Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-2 (B.Tech)

Subject: Introduction to Troubleshooting - BETME12202

Type of course: Skill Enhancement Courses (SEC)

Prerequisite: Introduction to Mechanical Engineering

Rationale: This syllabus covers essential troubleshooting skills for mechanical systems, focusing on practical, hands-on knowledge. It includes identifying issues with hand tools, fasteners, and common power transmission systems like belts and chains. Key areas such as bearing inspection, lubrication, and centrifugal pump faults are addressed to ensure reliable machine operation. The course also includes diagnosing problems in gearboxes, hydraulic and pneumatic systems, IC engines, fans, blowers, motors, couplings, and heat exchangers. Vibration analysis and seal/gasket troubleshooting are introduced to develop basic condition monitoring and maintenance skills. Overall, the syllabus prepares students for real-world mechanical diagnostics and maintenance.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
0	0	4	2	-	-	10	40	50	100

Legends: CI- Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

GYANMANJARI INNOVATIVE UNIVERSITY BHAVNAGAR

Course Content:

Sr. No	Course content	Hrs	% Weightage
1	**Fundamentals of Troubleshooting and Mechanical Fastening Systems** **Introduction to Mechanical Troubleshooting:** - Definition, importance, and general approach. Safety procedures and tool handling **Common Hand Tool Issues:** - Inspection, wear detection, and minor repairs, Preventive maintenance of tools **Fastener Inspection and Troubleshooting:** - Thread damage, loosening, over-torqueing issues. Anti-loosening techniques (lock washers, nyloc nuts, etc.) **Belt and Chain Drive Troubleshooting:** - Tension adjustment, alignment checks, wear identification. Chain elongation, sprocket damage, belt slippage causes	15	25%
2	**Troubleshooting of Rotating and Power Transmission Equipment** **Bearing Inspection and Lubrication:** - Types of bearings, failure modes, lubrication methods. Noise and temperature monitoring techniques **Centrifugal Pump Troubleshooting:** - Cavitation, priming issues, flow disruption, seal failures. Impeller wear and shaft misalignment **Gearbox Problem Identification:** - Gear wear, backlash, lubrication issues, noise diagnosis. Oil contamination detection and maintenance schedules **Vibration Analysis for Rotating Equipment:** - Introduction to vibration monitoring tools. Identifying imbalance, misalignment, and looseness	15	25%
3	**Troubleshooting of Fluid Power Systems and Engines** **Hydraulic System Troubleshooting:** - Leak detection techniques, pressure issues. Pump and valve malfunctions, fluid contamination **Pneumatic System Troubleshooting:** - Air leakage testing, pressure drop causes. Compressor and actuator diagnostics **Internal Combustion Engine Fault Diagnosis:** - Compression issues, ignition problems, fuel system faults. Visual and auditory inspection methods **Fan and Blower Troubleshooting:** - Airflow restrictions, impeller imbalance. Vibration and noise troubleshooting	15	25%
4	**Troubleshooting of Electrical-Mechanical Interfaces and Heat Transfer Equipment** **Motor and Coupling Troubleshooting:** - Motor overheating, abnormal noise, current imbalance. Misalignment and wear in couplings	15	25%

	Troubleshooting Bearings in Electrical Motors: - Causes of electrical fluting, lubrication failure. Bearing current detection and mitigation **Heat Exchanger Troubleshooting:** - Fouling detection, scale removal methods. Flow blockages and temperature differential analysis **Mechanical Seals and Gasket Troubleshooting:** - Seal face damage, gasket wear, leakage prevention techniques. Installation and maintenance best practices		

Continuous Assessment (ALA):

Sr. No	Active Learning Activities	Marks
1	**Design a Workshop Layout for Effective Troubleshooting** Design a workshop layout for mechanical maintenance and troubleshooting that allows smooth workflow, adequate space for each workstation, and adherence to safety standards. Upload the final layout (hand-drawn or CAD) as a photograph or PDF on the GMIU web portal.	10
2	**Prepare a Troubleshooting Report on Workshop Equipment** Select any one workshop equipment (lathe, air compressor, drilling machine, etc.) and create a report listing potential faults, symptoms, and corrective actions. Include real-life examples or observations. Upload the report (PDF/photograph) on the GMIU web portal.	10
3	**Fastener Condition Assessment** Inspect a set of bolts, nuts, and screws. Identify issues like wear, thread damage, or corrosion. Classify the causes and suggest corrective/preventive measures. Submit labeled photographs with annotations via the GMIU web portal.	10
4	**Leak Testing in Pneumatic/Hydraulic Systems** Observe any fan, wheel, or rotating device and describe where the bearing is likely used. Share 1 photo and mention the type of bearing (sliding/rolling) and why it's used. Upload the photo and short write-up on GMIU.	10
5	**Vibration Check on Running Equipment** Observe a running device (like a washing machine, mixer, or fan). Note any unusual vibration or noise. Describe what might cause it and suggest a fix. Upload your observation and photo on GMIU.	10
	Total	50

Course Outcome:

After learning the course the students should be able to:	
CO1	Identify and troubleshoot common issues in tools, fasteners, and drives.
CO2	Diagnose faults in bearings, pumps, gearboxes, and rotating machinery effectively.
CO3	Analyze and resolve faults in basic hydraulic, pneumatic, and engine systems.
CO4	Troubleshoot problems in motors, heat exchangers, seals, and mechanical interfaces.

List of Practical

Sr. No	Descriptions	Unit No	Hrs
1	**Identifying and Fixing Common Hand Tool Issues:** Demonstrate inspection, maintenance, and repair techniques for commonly used hand tools.	1	04
2	**Inspection and Troubleshooting of Fasteners (Nuts, Bolts, and Screws):** Examine fasteners for wear, damage, and apply corrective fixing methods.	1	04
3	**Basic Belt and Chain Drive Troubleshooting:** Identify misalignment, slack, and wear in belt and chain drive systems.	1	04
4	**Bearing Inspection and Lubrication:** Inspect bearings for damage and perform correct lubrication procedures.	1	04
5	**Pump Troubleshooting (Centrifugal Pump):** Diagnose and rectify common faults in centrifugal pump operation and components.	2	04
6	**Identification of Common Gearbox Problems:** Detect gear wear, noise, and oil leakage in basic gearbox assemblies.	2	04
7	**Troubleshooting of Hydraulic Systems (Basic Leak Detection and Pressure Issues):** Identify leaks and pressure-related issues in simple hydraulic systems.	2	04
8	**Troubleshooting of Pneumatic Systems (Air Leakage and Pressure Drop):** Detect and troubleshoot air leakages and pressure drops in pneumatic circuits.	2	04
9	**Fault Diagnosis in Simple Internal Combustion (IC) Engines:** Analyze operational issues in IC engines and suggest corrective actions.	2	04
10	**Fan and Blower Troubleshooting:** Inspect and resolve issues related to airflow, vibration, and noise in fans and blowers.	3	04

11	**Motor and Coupling Troubleshooting:** Evaluate and fix alignment, vibration, or connection issues in motor-coupling setups.	3	04
12	**Vibration Analysis for Simple Rotating Equipment:** Measure and interpret vibration data to diagnose rotating machine faults.	3	04
13	**Troubleshooting Heat Exchangers (Fouling and Flow Blockage Detection):** Identify and address fouling or blockage problems in heat exchangers.	4	04
14	**Troubleshooting Mechanical Seals and Gaskets:** Detect and rectify leaks due to worn-out seals and gaskets.	4	04
15	**Troubleshooting Bearings in Electrical Motors:** Inspect motor bearings for faults and recommend suitable maintenance practices.	4	04
		Total	60

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Maintenance Engineering and Management by S. K. Srivastava S. Chand

[2] Plant Engineering Handbook by R. Keith Mobley McGraw Hill

[3] Troubleshooting and Maintenance of Industrial Equipment by Robert C. Rosaler, McGraw Hill

[4] Hydraulic and Pneumatic Controls by S. R. Majumdar McGraw Hill

[5] Mechanical Maintenance of Machines by A. R. Basu Dhanpat Rai Publishing