

Doctor of Philosophy in Mechanical Engineering Ph.D. Course Work Scheme

TEACHING AND EXAMINATION SCHEME

ABHILASHI UNIVERSITY

School of Engineering and Technology
Doctor of Philosophy in **Mechanical Engineering**
PhD Course Work Scheme

Sr.No.	Course Code	Course Title	Credit	Examination		
				Internal Assessment	External Assessment	Total
1.	AUPH DRM-101	Research Methodology	4	40	60	100
2.	AURPE-04	Research & Publication Ethics	4	40	60	100
3.	AUPHDME-103*	Elective -1	4	40	60	100
4.	AUPHDME-104*	Elective -1				

Elective:1(Choose one subject only)

Sr.No.	Course Code	Course Title
1.	AUPHDME-103(A)	Applied Mechanics and Design
2.	AUPHDME-103(B)	Fluid Mechanics and Thermal Sciences

Elective:2(Choose one subject only)

Sr.No.	Course Code	Course Title
1.	AUPHDME-104(A)	Material, Manufacturing and Industrial Engineering
2.	AUPHDME-104(B)	Industrial Tribology

Research Methodology

PHD MECHANICAL ENGINEERING COURSE WORK

Name of Course	Research Methodology	
Course Code	(AUPH DRM 101)	
Total Credits	04	
Examination	External	Internal
Maximum Marks	60	40

Contents

Overview of Research 10 Hrs

Research and its type, identifying and defining research problems, introduction to different types of research designs. Essential constituents of literature review. Basic principles of experimental design, completely randomized, randomized block, Latin square, factorial

Methods of Data Collection 04 Hrs

Primary and secondary data, methods of primary data collection, classification of secondary data

Sampling Methods 10 Hrs

Probability sampling: simple random sample, systematic sampling, stratified sampling, cluster sampling and multistage sampling; Non-probability sampling: convenience sampling, judgment sampling, quota sampling; sampling distribution

Processing and Data Analysis 15 Hrs

Statistical measures and their significance: central tendencies, measures of variability, skewness, kurtosis, correlation and regression; hypothesis testing: parametric test (z, t, F), Chi square, ANOVA and non-parametric test

Reliability and Validity 03 Hrs

Test- retest reliability, alternative form reliability, internal-comparison reliability, and scorer reliability; content validity, criterion- related validity and construct validity

Essentials of Report Writing 05 Hrs

Suggested Readings/Recommended Books (Latest Editions)

1. Geoffrey R. Norman, David L. Streiner, Biostatistics: The Bare Essentials, PMPH USA
2. Beth Dawson, Robert G. Trapp, Basic & Clinical Biostatistics, McGraw-Hill
3. Marcello Pagano, Kimberlee Gauvreau, Principles of Biostatistics, CRC Press
4. Antonella Bacchieri, Giovanni Della Cioppa, Fundamentals of Clinical Research, Springer

PHD MECHANICAL ENGINEERING COURSE WORK

Name of Course	Applied Mechanics and Design	
Course Code	(AUPHDME-103-A)	
Total Credits	04	
Examination	External	Internal
Maximum Marks	60	40

Engineering Mechanics: Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions.

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts. Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Suggested Readings/Recommended Books (Latest Editions)

1. Shames and Rao, "Engineering Mechanics: Statics and Dynamics", Pearson.
2. Beer & Johnston, "Vector Mechanics for Engineers", Tata McGrawHill.
3. Meriam, "Statics and Dynamics", John Wiley & Sons. 4. R.C Hibbler, "Statics and Dynamics", Pearson.
4. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Mallik, Third Edition Affiliated East West Press.
5. Theory of Machines: S.S.Rattan, Tata McGraw Hill
6. Mechanical Vibration by V.P. Singh, Dhanpat Rai Publications.
7. Mechanical Vibration by G.K. Grover, Nem Chand & Bros, Roorkee, India.

PHD MECHANICAL ENGINEERING COURSE WORK BATCH 2020

Name of Course	Fluid Mechanics and Thermal Sciences	
Course Code	(AUPHDME-103-B)	
Total Credits	04	
Examination	External	Internal
Maximum Marks	60	40

Fluid Mechanics: Fluid properties; fluid statics, manometer, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations. Applications:

Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychometric chart, basic psychometric processes. Turbo Machinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

Suggested Readings/Recommended Books (Latest Editions)

1. Modi and Seth, Fluid Mechanics and Hydraulic Machines, CBS Publishers.
2. Rajput, R.K., A Text Book of Hydraulics, S. Chand and Sons, New Delhi.
3. Heat and Mass Transfer: Yunus A. Cengel, Tata McGraw Hill.
4. Heat Mass Transfer: Domkundwar

5. Rajput, R.K., "Thermal Engineering", Laxmi Publications.
6. Power Plant Technology – M.M. EL -Wakil, McGraw Hill Book Co.
7. Power Plant Engineering – P.C. Sharma, S.K. Kataria and Sons.

PHD MECHANICAL ENGINEERING COURSE WORK BATCH 2020

Name of Course	Material, Manufacturing and Industrial Engineering	
Course Code	(AUPHDME-104-A)	
Total Credits	04	
Examination	External	Internal
Maximum Marks	60	40

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, design of jigs and fixtures.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools.

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning. Inventory Control: Deterministic models; safety stock inventory control systems.

Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

Suggested Readings/Recommended Books (Latest Editions)

1. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi.
2. Production Technology: R.K.Jain, Khanna Publishers
3. Gupta, I.C., "Engineering Metrology", Dhanpat Rai & Sons, New Delhi.
4. CAD/CAM (Theory & Practice) by Ibrahim by Zeid, Tata McGraw Hill.
5. Industrial Engineering - Ravi Shankar, Galgotia Publications.
6. Operation Research, Operation Research, Raja Gopal, PHI Learning Private Limited.

PHD MECHANICAL ENGINEERING COURSE WORK

Name of Course	Industrial Tribology	
Course Code	(AUPHDME-104-B)	
Total Credits	04	
Examination	External	Internal
Maximum Marks	60	40

Objective: To understand the topics on the wear, friction and lubrication.

Course Outcomes:

- Students will be able to design bearings and to minimize wear and friction.
- Knowledge about solid friction and rolling friction.

Course Content:

Unit1:

Introduction: Friction, wear and lubrication, types of egg. Contacts: conforming and non-conforming. Types of motion; rubbing sliding. Oscillating. Rolling. and Surface of interactions: elastic and plastic deformations. Properties of materials. Surface energy and flash temperature theory.

Friction: Laws of sliding friction, concept of adhesion, Tabor's mode off friction elastic thermo friction, rolling friction, measurement of friction.

Unit: 2

Wear: Laws of wear. Types of wear such as adhesive, delamination, abrasive, fatigue, corrosive, fretting, erosive, electrical and oxidative. Measurement of wear in dry at me sphere and different environments. Prevention and control of wear and friction in machines, wear of cutting tool and dies, study of abrasion in grinding, lapping and honing.

Lubrication: Mechanisms of lubrication, Boundary. Squeeze film hydrodynamic and elasto hydrodynamic and hydro static lubrications plasto hydrodynamic lubrication, solution of Reynolds's equation in two and three-dimensional flow. Pressure distribution load carrying capacity friction forces in oil film and Co-efficient of friction in journal bearing. Sold lubricants types and applications.

Unit: 3

Bearing Design: Design of bearing: clearance in journal bearing. Minimum film thickness, sommar-field Number, Oil grooves and flow of oil in axial and circumferential grooves ca vi tat ions and turbulence in oil bearings. Heat generation and cooling or bearing Hydrostatic and dynamic and their applications in machine Tools. Design of air bearing and other gas bearing.

Unit: 4

Rolling Friction: Reynold's slip, Heathe cote concept selection of roller bearings and their methods of lubrication design aspects and modes of bearing failures and elasto hydro dynamic lubrication.

Solid Lubricants: Their applications in metal forming processes.

Books Recomend :

1. Sharma Aggarwal, A Test Book, Kataria
2. Main Engg. Hand Book, A M/c Desig.', McGraw Hill.
3. Industrial Tribology, Tribology failures and their analysis, Dr. B.S. Prabhu