

I. **SUGGESTED LIST OF EXPERIMENTS**

1. Experimental study of velocity ratios of Epicyclic gear train.
2. Motorized gyroscope– Study of gyroscopic effect and couple.
3. Governor - Determination of range sensitivity, effort etc., for Watts, Porter Governors.
4. Evaluation of Undamped and Damped Natural frequencies.
5. Vibration of Equivalent Spring mass system–Undamped and damped vibration.
6. Determination of torsional natural frequency of single Rotor system
7. Whirling of shafts–Determination of critical speeds of shafts with concentrated loads.
8. Balancing of rotating masses.

TEXT / REFERENCE BOOKS

1. Khurmi R.S & Gupta J.S, "Theory of Machines", 16th Edition, S.Chand & Company, 2005, Reprint 2020.
2. Singh V.P, "Mechanical Vibrations", 3rd Edition, Dhanpatrai & Co., 2016.
3. Ghosh A. and Malik A.M, "Theory of Mechanism and Machines", 4th Edition, Affiliated East West Press (P) Ltd. 2009 Reprint 2020.
4. Ashok G. Ambekar, "Mechanism and Machine Theory", 3rd Edition, PHI Learning Private limited, 2011.
5. Rattan S. S, Theory of Machines, 4th Edition, Tata Mcgraw Hill, 2017.



New Courses for 2023 batch Bachelors of Engineering– Mechanical Engineering course syllabus

SMEB2403	THERMAL ENGINEERING AND SPECIAL MACHINES LAB	L	T	P	EL	Credits	Total Marks
		0	0	4	0	2	100

COURSE OBJECTIVES

- To expose the students to the basic knowledge on testing the properties of fuels and lubricants.
- To conduct experiments and prepare report on I.C. Engine performance.
- To perform heat balance sheet in I.C. Engines.
- To study and practice the various operations that can be performed in shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

I. THERMAL ENGINEERING

1. Valve timing diagram of a four stroke diesel engine
2. Port timing diagram of a two stroke petrol engine.
3. Evaluation of kinematic viscosity of liquid using say bolt viscometer and redwood viscometer.
4. Determination of Calorific value of liquid fuel.
5. Performance test on a four stroke Single cylinder diesel engine.
6. Determination of Mechanical efficiency using negative horse power method.
7. Heat balance test on a four stroke diesel engine.
8. Performance test on a four stroke multi cylinder diesel engine.
9. Performance characteristics of a four stroke multi -cylinder petrol engine.
10. Determination of Mechanical efficiency using retardation test.
11. Study of FFF measurement of raw oil and biodiesel production
12. Study of Calorific value measurement
13. Study of Cloud point and pour point measurement.

II. OPERATIONS ON SPECIAL MACHINES:

1. Shaping: Machining of plane and inclined surfaces.
2. Cutting a V- groove in shaping machine.
3. Planning: Exercise involving plane and inclined surfaces.
4. Finishing of cylindrical surface using cylindrical grinding machine.
5. Finishing a flat surface in surface grinding machine.
6. Preparation of single point cutting tool using tool and cutter grinding machine.
7. Generating spur gear using gear hobbing machine and Milling
8. Cutting external keyway using slotter machine.
9. Measurement of cutting forces in turning operation using tool dynamometer.
10. Practices in Capstan and Turret lathes
11. Study of 3D Scanning: Principles and Applications
12. Study of Design Modification, Model Preparation, Parameter Setting through additive manufacturing.
13. Study of a functional product using FDM printer

Max. 30 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Perform test to determine the performance characteristics of petrol engines.

CO2 - Perform test to determine the performance characteristics of diesel engines.

CO3 - Examine the fuel properties for the given fuel samples

CO4- Explain with sketches the procedure of performing the given planning, shaping, slotter machine operation on a job.

CO5 - Explain with sketches the procedure of performing the given grinding machine operation on a job.

CO6 - Explain with sketches the procedure of performing the given milling machine operation on a job.



New Courses for 2024 batch Bachelors of Engineering– Mechanical Engineering course syllabus

SMEB3039	Materials Testing and Characterization Techniques	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Make them acquainted with microscopic techniques to analyse crystal structures
- Acquire an understanding on the electron microscopic techniques for characterization
Gain a fundamental on chemical and thermal analysis
- Provide the knowledge on various static methods to characterize materials
- Study the failure of materials under stress

UNIT I MICRO AND CRYSTAL STRUCTURE ANALYSIS

9Hrs

Principles of Optical Microscopy - Specimen Preparation Techniques - Polishing and Etching - Polarization Techniques - Quantitative Metallography - Estimation of grain size - ASTM grain size numbers - Microstructure of Engineering Materials - Elements of Crystallography - X- ray Diffraction - Bragg's law - Techniques of X-ray Crystallography - Debye - Scherer camera - Geiger Diffractometer - analysis of Diffraction patterns - Inter planer spacing - Identification of Crystal Structure, Elements of Electron Diffraction

UNIT II ELECTRON MICROSCOPY

9Hrs

Interaction of Electron Beam with Materials - Transmission Electron Microscopy - Specimen Preparation - Imaging Techniques - BF & DF - SAD - Electron Probe Microanalysis - Scanning Electron Microscopy - Construction & working of SEM - various Imaging Techniques - Applications Atomic Force Microscopy- Construction & working of AFM - Applications.

UNIT III CHEMICAL AND THERMAL ANALYSIS

9Hrs

Basic Principles, Practice and Applications of X-Ray Spectrometry, Wave Dispersive X-Ray Spectrometry, Auger Spectroscopy, Secondary Ion Mass Spectroscopy, Fourier Transform Infra-Red Spectroscopy (FTIR)- Proton Induced X-Ray Emission Spectroscopy, Differential Thermal Analysis, Differential Scanning Calorimetry (DSC) And Thermo Gravity metric Analysis (TGA)

UNIT IV MECHANICAL TESTING - STATIC TESTS

9Hrs

Hardness - Brinell, Vickers, Rockwell and Micro Hardness Test - Tensile Test - Stress - Strain plot - Proof Stress - Torsion Test - Ductility Measurement - Impact Test - Charpy & Izod - DWTT - Fracture Toughness Test, Codes and standards for testing metallic and composite materials.

UNIT V MECHANICAL TESTING - DYNAMIC TESTS

9Hrs

Fatigue - Low & High Cycle Fatigues - Rotating Beam & Plate Bending HCF tests - S-N curve - LCF tests - Crack Growth studies - Creep Tests - LM parameters - AE Tests-modal analysis - Applications of Dynamic Tests.

Max. 45 Hrs

OUTCOMES:

At the end of this course the students are expected

- CO1: To apply appropriate characterization techniques for analyse the micro structural characteristics of material and to examine the crystallography structure of materials.
- CO2: To select suitable characterization technique to identify the surface and sub surface metallurgical characteristic of various materials.
- CO3: To apply the suitable spectroscopy and thermal analysis techniques to determine the elemental, chemical composition and thermal stability of the material.
- CO4: To chose suitable static testing method to the evaluate the mechanical properties of the material.
- CO5: To apply the appropriate Static technique to measure the mechanical properties of material.
- CO6: To apply the appropriate dynamic technique to measure the mechanical properties of material.

REFERENCES:

1. ASM Hand book-Materials characterization, Vol - 10, 2016.
2. Culity B.D., Stock S.R& Stock S., Elements of X ray Diffraction, (3rd Edition). Prentice Hall, 2001.
3. Davis J. R., Tensile Testing, 2nd Edition, ASM International, 2019.
4. Davis, H.E., Hauck G. & Troxell G.E., The Testing of engineering Materials, (4th Edition), McGraw Hill, College Divn., 1982.
5. Dieter G.E., Mechanical Metallurgy, (3rd Edition), ISBN: 0070168938, McGraw Hill, 1988.
6. Goldsten,I.J., Dale.E., Echin.N.P.& Joy D.C., Scanning Electron Microscopy & X ray- Micro Analysis, (2nd Edition), ISBN - 0306441756, Plenum Publishing Corp., 2020.
7. Grundy P.J. and Jones G.A., Electron Microscopy in the Study of Materials, Edward Arnold Limited, 1976.
8. Morita.S, Wiesendanger.R, and Meyer.E, "Non-contact Atomic Force Microscopy" Springer, 2002,
9. Newby J., Metals Hand Book- Metallography & Micro Structures, (9th Edition), ASM International, 1989.
10. Suryanarayana A. V. K., Testing of metallic materials, (2nd Edition), BS publications, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A :10 questions of 2marks each-Nochoice

PART B : 2 questions from each unit of internal choice; each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks



New Courses for 2024 batch Bachelors of Engineering– Mechanical Engineering course syllabus

SMEB2602	Metrology and Material characterization lab	L	T	P	EL	Credits	Total Marks
		0	0	4	0	2	100

COURSE OBJECTIVES

- To understand metrology and working of various measuring instruments. →
- To acquire the knowledge on linear and angular measurements, coordinate measuring machines, comparators, screw thread and gear measurements
- To understand how certain measuring devices are used for dynamic testing
- To understand micro structure of Materials

I.METROLOGY LAB

1. Angle measurement using Bevel Protractor and Sine bar .
2. Testing Squareness of a Tri-square using Slip Gauges.
3. Bore diameter Measurement by two balls and four balls method.
4. Internal taper angle measurement by using spheres.
5. Measurement of linear and angular dimensions by using profile projector.
6. Measurement of gear tooth thickness by using gear tooth vernier.
7. Measurement of circularity, cylidricity, dimensional tolerance and run out using Mechanical, Electronic comparator.
8. Composite error in gears using Parkinson Gear Tester .
9. Measurement of surface finish by using surface roughness tester.

II.MATERIAL CHARACTERIZATION LAB

1. Study of X-Ray Diffractometer (XRD)
2. Study of Field Emission Scanning Electron Microscopy (FESEM)
3. Study of High-Resolution Scanning Transmission Electron Microscopy (HRSTEM)
4. Study of X-Ray Photoelectron Spectroscopy (XPS) in detail, its working, and its
5. Study of Atomic Force Microscopy (AFM)
6. Study of Micro Raman Spectrophotometer

Max. 30 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1** - Demonstrate and use different length measuring instruments like Vernier calipers and Micrometers.
- CO2** - Explain different angle measuring instrument like universal bevel protractor, sine bar.
- CO3** - Evaluate the surface quality of a given specimen which is important in all kind of manufacturing.
- CO4** - To select suitable characterization technique to identify the surface and sub surface metallurgical characteristic of various materials
- CO5** - To select suitable characterization technique to identify sub surface metallurgical characteristic of various materials
- CO6** - To study the micro structure of given specimen