SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES
SCHOOL OF ENGINEERING
Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology

Department of Mechanical Engineering

BE-SEMESTER-VII SYLLABUS

MEA-701	**MECHANICAL VIBRATION AND NOISE ENGINEERING**	**3L:0T:0P**	**03 credits**	**3Hrs/Week**

Course Preamble:

1. To state the importance Mechanical Vibrations
2. To make the students aware about various modeling techniques helpful in imitating a Mechanical system.
3. To give them practical exposure of Elements of a Vibrating system
4. To tell them about applications of Elements of a Vibrating system
5. To make students learn the harmful effects of vibrations and techniques required to make system safe from its ill effects.

Course Outcomes

1. The principle and working of Elements of a Vibrating system
2. Formulation of Workable model of a Vibrating system
3. Formulations and solution of equations of motion for various types of vibrating systems
4. Methods to bring reduction in the levels of vibration in system to which they are harmful by learning to design vibration controlling Mechanical systems

Unit I

Fundamental Aspects of Vibrations: Vibration, main causes, advantages and disadvantages; engineering applications of vibration and noise; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion; periodic, non-harmonic functions- Fourier series analysis; evaluation of coefficients of Fourier series; elements of vibratory system; lumped and distributed parameter systems.

Undamped Free Vibrations: Derivation of differential equation of motion: the energy method, the method based on Newton‟s second law of motion, and Rayleigh‟s method. Solution of differential equation of motion: Natural frequency of vibration. Systems involving angular oscillations: the compound pendulum.

(10 hours)

Unit II

Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio-Under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration; Coulomb or dry friction damping; frequency, decay rate and comparison of viscous and Coulomb damping; solid and structural damping; slip or interfacial damping.

(9 hours)

Unit III

Harmonically excited Vibration: One degree of freedom- forced harmonic vibration; vector representation of forces; excitation due to rotating and reciprocating unbalance; vibration Isolation, force and motion transmissibility; absolute and relative motion of mass (Seismic Instruments). Whirling Motion and Critical Speed : Whirling motion and Critical speed : Definitions and significance .Critical - speed of a vertical. Critical speed of a shaft carrying multiple discs (without damping), Secondary critical speed.

(9 hours)

Unit IV

Systems With Two Degrees of Freedom : Principal modes of vibration; torsion vibrations; Forced, Un-damped vibrations with harmonic excitation ; Coordinate coupling; Dynamic vibration absorber; torsion Vibration Absorber; Pendulum type of dynamic vibration.

(8 hours)

Unit V

Noise Engineering -Subjective response of sound: Frequency and sound dependent human response; the decibel scale; relationship between, sound pressure level (SPL), sound power level and sound intensity scale; relationship between addition, subtraction and averaging,

Noise: Sources, Isolation and Control: Major sources of noise on road and in industries, noise due to construction equipments and domestic appliances, industrial noise control, strategies- noise control at source (with or without sound enclosures)

(9 hours)

References Book :

1. Ambekar A.G.,‟ Mechanical Vibrations and Noise Engineering; PHI
2. Meirovitch Leonard; Element of Vibration Analysis; TMH
3. Dukikipati RV Srinivas J Text book of Mechanical Vibrations; PHI
4. Kelly SG and kudari SK; Mechanical Vibrations; Schaum Series;TMH

5. Thomson , W.T., Theory of Vibration with Applications , C.B.S Pub & distributors . Grading System 2013 – 14
6. Singiresu Rao, "Mechanical Vibrations , Pearson Education .

MEA-701	**MECHANICAL VIBRATION AND NOISE ENGINEERING**	**0L:0T:2P**	**1 credits**	**2Hrs/Week**

List of Experiments:-

1- To find out effect of load on natural frequency of vibrations of a lever pin supported at one end carrying adjustable load on a vertical screwed bar and spring supported at some intermediate point (i) When the dead weight of rods is neglected and (ii) when their dead weight is taken into account .

2- To find out frequency of damped free vibration and rate of decay of vibration-amplitude in the system.

3- To find out natural frequency and damped free frequency of a torsion pendulum and , hence to find out coefficient of damping of the oil ;

4- To observe the phenomenon of whirl in a horizontal light shaft and to determine the critical speed of the shaft.

5- To observe the mode shapes of a spring-connected, double pendulum and hence to demonstrate the phenomenon of beats.

6- To demonstrate the principle of tuned Undamped Dynamic Vibration Absorber and to determine the effect of mass-ratio (of main and auxiliary mass) on the spread of the resulting natural frequencies ;

7- To take measurements of sound Pressure Level (SPL) and to carry out octave band analysis of a machine using Noise Level Meter.

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MEA-702	**AUTOMOBILE ENGINEERING**	**3L:0T:0P**	**03 credits**	**3Hrs/Week**

Course Preamble:

1. To understand the basic concepts about automobile and performance parameters.
2. To understand the working of engine and its sub-systems.
3. To understand about function, necessity and working of various types of clutches. Selection for different application.
4. To understand power transmission from engine to tyres. Conversions at different stages, understanding working of different sub-systems in transmission to understand the power flow.
5. To understand working of various control systems like suspension, steering and brakes.
6. To understand the environmental impacts and study various means emission control from automobile.

Course Outcomes

1. Basic understanding about working of automobile
2. Understanding, importance of various sub-systems in performance of automobile
3. Understand importance of control in automobile
4. 4.Environmental friendly automobiles

Unit-I:

Chassis & Body Engg : Types, Technical details of commercial vehicles, types of chassis, lay out, types of frames, testing of frames for bending & torsion on unutilized body frame, vehicle body and their construction, drivers visibility and methods for improvement, safety aspects of vehicles, vehicle aerodynamics, optimization of body shape, drivers cab design, body materials, location of engine, front wheel and rear wheel drive, four wheel drive.

(10 hours)

Unit-II

Steering System: front axle beam, stub axle, front wheel assembly, principles of types of wheel alignment, front wheel geometry viz. camber, Kingpin inclination, castor, toe-in and toe out, condition for true rolling motion, center point steering, directional stability of vehicles, steering gear, power steering, slip angle, cornering power, over steer & under steer, gyroscopic effect on steering gears.

(9 hours)

Unit-III

Transmission System: Function and types of clutches, single plate, multi-plate clutch, roller & spring clutch, clutch lining and bonding, double declutching, types of gear Boxes, synchroniser, gear materials, determination of gear ratio for vehicles, gear box performance at different vehicle speed, automatic transmission, torque converters, fluid coupling, principle of hydrostatic drive, propeller shaft, constant velocity universal joints, differential gear box, rear axle construction.

(9 hours)

Unit-IV

Suspension system : Basic suspension movements, Independent front & rear suspension, shock absorber, type of springs: leaf spring, coil spring, air spring, torsion bar, location of shackles, power calculations, resistance to vehicle motion during acceleration and breaking, power & torque curve, torque & mechanical efficiency at different vehicle speeds, weight transfer, braking systems, disc theory, mechanical, hydraulic & pneumatic power brake systems, performance, self-energisation, airbleeding of hydraulic brakes, types of wheels and tyres, tyre specifications, construction and material properties of tyres & tubes.

(10 hours)

Unit-V

Electrical and Control Systems: storage battery, construction and operation of lead acid battery, testing of battery, principle of operation of starting mechanism, different drive systems, starter relay switch, regulator electric fuel gauge, fuel pump, horn, wiper, Lighting system, head light dazzling, signaling devices, battery operated vehicles, choppers. importance of maintenance, scheduled and unscheduled maintenance, wheel alignment, trouble Shooting probable causes & remedies of various systems, microprocessor based control system for automobile, intelligent automobile control systems.

(10 hours)

Unit-VI

Emission standards and pollution control: Indian standards for automotive vehicles- Bharat I and II, Euro-I and Euro-II norms, fuel quality standards, environmental management systems for automotive vehicles, catalytic converters, fuel additives, and modern trends in automotive engine efficiency and emission control. **(8 hours)**

References Books:

1. Crouse , Automotive Mechanics TMH.
2. Srinivasan S; Automotive engines; TMH
3. Gupta HN; Internal Combustion Engines; PHI;
4. Joseph Heitner, Automotive Mechanics, Principles and Practices, CBS Pub.
5. Kripal Singh, Automotive Engineering Khanna Pub.

6. Newton & Steeds , Automotive Engineering
7. Emission standards from BIS and Euro I and Euro-III

MEA-702	**AUTOMOBILE ENGINEERING**	**0L:0T:2P**	**1 credits**	**2Hrs/Week**

List of Experiments

1. To study the working principles and operation of the chassis,
2. To study the working principles and operation of the suspension,
3. To study the working principles and operation of the steering mechanisms,
4. To study the working principles and operation of the transmission,
5. To study the working principles and operation of the gear-box,
   Differential systems, and electrical systems of various light and heavy automotive vehicles;

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MEA-703 (A)	**DESIGN OF HEAT EXCHANGERS**	**3L:0T:0P**	**03 credits**	**3Hrs/Week**

Course Preamble:

1. Introducing of various types of heat exchangers providing heat transfer between two or more fluids and acquiring necessary information for the design of heat exchangers.

Course Outcomes:

At the end of this course students will have the ability of:

1. Learning the essentials and basic concepts of heat exchangers,
2. Learning heat exchanger types and selection criteria of heat exchanger according to usage area,
3. Capability to do thermal, pressure drop, strength, and cost analysis of heat exchangers

Unit I

Introduction: Types of heat exchangers heat transfer laws applied to heat exchangers convection Coefficients, resistance caused by the walls and by fouling, overall heat transfer coefficient.

(10 hours)

Unit II

Thermal & hydraulic design of commonly used heat exchangers : LMTD & NTU Methods, correction factors, Double pipe heat exchangers , shell and tube heat exchangers, condensers , Evaporators ,Cooling and dehumidifying coils, cooling towers, evaporative condensers ,design of air washers, desert coolers.

(10 hours)

Unit III

TEMA standard: Tubular heat exchangers TEMA standard heat-exchanger nomenclature, selection criteria for different types of shells and front and rear head ends; geometrical characteristics of TEMA heat exchangers.

(8 hours)

Unit IV

Review of mechanical Design, Materials of Construction, corrosion damage, testing and inspection.

(7 hours)

Unit V

Heat Pipe: Basics & its mathematical model, micro Heat Exchangers , Use of Software in heat exchanger design.

(7 hours)

References Books:

1. Kern D Q, Kraus A D; Extended Surface Heat Transfer; TMH.
2. Kays, Compact Heat Exchangers and London, TMH.
3. Kokac, Heat Exchangers- Thermal Hydraulic fundamentals and design;TMH.
4. Tubular Exchanger Manufacturer Association (TEMA), and other codes

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MEA-703 (B)	Industrial Robotics	3L:0T:0P	03 credits	3Hrs/Week

Course Preamble:

1. To understand the basic concepts associated with the design and Functioning and applications of Robots
2. To study about the drives and sensors used in Robots To learn about analyzing robot kinematics and robot programming.

Course Outcomes:

1. Upon completion of this course, the students can able to apply the basic engineering
2. To learn about knowledge for the design of robotics.
3. Will understand robot kinematics and robot programming.
4. Will understand application of Robots
5. To learn about force and torque sensing
6. To learn about application of robot.

Unit I
INTRODUCTION: Need and importance, basic concepts, structure and classification of industrial robots, terminology of robot motion, motion characteristics, resolution, accuracy, repeatability, robot applications.

(8 hours)

Unit II
END EFFECTORS AND DRIVE SYSTEMS: Drive systems for robots, salient features and comparison, different types of end effectors- Mechanical - Magnetic -Vacuum – Adhesive - Drive systems and controls; design and applications of end effectors.

(10 hours)

Unit III
SENSORS: Sensor evaluation and selection, Piezoelectric sensors, linear position and Displacement, sensing, revolvers, encoders, velocity measurement, proximity, tactile, compliance and range sensing, Image Processing and object recognition.

(8 hours)

Unit IV
INDUSTRIAL APPLICATIONS : Application of robots in manufacturing, processing operations

like Welding, painting, Assembly, machining, Welding, Assembly, Material transfer and machine loading/unloading, CIM and hostile and remote environments - safety considerations.

(10 hours)

Unit V

SAFETY AND ECONOMY OF ROBOTS: Work cycle time analysis, economics and effectiveness of robots, safety systems and devices, concepts of testing methods and acceptance rule for industrial robots.

(8 hours)

References:

1. Mittal RK, Nagrath IJ; Robotics and Control; TMH
2. Groover M.P,Weiss M, Nagel,OdreyNG; Industrial Robotics-
3. Groover M.P; CAM and Automation; PHI Learning
4. Spong Mark and Vidyasagar; Robot Modelling and control; Wiley India
5. Yoshikava ; Foundations of Robotics- analysis and Control; PHI Learning;
6. Murphy ; Introduction to AI Robotics; PHI Learning
7. FU KS, Gonzalez RC, Lee CSG; Robotics
8. Shimon, K; Handbook of Industrial Robots; John Wiley & Sons,.
9. Ghosal Ashitava; Robotics Fundamental concepts and analysis; Oxford
10. Saha S; Introduction to Robotics; TMH

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MEA-704 (A)	PROJECT MANAGEMENT	3L:0T:0P	03 credits	3Hrs/Week

Course Preamble:

The objectives of this course are to:

1. To make them understand the concepts of Project Management for planning to execution of projects.
2. To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3. To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting.
4. Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context

Course Outcomes:

On completion of this course, the students will be able to:

1. Understand project characteristics and various stages of a project.
2. Understand the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic.
3. Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.
4. Apply the risk management plan and analyze the role of stakeholders.
5. Understand the contract management, Project Procurement, Service level Agreements and productivity.
6. Understand the How Subcontract Administration and Control are practiced in the Industry.

Unit I

Concepts of project management:: Meaning, definition and characteristics of a project, technical and socio-cultural dimensions; project life cycle phases, project planning and graphic presentation; work breakdown structure, manageable tasks; size of network; blow down NW; identity and logic dummy activity; Fulkerson rule for numbering NW; time-scaled NW.

(10 hours)

Unit-II

NW analysis: PERT network; mean time and variances; probability to complete PERT project in specified time; CPM network; Event Occurrence Time (EOT); activity start/ finish times; forward and reverse path calculations, concept and calculation of floats; resource allocation and critical-chain; overview of MS-project-2000.

(9 hours)

Unit-III

Project duration and control: Importance and options to accelerate project completion; timecost tradeoff; fixed variable and total costs; use of floats and cost optimization; project performance measures; project monitoring info and reports; project control process; Gant chart and control chart; cost-schedule S-graph; planned cost of work schedule (PV).

(9 hours)

Unit-IV

Project organization, culture and leadership: projects within functional organization; dedicated project/ task-force teams; staff, matrix and network organization; choosing appropriate project organization; Organization culture; ten characteristics; cultural dimensions supportive to projects; social network and management by wandering around (MBWA); different traits of a manager and leader; managing project teams; five stage team development model.

(9 hours)

Unit-IV

Strategic planning and project appraisal: Capital allocation key criteria; Porters competitive strategy model; BCG matrix; Strategic Position Action Evaluation (SPACE); time value of money; cash flows; payback period; IRR; cost of capital; NPV; social cost benefit analysis; UNIDO approach; project risks and financing.

(9 hours)

References Books:

1. Prasana Chandra: Projects: planning Implementation control; TMH.
2. Gray Clifford F And Larson EW; Project The managerial Process; TMH
3. Panneerselven and Serthil kumar; Project management, PHI
4. Burke ; Project Management-Planning and control technics; Wiley India
5. Kamaraju R; Essentials of Project Management; PHI Learning
6. Jack R. Meredith, Project Management: a managerial approach, Wiley.
7. Choudhary ;Project Management; TMH

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MEA-704 (B)	**NANO MANUFACTURING**	**3L:0T:0P**	**03 credits**	**3Hrs/Week**

Course Preamble:

1. To understand the scope of micro and nano technology:
2. To understand the concepts and Applications of micro- and nanofabrication
3. To understand Nano technology in India
4. To understand the scope for Micro fabrication
5. To understand commercialization Issues of Micro-Nano Technology

Course outcome:

1. Students will have a complete understanding of scope, concepts and applications
2. Micro and Nano technology in the field of manufacturing.

Unit-I

Introduction to Nano-manufacturing and Nanotechnology, Advantages, disadvantages and applications of Nanotechnology and Nano-manufacturing, Top-down and Bottom-up techniques.

(9 hours)

Unit-II

Self-Assembly, self-assembled monolayer. Characterization Techniques: Scanning Electron Microscope, Transmission Electron Microscope, Atomic force microscopy (AFM), Scanning Probe Microscope (SPM).

(8 hours)

Unit-III

Scanning Tunneling Microscope (STM), X-ray Diffraction (XRD). Nano-lithography: Photolithography:

UV Photolithography, X-ray Lithography, Electron Beam Lithography, Particle Beam Lithography‟s, Probe lithography‟s.

(10 hours)

Unit-IV

Micro and Nano machining, Focused Ion beam machining. Chemical methods in Nano manufacturing, Si processing methods: Cleaning /etching, Epitaxy, Molecular-beam epitaxial, chemical beam epitaxial.

(8 hours)

Unit-V

Metal-organic CVD (MOCVD), Plasma enhanced CVD (PECVD), Sol-gel Technique. Properties and application of Nano Materials: Fullerene Structure, Carbon nano tubes, Nano Particles, Processing of Nano composites, Micro & Nano Electromechanical Systems (MEMS, & NEMS).

(10 hours)

References Books:

1. Introduction to nanotechnology by Charles P. Poole Jr. & Frank J. Owens Publisher: John Wiley & Sons (Asia) Pvt. Ltd.
2. Nanotechnology: Introduction to Nanostructuring Technoques by Michael Kohler, Publisher: John Wiley & Sons (Asia) Pvt. Ltd.
3. Magnetic Microscopy of Nanostructures by H. Hopster & H. P. Oepen, Publisher:Springer
4. Micro-engineering, MEMS and Interfacing: A practical Guide by Danny Banks, Publisher: Taylor & Francis
5. Nanomaterials Chemistry Recent Developments and New Directions by C. N. R. Rao, Publisher: John Wiley & Sons (Asia) Pvt. Ltd.