University Mechanical Engineering Syllabus Checklist

Tick one box per statement: ☐ not yet ☐ nearly ☐ confident.

1. Engineering Mechanics – Statics

1.1 Vectors and forces

☐☐☐ Vectors and forces

1.2 Free-body diagrams

☐☐☐ Free-body diagrams

1.3 Particle equilibrium

☐☐☐ Particle equilibrium

1.4 Moments and couples

☐☐☐ Moments and couples

1.5 Rigid-body equilibrium and supports

☐☐☐ Rigid-body equilibrium and supports

1.6 Structures – trusses and frames

☐☐☐ Structures – trusses and frames

1.7 Friction

☐☐☐ Friction

1.8 Centroids and distributed loads

☐☐☐ Centroids and distributed loads

2. Mathematical Methods for ME

2.1 Calculus for engineering

☐☐☐ Calculus for engineering

2.2 Linear algebra

☐☐☐ Linear algebra

2.3 Differential equations

☐☐☐ Differential equations

2.4 Numerical methods

☐☐☐ Numerical methods

2.5 Vector calculus

☐☐☐ Vector calculus

2.6 Probability and uncertainty

☐☐☐ Probability and uncertainty

3. Engineering Mechanics – Dynamics

3.1 Particle kinematics

☐☐☐ Particle kinematics

3.2 Particle kinetics (Newton)

☐☐☐ Particle kinetics (Newton)

3.3 Work and energy

☐☐☐ Work and energy

3.4 Impulse and momentum

☐☐☐ Impulse and momentum

3.5 Rigid-body kinematics

☐☐☐ Rigid-body kinematics

3.6 Rigid-body kinetics

☐☐☐ Rigid-body kinetics

4. Engineering Materials

4.1 Structure and bonding

☐☐☐ Structure and bonding

4.2 Stress-strain and elastic behaviour

☐☐☐ Stress-strain and elastic behaviour

4.3 Metals and alloys

☐☐☐ Metals and alloys

4.4 Polymers, ceramics and composites

☐☐☐ Polymers, ceramics and composites

4.5 Processing and property links

☐☐☐ Processing and property links

4.6 Failure and material selection

☐☐☐ Failure and material selection

5. Thermodynamics

5.1 Properties and state

☐☐☐ Properties and state

5.2 First law for closed systems

☐☐☐ First law for closed systems

5.3 First law for open systems

☐☐☐ First law for open systems

5.4 Second law and entropy

☐☐☐ Second law and entropy

5.5 Power cycles

☐☐☐ Power cycles

5.6 Refrigeration and heat pumps

☐☐☐ Refrigeration and heat pumps

6. Mechanics of Materials

6.1 Axial loading

☐☐☐ Axial loading

6.2 Torsion

☐☐☐ Torsion

6.3 Shear and bending

☐☐☐ Shear and bending

6.4 Beam stresses and deflection

☐☐☐ Beam stresses and deflection

6.5 Combined stress and Mohr's circle

☐☐☐ Combined stress and Mohr's circle

6.6 Buckling and failure criteria

☐☐☐ Buckling and failure criteria

7. Fluid Mechanics

7.1 Fluid properties and statics

☐☐☐ Fluid properties and statics

7.2 Conservation and control volumes

☐☐☐ Conservation and control volumes

7.3 Bernoulli and flow measurement

☐☐☐ Bernoulli and flow measurement

7.4 Dimensional analysis

☐☐☐ Dimensional analysis

7.5 Pipe flow and losses

☐☐☐ Pipe flow and losses

7.6 External flow

☐☐☐ External flow

8. Manufacturing Processes

8.1 Engineering drawings and tolerances

☐☐☐ Engineering drawings and tolerances

8.2 Casting and forming

☐☐☐ Casting and forming

8.3 Machining

☐☐☐ Machining

8.4 Joining

☐☐☐ Joining

8.5 Additive manufacturing

☐☐☐ Additive manufacturing

8.6 Process planning and quality

☐☐☐ Process planning and quality

9. Machine Design

9.1 Design communication and CAD

☐☐☐ Design communication and CAD

9.2 Load paths and design safety

☐☐☐ Load paths and design safety

9.3 Static and fatigue criteria

☐☐☐ Static and fatigue criteria

9.4 Shafts and bearings

☐☐☐ Shafts and bearings

9.5 Joints and gears

☐☐☐ Joints and gears

9.6 Constrained design project

☐☐☐ Constrained design project

10. Heat Transfer

10.1 Conduction

☐☐☐ Conduction

10.2 Transient conduction

☐☐☐ Transient conduction

10.3 Convection

☐☐☐ Convection

10.4 Radiation

☐☐☐ Radiation

10.5 Heat exchangers

☐☐☐ Heat exchangers

10.6 Thermal design

☐☐☐ Thermal design

11. Theory of Machines and Vibrations

11.1 Mechanisms and kinematic pairs

☐☐☐ Mechanisms and kinematic pairs

11.2 Velocity and acceleration analysis

☐☐☐ Velocity and acceleration analysis

11.3 Balancing

☐☐☐ Balancing

11.4 Free vibration

☐☐☐ Free vibration

11.5 Forced vibration

☐☐☐ Forced vibration

11.6 Multi-degree-of-freedom systems

☐☐☐ Multi-degree-of-freedom systems

12. System Dynamics and Control

12.1 Lumped-parameter modelling

☐☐☐ Lumped-parameter modelling

12.2 Electromechanical systems

☐☐☐ Electromechanical systems

12.3 Transfer functions and response

☐☐☐ Transfer functions and response

12.4 Feedback and PID control PID

☐☐☐ Feedback and PID control

12.5 Digital implementation

☐☐☐ Digital implementation

12.6 Sensors and actuators

☐☐☐ Sensors and actuators

12.7 Mechatronics project

☐☐☐ Mechatronics project