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Department of Mechanical Engineering

120701- (DLC-): Reliability and Vibration Lab

Category	Title	Code	Credit - 2			Practical Paper
			L	T	P	Max.Marks-50
Departmental Lab Core	**Reliability and Vibration Lab**	**120701**	-	-	4	Min.Marks-16

Course Objectives:

1. To understand the fundamentals of Vibration Theory.
2. To be able to mathematically model real-world mechanical vibration problems.
3. To be able to resolve industrial problems related to vibration and noise.

List of Experiments

1. Determination of Critical Speed in Whirling of Shafts.
2. Determination of Natural Frequency in Longitudinal Vibrating System.
3. Determination of Natural Frequency in Torsional Vibration System.
4. To verify the relation of compound pendulum & to determine the radius of gyration
5. To study the undamped free vibration of spring mass system.
6. To study the forced vibration of simply supported beam for different damping.
7. Undamped tensional vibrations of single and double rotor system.
8. To study the damped torsional vibration of single rotor system and to determine the damping coefficient.
9. To study the forced damped vibration of spring mass system.
10. Study the machine fault diagnostic system based on vibration analysis.
11. Measurement of Noise

Text Books:

1. **Mechanical Vibrations**: by G K Groover.

References Books:

1. **Theory of Vibrations with Applications**: W T Thomson CBS Publishers Delhi
2. **Mechanical Vibrations**: S SRao Addison-Wesley Publishing Co.
3. **Fundamentals of Vibration:** Leonard Meirovitch , McGraw Hill International Edison.

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120851: **Quality Design and Control**

Category	**Title**	**Code**	**Credit - 3**			**Theory Paper**
Departmental Elective-DE 5	Quality Design and Control	120851	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_mg16/preview
The details of the course are mentioned below:-

Course Start Date	**Course End Date**	**Exam date**	**Duration**
24 Jan 2022	15 Apr 2022	24 Apr 2022	12 Weeks

Course layout

Week 1: History and Evolution of Quality Control and Management
Week 2: Management of Quality-I
Week 3: Management of Quality-II
Week 4: Statistical Process Control-I
Week 5: Statistical Process Control-II
Week 6: Process Capability Analysis
Week 7: Acceptance Sampling-I
Week 8: Acceptance Sampling-II
Week 9: Design for Reliability-I
Week 10: Design for Reliability-II
Week 11: Quality by Experimental Design
Week 12: Robust Design and Taguchi Method

Books and references

- Mitra, A. Fundamentals of Quality Control and Improvement, Prentice-Hall, 2nd Edn (1998), ISBN: 0-13-645086-5.
- Dukkipati, R V and Pradip K Ray, Product and Process Design for Quality, Economy and Reliability, New Age International. 1st Edn. (2010), ISBN: 978-81-224-2661-8.

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120852: **Robotics: Basics and Selected Advanced Concepts**

Category	**Title**	**Code**	**Credit - 4**			**Theory Paper**
Departmental Elective-DE 5	Robotics: Basics and Selected Advanced Concepts	120852	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_me39/preview
The details of the course are mentioned below:-

Course Start Date	**Course End Date**	**Exam date**	**Duration**
24 Jan 2022	15 Apr 2022	23 Apr 2022	12 Weeks

Course layout
Week 1: Introduction, Elements of a robot
Week 2: Mathematical preliminaries, D-H convention, Examples
Week 3: Direct and Inverse kinematics of serial robots, Workspace, Analytical and numerical solutions
Week 4: Parallel robots – direct and inverse kinematics, Mobility, Stewart-Gough platform
Week 5: Applications of parallel robots in sun tracking, vibration isolation
Week 6: Velocity analysis, Singularities in serial and parallel robots, Statics
Week 7: Redundancy and resolution of redundancy in robots
Week 8: Dynamic equations of motion, derivation & simulation using Matlab
Week 9: Motion planning, Introduction to linear control, simulations & experiments
Week 10: Nonlinear position and force control of robots, Simulations
Week 11: Wheeled mobile robots, modeling and simulations
Week 12: Over-constrained and deployable structures, Cable driven & pneumatically actuated flexible robots

Books and references
Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2006

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120854: **Sound and structural vibration**

Category	**Title**	**Code**	**Credit - 3**			**Theory Paper**
Departmental Elective-DE 6	Sound and structural vibration	120854	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course:
https://onlinecourses.nptel.ac.in/noc22_me34/previewpreview
The details of the course are mentioned below:-

Course Start Date	**Course End Date**	**Exam date**	**Duration**
24 Jan 2022	15 Apr 2022	24 Apr 2022	12 Weeks

Course Layout
Week 1: Introduction to Waves
Week 2: The coupled roots and the physics
Week 3: The coupled sound and vibration field
Week 4: The 2-D structural-acoustic waveguide
Week 5: Closed form derivations of coupled waves
Week 6: Vibrating rectangular plate backed by a cavity
Week 7: Sound radiation from a rectangular plate set in a baffle.
Week 8: Sound radiation from a baffled plate contd.
Week 9: Radiation resistance defined by Maidanik
Week10: Transmission of sound through vibrating plates
Week11: Structural acoustics in cylindrical geometry
Week 12: Fluid loading phenomenon in structural acoustics

Books and references
1.Sound and Structural Vibration by F. Fahy and Paolo Gardonio
2.Sound, Structure and their Interaction by Miguel Junger and David Feit.
3.Structure Borne Sound by L. Cremer and M. Heckl

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120855: Carbon Material and Manufacturing

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 6	Carbon Material and Manufacturing	120855	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_mm01/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
24 Jan 2022	15 Apr 2022	23 Apr 2022	12 Weeks

Course layout

Week 1: Introduction to materials and manufacturing, mathematical representation of material properties, introduction to carbon, carbon on the Earth and in outer space, carbon in technology and economy, carbon isotopes, carbon atomic structure and hybridization
Week 2: Diamond, graphite, carbyne and curved carbons, classification of carbon allotropes, conversion of one allotropic form into another, phase diagram of carbon
Week 3: Engineering carbons, graphite crystal structure, stacking faults and rhombohedral graphite, graphite ore processing, synthetic graphite production from needle coke
Week 4: Kish graphite, polymer-derived graphite, Highly Oriented Pyrolytic Graphite (HOPG), pyrolysis of gaseous hydrocarbons, kinetics of graphitization, polymer-derived carbon: coking and charring mechanism
Week 5: Microstructure of non-graphitizing carbon, glass-like carbon: introduction, properties and industrial manufacturing, pyrolysis of polymers and other solid hydrocarbons, microfabrication with glass-like carbon
Week 6: Photolithography, X-Ray and Nano-Imprint Lithography, conversion of microfabricated structure into carbon, activated carbon: introduction, properties and industrial manufacturing
Week 7: Carbon black: introduction, properties and industrial manufacturing, carbon fiber: introduction and properties, melt spinning of petroleum pitches, electrospinning and viscoelasticity
Week 8: Carbonization of polyacrylonitrile (PAN) fibers, mechanical property testing methods for carbon fibers, defects in carbon fibers, Carbon Fiber Reinforced Plastic (CFRP), machining of CFRPs
Week 9: Carbon/ carbon, carbon/ metal and carbon/ concrete composites: Manufacture and Properties, graphene: introduction and crystal structure, graphene history and nomenclature, Chemical Vapor Deposition (CVD) of graphene
Week 10: Graphene CVD parameter optimization, defects in graphene, (n,m) notations, carbon nanotube: introduction and properties, vapor phase growth of carbon nanotube
Week 11: Vapor deposited diamond, diamond-like carbon, X-Ray Diffraction analysis of carbon, Raman spectroscopy of carbon, Transmission Electron Microscopy of carbon
Week 12: Gas adsorption isotherms and surface area analysis of porous carbons, numerical problem solving, large-scale industrial applications of carbon materials, micro and nano-scale applications of carbon materials, rigid and flexible carbon devices, device characteristics and challenges, supply chain of industrial carbons, summary and overview

Books and references

Jenkins, G. M. & Kawamura, K. Polymeric carbons--carbon fibre, glass and char. (Cambridge University Press, 1976).
Marsh, H. & Rodríguez-Reinoso, F. Activated carbon. (Elsevier, 2006).
Kinoshita, K. Carbon: electrochemical and physicochemical properties. (Wiley, 1988)

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120856: Introduction to Abrasive Machining and Finishing Processes

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 6	Introduction to Abrasive Machining and Finishing Processes	120856	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_me20/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
24 Jan 2022	18 Mar 2022	27 Mar 2022	8 Weeks

Course layout

Week 1 : Introduction conventional abrasive processes, Introduction to abrasive processes, Grinding Process

Week 2 : Conventional abrasive finishing processes (CAFP): Honing & Wire Brushing,CAFP: Lapping, Buffing & Superfinishing, Practical Conventional abrasive finishing processes

Week 3 : Adv. abrasive machining processes (AAMP), AAMP

Week 4 : Hybrid Adv. Abrasive Machining Processes, Advanced Finishing

Week 5 : Adv. Finishing: Abrasive Flow Finishing

Week 6 : Adv. Finishing: Magnetic Abrasive Finishing

Week 7 : Adv. Finishing: Magnetic Rheological Finishing

Week 8 : Hybrid abrasive finishing, Finishing of Advanced Materials

Books and references

1. M. C. Shaw, Principles of Abrasive Processing, Oxford University Press, 1996.
2. VK Jain, Micromanufacturing Processes, CRC press, 2012.
3. Jain VK, Nanofinishing Science and Technology: Basic and Advanced Finishing and Polishing Processes, CRC Press, 2016.
4. J. A McGeough, Advanced methods of machining, Springer Science & Business Media, 1988.
5. G. K. Lal, Introduction to Machining Science, New Age International Publishers, 2007
6. A. Ghosh and A. K. Malik, Manufacturing Science, East West Press, 2010.
7. Metalworking Fluids (MWFs) for Cutting and Grinding, Edited by:V.P. Astakhov and S. Joksch

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900605: Waste to Energy Conversion

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Open Category- OC 4	Waste to Energy Conversion	900605	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: -https://onlinecourses.nptel.ac.in/noc22_ch05/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
24 Jan 2022	18 Mar 2022	27 Mar 2022	12 Weeks

COURSE LAYOUT

Week 1 -Introduction, characterization of wastes.
Week 2 -Energy production form wastes through incineration, energy production through gasification of wastes.
Week 3 -Energy production through pyrolysis and gasification of wastes, syngas utilization.
Week 4 -Densification of solids, efficiency improvement of power plant and energy production from waste plastics.
Week 5 -Energy production from waste plastics, gas cleanup.
Week 6 -Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells.
Week 7 -Energy production from wastes through fermentation and transesterification.
Week 8 -Cultivation of algal biomass from wastewater and energy production from algae.

Books and references

- Rogoff, M.J. and Screve, F., "Waste-to-Energy: Technologies and Project Implementation", Elsevier Store.
- Young G.C., "Municipal Solid Waste to Energy Conversion processes", John Wiley and Sons.
- Harker, J.H. and Backhusrt, J.R., "Fuel and Energy", Academic Press Inc.

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900609: Product Design and Manufacturing

Category	**Title**	**Code**	**Credit - 3**			**Theory Paper**
Open Category- OC 4	Product Design and Manufacturing	900609	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: - https://onlinecourses.nptel.ac.in/noc22_me11/preview
The details of the course are mentioned below:-

Course Start Date	**Course End Date**	**Exam date**	**Duration**
24 Jan 2022	15 Apr 2022	23 Apr 2022	12 Weeks

COURSE LAYOUT

Week 1 : Introduction to Product Design and Manufacturing
Week 2 : Product Design Morphology
Week 3 : Visual Design, and Quality Function Deployment (QFD)
Week 4 : Value Engineering
Week 5 : Material, and Manufacturing process selection
Week 6 : Design for Manufacturing, Assembly, and Maintenance
Week 7 : Design for Environment, and Quality Control
Week 8 : Patenting, and Creativity
Week 9 : Rapid Prototyping
Week 10 : Plant Layout Design
Week 11 : Computer Integrated Manufacturing
Week 12 : Reverse Engineering, and Managing Competitiveness

Books and references

- Eppinger, S. and Ulrich, K., 2015. Product design and development. McGraw-Hill Higher Education
- Magrab, E.B., Gupta, S.K., McCluskey, F.P. and Sandborn, P., 2009. Integrated product and process design and development: the product realization process. CRC Press.
- Boothroyd, G., 1994. Product design for manufacture and assembly. Computer-Aided Design, 26(7), pp505-520.

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900610: Automatic Control

Category	Title	Code	Credit - 3			Theory Paper
Open Category- OC 4	Automatic Control	900610	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: - https://onlinecourses.nptel.ac.in/noc22_me12/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
24 Jan 2022	18 Mar 2022	27 Mar 2022	8 Weeks

COURSE LAYOUT

Week 1: Automatic Control System.
Week 2: Mathematical Modeling.
Week 3: Transient Response Analysis.
Week 4: Stability and Steady State Error.
Week 5: Root Locus Technique.
Week 6: Design via Root Locus and Compensation Techniques.
Week 7: State Space Method.
Week 8: Application of MATLAB in Automatic Control.

Books and references

- Nise, N.S., Control Systems Engineering, 5th Ed., Willey, 2008.
- Ogata, K., " Modern Control Engineering", 5th Ed., Prentice Hall of India, 2013.
- Kuo, B.C., "Automatic Control System", 5th Ed., Prentice Hall of India, 1995.
- Raven, F.H., "Automatic Control Theory", 5th Ed., McGraw Hill, 1995.