyration, the moment of inertia and the mass of the pendulum as well as gravitational acceleration.
Scope	A compound pendulum has more vibrations and more energy. It can be used Engineering, technical and other construction fields.
Responsibility	Faculty In-charge and HOD/MECH
STANDARD OPERATING PROCEDURE FOR COMPOUND PENDULUM	
<ul style="list-style-type: none"> → The rod is supported on the knife-edge.. → The total length of suspended rod is noted and 'OG' is determined. → The bar is allowed to oscillate and the time taken for 10 oscillations is noted → The time period is calculated. → The same procedure repeated for the other pendulum. → Using the experimental time period the radius gyration is calculated using given relation. → The experimental value is verified with the theoretical value. 	
PRECAUTIONS TO BE FOLLOWED	
<p>The bob of pendulum should be displaced with a small angle. The amplitude of the oscillation of a simple pendulum should be small. Fans should be switched off to reduce the air resistance. The simple pendulum should be oscillate in a vertical plane only.</p>	
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Purpose	The purpose of Whirling of shaft is to determine the critical speed or whirling speed of a rotating shaft and it verify the value theoretically
Scope	Whirling of shafts occurs due to rotational imbalance of a shaft, even in the absence of external loads, which causes resonance to occur at certain speeds, known as critical speeds, and also can understand different types of vibrations
Responsibility	Faculty In-charge and HOD/MECH
STANDARD OPERATING PROCEDURE FOR WHIRLING OF SHAFT	
<ul style="list-style-type: none"> → Fix the shaft properly at both ends → Check the whole apparatus for tightening the screw etc. → First increase the voltage slowly for maximum level and then start slowing down step by step → Observe the loops appearing on the shaft and note down the number of loops and the speed at which they are appearing. → Slowly bring the shaft to rest and switch of the supply → Repeat the same procedure for different shaft → since both the ends have double ball bearing hence both the ends are assumed fixed. 	
PRECAUTIONS TO BE FOLLOWED	
<ul style="list-style-type: none"> → It is destructive test and fresh test pieces may be used every time → If the revolution of an unloaded shaft is gradually increased, it will be reached at which violent instability will occur, the shaft. → Fix the apparatus firmly on suitable foundation 	
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Purpose	Bevel protractor is used to measure the angle of any job or work piece. It can be used to measure the angle 0° to 360°. Bevel Protractor is used to check V Blocks, and can measure inside beveled face of the ground surface. It is also used for measuring acute angles.
Scope	The bevel protractor is useful for establishing and testing the angles to very close tolerances. It reads to 5 arc minutes and can also measure angles from 0 degrees to 360 degrees. It plays a very important role in the mechanical and architectural drawing, although its general use is decreasing with the availability of the modern drawing software or CAD
Responsibility	Faculty In-charge and HOD/MECH
STANDARD OPERATING PROCEDURE FOR BEVEL PROTRACTOR	
<ul style="list-style-type: none"> ➔ Determine The Least Count Of Bevel Protractor. ➔ Place the specimen whose taper is to be measured between adjustable Plate and movable with one of its base parallel to the base plate. ➔ Lock the adjustable plate in this position and note down the main scale Reading (MSR). Depending upon the direction of rotation of adjustable Plate that is clockwise or anticlockwise, note the vernier scale reading (VSR) ➔ Suppose the adjustable plate is rotated clockwise direction then the VSR Right of zero should be taken. ➔ To obtain the actual multiply the VSR with the least count and add to MSR. 	
PRECAUTIONS TO BE FOLLOWED	
<ul style="list-style-type: none"> ➔ Angle of instrument must coincide with the angular scale ➔ Clean the measuring faces with paper or cloth. Keep the instrument in the box properly. ➔ Set the zero reading of the instrument before measuring ➔ Gripped the instrument to the measuring face exactly 	
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Name of the Lab/Facility	DYNAMICS AND METROLOGY LAB
PURPOSE	A sine bar with slip gauge blocks is used for precise angular measurement and used to measure sine bars very accurately or to detect any work that offered a high level of accuracy in measuring angles for milling, grinding, and inspection applications.
SCOPE	Accuracy up to 0.01mm/m of length of the sine bar can be obtained. Sine bars is used to measure on unknown angles of any components. It is used measure the flatness of any new products.
RESPONSIBILITY	FACULTY IN-CHARGE&HOD/MECH
STANDARD OPERATING PROCEDURE FOR MEASUREMENT TAPER ANGLE USING SINE BAR	
<ul style="list-style-type: none"> ➔ The dial gauge is fixed on the magnetic stand and placed on the surface plate and the parallelism of the sine bar is checked. ➔ The given specimen is placed above the sine bar and the dial gauge is placed on the top edge of the specimen and adjusted for zero deflection. ➔ The front end of the SINE BAR is raised with the slip gauges until the work surface is parallel to the datum surface. The parallelism is checked using dial gauge. ➔ Then the distance between the centers of the sine bar rollers is measured as 'L'. The height of the slip gauge in noted as 'H'. ➔ The angle of inclination of the wedge is a ratio of the height of gauge blocks used and the distance between the centers of the cylinders. 	
PRECAUTIONS TO BE FOLLOWED	
<ul style="list-style-type: none"> ➔ The sine bar should not be used for angle greater than 60° because any possible error in construction accentuated at this limit. ➔ A compound angle should not be formed by mis-aligning of work piece with the sine bar. This can be avoided by attaching the sine bar and work against an angle plate. ➔ Accuracy of sign bar should be ensured. 	
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Name of the Lab/Facility	DYNAMICS AND METROLOGY LAB
Purpose	Rota meter is a form of variable area flow meter which is used to measure the flow of liquid or gas passes through a tapered tube. The spinning float is giving clear indication that fluid is flowing.
Scope	Rota meter widely used for industrial applications, Transportation, Agriculture, Energy Engineering and Biotechnology etc
Responsibility	Faculty In-charge and HOD/MECH
STANDARD OPERATING PROCEDURE FOR ROTAMETER	
<ul style="list-style-type: none"> ➔ A rotameter consists of a tapered tube, typically made of glass with a 'float', made either of anodized aluminum or a ceramic, actually a shaped weight, inside that is pushed up by the drag force of the flow and pulled down by gravity. ➔ The drag force for a given fluid and float cross section is a function of flow speed squared only. ➔ A higher volumetric flow rate through a given area increases flow speed and drag force, so the float will be pushed upwards. ➔ Keeping the voltage fixed note down the Rota meter discharge and switch off the apparatus ➔ At the same time note down actual discharge in the collecting tank ➔ Empty the collecting tank to zero position Switch on the apparatus and again hold down. ➔ We use the experiment and note down the time of different voltage and reading ➔ The time is set for 60 seconds. 	
PRECAUTIONS TO BE FOLLOWED	
<ul style="list-style-type: none"> ➔ The Rota meters must be installed vertically ➔ It is necessary to keep the float and cone tube is clean ➔ Use line mounting only ➔ Only clean water can use as a circulating fluid 	
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Purpose	The profile projector is widely used for measure the complex-shape stampings, gears, cams, threads and comparing the measured contour model. Profile projector can magnify every minute details of the components, it will give the clear picture of the product and we can easily find out the errors in the production side
Scope	Profile Projector technology designed to display accurate magnification of sample for comparison and precision measurements with data processing. Profile projector gives the better quality of the products. Profile projector is widely used in major machinery manufacturing including aviation, aerospace industry, watches and clocks, electronics, instrumentation industry, research institutes and detection metering stations at all levels
Responsibility	Faculty In-charge and HOD/MECH
STANDARD OPERATING PROCEDURE FOR MEASUREMENT OF PROFILE PROJECTOR	
<ul style="list-style-type: none"> → Keep the specimen on the glass table and switch on the bulb → Adjust the height of the table until; a sharp image of contour of the specimen appears on the screen. → In this position note down the reading of the micrometer. → Rotate the micrometer thimble until same Vertical cross line occupies diametrically opposite point. → In this position again note down the reading of micrometer. → Repeat the above procedure for other sides. 	
PRECAUTIONS TO BE FOLLOWED	
<ul style="list-style-type: none"> → Students are advised to take readings without any parallax error. → For each feature at least two readings must be taken and average is to be presented. → Table must be properly adjusted to get a sharp image. 	
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Purpose	LVDT is an electromechanical sensor used to transform mechanical motion into a variable electrical signal (current or voltage) and is used for measurement of displacement. LVDT is used to measure the physical quantities such as Force, Tension, Pressure, Weight, etc.
Scope	LVDT has a very wide range of measurement of displacement. It can measure displacement ranging from 1.25mm to 250 mm. It is mostly used in industries as well as a servomechanism. It is also used in Industrial Automation, Aircraft. Turbine, Satellite, hydraulics, etc.
Responsibility	Faculty In-charge and HOD/MECH
STANDARD OPERATING PROCEDURE FOR LINEAR VARIABLE DIFFERENTIAL TRANSDUCER (LVDT)	
<ul style="list-style-type: none"> → LVDT consists of one primary winding P and two secondary windings S1 & S2 mounted on a cylindrical former → There is a movable soft iron core placed inside the former. → Connect the LVDT and Digital displacement meter to main supply. → Adjust the zero pot of the displacement indicator to indicate zero. → Connect the LVDT sensor to the displacement indicator through the cable. → Rotate the micrometer knob to clock wise or antilock direction, to bring the LVDT core to null position of the sensor. Where there is no induced emf. At this position indicator will read zero. Note down the micrometer reading. This is initial reading of micrometer. 	
PRECAUTIONS TO BE FOLLOWED	
<ul style="list-style-type: none"> → LVDT is sensitive to stray magnetic fields so it always requires a setup to protect them from stray magnetic fields. → All connections should be neat & clean. → Sometimes, the transducer performance is affective by the vibration. 	
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Purpose	The stroboscopic effect is a phenomenon due to interrupted illumination of a moving object. When an oscillating body is seen in periodically interrupted light (a series of light flashes occurring at a definite rate) it appears different. If the periodicity of the vibrating body is same as that of the flashing light, the body appears to be stationary.
Scope	Stroboscopes play an important role in the study of stresses on machinery in motion, and in many other forms of research.
Responsibility	Faculty In-charge and HOD/MECH
STANDARD OPERATING PROCEDURE FOR STROBOSCOPE	
<ul style="list-style-type: none"> → Connect the stroboscope to a 230/50Hz A.C. Supply → Switch ON' the motor and stroboscope simultaneously. → Set the voltage in the variac and vary the frequency of illuminations till the rotating member appears stationary with three leaves in the case of constant marking with the varying voltage → In the case of varying making set the voltage as 50 volts. → The indicator gives the stroboscope reading. → Repeat the experiments. 	
PRECAUTIONS TO BE FOLLOWED	
<ul style="list-style-type: none"> → When using the stroboscope, the user is cautioned not to become careless and touch the object → Stroboscope having high intensity of light source 	
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