

MINIMUM CORE SUBJECT AREAS: MECHANICAL ENGINEERING

AREA	SUBJECTS / DESCRIPTION	RECOMMENDED CONTACT HOURS
<p>A minimum of 7 areas must be fulfilled from Group 1 (Core) and Group 2 (Elective) with a minimum of 5 areas from Group 1 (Core). The courses specified for each area under Group 1 (Core) and Group 2 (Elective) must cover at least 80% and 60% of topics listed respectively.</p>		
<p>Group 1 (Core):</p>		
1. Solid Mechanics	- typical topics: Stress and strain; Bending & deflection of beams; Torsion of shaft; Thin-walled pressure vessels; Two-dimensional theory of elasticity; Thermal stress, disks and cylinders; Columns stability, buckling; Failure & yielding criteria; Energy methods; Bending of plates; Finite element analysis of plane truss framework; biomechanics.	45
2. Fluid Mechanics	- typical topics: Basic concepts on fluids; Fluid statics; Fluids in motions (streamline, Bernoulli equation); Kinematics of fluid motion (velocity and acceleration fields, Reynolds transport theorem); Flow analysis using control volume approach (continuity, linear momentum, and energy equations) potential and viscous flows; Dimensional analysis; Pipe flows (laminar and turbulent flows); Fluid machineries	45
3. Thermal Engineering	- typical topics: Basic thermodynamic concepts: system, control volume, control mass, energy; Properties of pure substance, phases and phase change; First law of thermodynamics for open and closed systems; Second law of thermodynamics; Entropy and energy; Internal combustion engines and gas turbines; Steam cycle and refrigeration; Introduction to heat transfer	45
4. Engineering Materials	- typical topics: Atomic bonding and structure of materials; Phase diagrams and diffusion; Defects and plastic deformation in the crystalline state; Mechanical Properties of materials; Fracture and fatigue; Heat treatment of steel; Classification of polymers; Mechanical properties of plastics; Corrosion; advanced materials for energy and sustainable infrastructure	45
5. Design and Manufacturing	- typical topics: Design specification and evaluation; Drawing & design communication methods; Dimensioning and Tolerancing; Material selection; Manufacturing processes: primary, secondary and tertiary manufacturing processes; Jigs & fixture design; Process Planning and Inspection	45
6. Automatic & Control Systems	- typical topics: Introduction to control systems; Modelling of physical systems; State-space approach; Characterizing system performance; Time response analysis; Feedback control; Stability & Root-locus method; Control system design and applications	45
7. Dynamics & Mechanism	- typical topics: Kinematics & kinetics of particles; Plane motion of rigid bodies: forces and acceleration, energy and momentum methods; Introduction to free, forced and damped vibrations. Types of links and joints, degrees of freedom; Dynamic force analysis; Balancing of machines; Cam design, Gears & gear train analysis	45
<p>Group 2 (Elective):</p>		
1. Computational Intelligence for Engineers	- typical topics: Probability, statistics, and linear algebra for Machine Learning; Deep Learning: Neural Networks and Convolutional Neural Networks (CNNs); Reinforcement Learning and Robotics; Feature Engineering and Selection; Model Selection and Evaluation; Python and R programming languages for Machine Learning; Data Visualization for Machine Learning; Ethical considerations and bias in Machine Learning; real-world applications of Machine Learning in Engineering.	30

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2. Data Science	- typical topics: data source and data acquisition; data preparation and manipulation; exploratory data analysis; statistical and predictive analysis; data visualization and communication.	30
3. Digitalization of Mechanical Engineering Design	- typical topics: Building information modeling (BIM) software, Geographic Information System (GIS) software and Internet of Things (IoT); 3D computer modeling and computer visualization; 3D modelling, BIM and GIS standards and protocols; BIM for building, mechanical, electrical and plumbing design; BIM for energy analysis and sustainability; BIM for facility management and maintenance; BIM for safety analysis and risk assessment; Integration of BIM with GIS and IoT.	30
4. Industrial Internet of Things (IIoT)	- typical topics: applications of IIoT in various industries; IoT platforms and protocols for IIoT; Integration of IIoT with cloud computing and big data analytics; Cybersecurity and data privacy issues in IIoT; Sensors, actuators, and smart devices used in IIoT; Machine learning and AI in IIoT; IIoT architectures and system design; Industry 4.0 and IIoT; IIoT standards and regulations.	30