Course curriculum for Mechanical Engineering for 2021 Batch

Semester IV (2021 batch)				
Serial no.	**Course code**	**Course name**	**Credits**	**Instructor**
1	ME 204	Mechanical Measurements	6	Prof. Sudheer Siddapureddy
2	ME 208	Manufacturing Processes - I	6	Prof. Somashekara M A
3	ME 222	Mechanics of Materials	6	Prof. Amar Gaonkar
4	EE 226	Control System and lab	6	Prof. Sangamesh Deepak R
5	ME 212	Manufacturing processes and Metrology Laboratory	3	Prof. Rakesh Lingam Prof. Somashekara
6	MA 208	Introduction to Numerical Linear Algebra (First Half)	4	Prof. Amlan K Barua
7	MA 206	Introduction to Numerical Methods (Second Half)	4	Prof. Sagnik Sen
8	ME 224	Fluid Mechanics Laboratory	3	Prof. Hiranya Deka Prof. Surya Prakash

SYLLABUS

Name of Academic Unit: Mechanical Engineering
Level: UG
Programme: B.Tech.

i	**Title of the course**	ME 208 Mechanical Measurements
ii	**Credit Structure (L-T-P-C)**	(3-0-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Nil
vii	**Course Content**	**Introduction**: generalized measurement system, static calibration, calibration, random errors, uncertainty analysis, dynamic characteristics. Zero, first and second order measurement systems. **Temperature measurement**: Introduction to temperature measurement. Thermocouples: laws governing their use; Static and Dynamic characteristics. Other measurement techniques. **Pressure measurement**: Manometers, elastic transducers, static and dynamic characteristics. Other devices for measurement. **Flow measurement**: obstruction meters, variable area meters, velocity measurement. **Strain measurement:** electrical type strain gauges, metallic resistance strain gauge, selection and installation of strain gages, circuitry for strain measurement, temperature compensation, calibration, semi-conductor strain gauges, stress analysis methods **Force and torque measurement:** standards, elastic transducers, strain gage load cells, hydraulic and pneumatic systems, torque measurement, combined force and moment measurement. **Measurement of motion**: LVDT, general theory of seismic instruments, vibrometers and accelerometers, piezoelectric accelerometers and vibrometers-circuitry and calibration, exciter systems, vibration test methods. **Signal conditioning:** Operational amplifiers, filters. **Sampling, and data acquisition:** Sampling concepts, Bits and words, number systems, Analog to digital conversion and digital to analog conversion, data acquisition systems and components, analog input/output communication, Digital input/output communication.

viii	**Texts/References**	1. Measurement systems: Application and Design, "E.O. Doebelin, Fourth Ed., 1990, McGrawHill. 2. Richard S. Figliola and Donald E. Beasley, Theory and Design for Mechanical Measurements, John Wiley and Sons.
ix	**Name(s) of Instructor(s)**	SVP
x	**Name(s) of other Departments / Academic Units to whom the course is relevant**	Nil
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Needfor introducing the course**	This is a fundamental measurements course which is essential for appreciating the measurement of all mechanical parameters.

Name of Academic Unit: Mechanical Engineering
Level: B.Tech./DD
Programme: B.Tech./DD

i	**Title** of the course	**ME 208 Manufacturing Process I**	
ii	Credit Structure (**L-T-P-C**)	**(2-1-0-6)**	
iii	**Type** of Course	Core course	
iv	Semester in which normally to be offered	IV	
v	Whether **Full or Half Semester** Course	Full	
vi	**Pre-requisite(s)**, if any (For the students) – *specify course number(s)*		Mechanical Measurements (ME-3xx)
vii	Course **Content** *	**Casting processes**: dispensable and permanent mould processes; analysis of melting, pouring and solidification phenomena; design of pattern, core, feeder and gating system; casting defects and inspection. **Joining processes**: fusion and solid-state welding; brazing and soldering; weld joint design, cooling rate, and joint properties; welding defects and inspection. **Bulk and Sheet Forming processes**: rolling, forging, extrusion and drawing; sheet metal working; forming limit diagram; loads, friction and lubrication; forming defects and inspection. **Powder processing**: Powder manufacture, characterization, compaction and sintering; metal injection moulding; hot and cold iso-static pressing. **Polymers and Composites**: Thermoplastics, thermosets, elastomers and composites; related processes; injection mould design; moulding defects and inspection. **Advanced processes**: Free form fabrication (rapid prototyping), and net shape manufacturing processes.	
Viii	Texts/References	Ghosh A. and Mallick A.K., Manufacturing Science, Affiliated East West Press, 2001. Rao P.N., Manufacturing Technology- Foundry, Forming and Welding, TMG Hill, 1987. Schey J., Introduction to Manufacturing Processes, Tata McGraw Hill, 2000. DeGarmo E.P., Black J.T., Kohser R.A., Materials and Processes in Manufacturing, PHI, 1997. Pye R.G.W., Injection Mold Design, Longman Scientific & Technical, Essex, 1989.	
ix	Name(s) of **Instructor(s)** ***		
x	Name(s) of **other Departments/ Academic Units to whom** the course is **relevant**		Nil
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are **equivalent** to this course? If so, please give details.		No
xii	**Justification/ Need** for introducing the course	This is core course in the manufacturing stream of the Mechanical Engineering undergraduate curriculum.	

Name of Academic Unit : Mechanical Engineering
Level : B.Tech./DD
Programme : B.Tech./DD

i	**Title** of the course	**ME 209 Mechanics of Materials**	
ii	Credit Structure (**L-T-P-C**)	**(3-1-0-8)**	
iii	**Type** of Course	Core course	
iv	Semester in which normally to be offered	IV	
v	Whether **Full or Half Semester** Course	Full	
vi	**Pre-requisite(s)**, if any (For the students) – *specify course number(s)*		Mechanical Measurements (ME-3xx)
vii	Course **Content** *	Fundamentals of mechanics of deformable solids. Concepts of stress and strain and their relationships. Mechanics of material approach - axial forces, thin cylinders and spheres, simple (direct) shear, torsion of circular cross-section shafts; Beam bending - Euler-Bernoulli model, deflections, normal and shear stresses. Statically indeterminate problems in bending. Unsymmetrical bending problems. Combined stresses, Mohr's circle diagram for stress and principal stresses. Theories of failure. Experimental methods of stress analysis - strain gages, strain rosettes and photoelasticity. Theory of elasticity approach - equilibrium equations, strain displacement relation, plane stress and plane strain, stresses in thick cylinders. Energy methods - Castigliano's theorem and its applications. Potential energy methods and applications. Stability of structures - buckling of columns.	
Viii	Texts/References	S. Crandall, N. Dahl, S. Lardner, An Introduction to Mechanics of Solids, Tata MG Hill, 2012. E.P. Popov, Engineering Mechanics of Solids, Prentice Hall, 2012. Gere abd Goodno, Mechanics of Materials, 7th ed., Cengage Learning India, 2012. Gere and Timoshenko, Mechanical of Materials, CBS Publishers, 1986.	
ix	Name(s) of **Instructor(s)** ***	TPG, PS	
x	Name(s) of **other Departments/ Academic Units to whom** the course is **relevant**		Nil
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are **equivalent** to this course? If so, please give details.		No
xii	**Justification/ Need** for introducing the course	This is a core course for B.Tech./DD in the Mechanical engineering major.	

Name of Academic Unit: Electrical Engineering
Level: UG
Programme: B.Tech.

i	**Title of the course**	EE 312 Control Systems lab
ii	**Credit Structure (L-T-P-C)**	(0-0-3-3)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) specify course number(s)**	Exposure to control systems course
vii	**Course Content**	Experiments related to: • Modeling of systems: Obtaining transfer function models of mechanical/electrical/electro-mechanical systems Ordinary • Performance and stability: Time response, steady-state error, stability etc. • Basic modes of feedback control: Proportional, Integral, Derivative. • Root locus method of controller design • Frequency-domain techniques: Frequency responses • Compensator design using frequency response Course projects related to: • Advanced control concepts • Real life applications of control systems in various fields • Applications of Signal Processing Techniques to Control Systems etc.
viii	**Texts/References**	1. Norman Nise, Control System Engineering, Wiley, latest edition 2. K. Ogata, Modern Control Engineering, Pearson, latest edition 3. B. Kuo, Automatic Control System, Wiley
ix	**Name(s) of Instructor(s)**	AM
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Mechanical Engineering
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification / Need for introducing the course**	This lab course is essential for hands-on experience to the students so that they can understand the intricacies of control design.

Name of Academic Unit: Mechanical Engineering

Level: B. Tech.

Programme: B.Tech.

i	**Title of the course**	**Manufacturing processes and Metrology laboratory**
ii	**Credit Structure (L-T-P-C)**	0-0-3-3
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	4^{th} or 6^{th}
v	**Whether Full or Half**	Full
vi	**Pre-requisite(s), if any – specify course number(s)**	No
vii	**Course Content**	**List of experiments:** • Angle measurement using Sine bar • Chip Thickness measurement using microscope • Calibration of measuring instruments • Three Wire Method Of Measuring Pitch Diameter • Surface Roughness testing • Manual Milling • Manual Turning • Welding of AI, etc. • Shaping • Green Sand moulding.
viii	**Texts/ References**	• Jerzy A. Slade Coordinate Metrology: Accuracy of Systems and Measurements ISSN2195-9862, Springer publisher • Val Marinov Manufacturing Process Design Laboratory Manual, Kendall/Hunt PublishingCompany, ISBN 1465275312, 9781465275318 • R. K. Rajput A Textbook of Manufacturing Technology: Manufacturing Processes • Ghosh and A. K. Mallik, Manufacturing Science, Affiliated East West Press, 1985. HMT,Production Technology, Tata McGraw Hill, 1980. • J. Mcgeough, Advanced Methods of Machining, Chapman and Hall, 1988.
ix	**Name(s) of Instructor(s)**	Somashekara M A/ Amar Gaonkar
x	**Name(s) of other Departments/ Academic Units to whom thecourse is**	--
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give**	NA
xii	**Justification/ Needfor introducing the course**	This is a core laboratory for understanding about type metrology, measurements and introduction of different type of Manufacturing processes for all appreciating the manufacturing processes of all mechanical parameters.

Name of Academic Unit: Mathematics

Level: UG.

Programme: B.Tech.

1	**Title of the course**	Introduction to Numerical Linear Algebra
2	**Credit Structure (L-T-P-C)**	L: **3** T: **1** P: 0 C: **4**
3	**Mention academic programme(s) for which this course will be a core course** (Write "elective" if not core for any)	Mechanical Engineering
4	**Semester in which normally it is offered** Tick mark (or underline) appropriate option(s)	☐ ~~Autumn (August-Nov)~~ ☐ Spring (Jan-Apr) ☐ ~~Summer (May-July)~~
5	**Whether full or half semester course** Tick mark (or underline) appropriate option	☐ ~~Full Semester~~ ☐ Half Semester
6	**Course content**	Floating point number system, Big O notation Matrix and vector norms, ill conditioned problems Solution of a system of linear equations, Gauss elimination, LU factorization, Cholesky method, Classical iterative methods: Jacobi and Gauss-Seidel Eigenvalue problems, Power method, QR method, Gershgorin theorem. Exposure to MATLAB
7	**Texts/References**	S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980
8	**Name (s) of the instructor (s)**	Amlan K. Barua, Sagnik Sen
9	**Name (s) of other departments / Academic Units to whom the course is relevant**	Any branch of science and engineering
10	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If**	No

	so, please give details.	
11	**Mandatory Pre-requisite(s) - specify course number(s)**	Calculus, MA 101 & Linear Algebra, MA 106
12	**Recommended Pre-requisite(s) - specify course number(s)**	None
13	**Mention 8 to 12 keywords/phrases about this course that would facilitate automated course recommendation and course interdependency** (These may or may not be from the syllabus content)	Scientific computing, numerical linear algebra, Solving systems of linear equations, LU decomposition, Choleskydecomposition, numerical Eigenvalue computation
14	**Justification/ Need for introducing the course**	Numerical linear algebra has emerged as a vibrant sub branch of numerical analysis. In this course, the students would learn a few introductory topics of numerical linearalgebra like LU decomposition, classical iterative solversand power methods. The course is integral for students who wishes to learn numerical ODE/PDE as linear algebraic calculations are often encountered in such topics. Students interested in data science and parallel algorithms for linear algebraic calculations will also benefit.

Name of Academic Unit: Mathematics

Level: UG.

Programme: B.Tech.

1	**Title of the course**	Introduction to Numerical Methods
2	**Credit Structure (L-T-P-C)**	L: **3** T: **1** P: 0 C: **4**
3	**Mention academic programme(s) for which this course will be a core course** (Write "elective" if not core for any)	Mechanical Engineering
4	**Semester in which normally it is offered** Tick mark (or underline) appropriate option(s)	☐ ~~Autumn (August-Nov)~~ ☐ Spring (Jan-Apr) ☐ ~~Summer (May-July)~~
5	**Whether full or half semester course** Tick mark (or underline) appropriate option	☐ ~~Full-Semester~~ ☐ Half Semester
6	**Course content**	Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation. Numerical integration, composite rules, error formulae. Solution of a nonlinear equation, bisection and secant methods. Newton's method, rate of convergence, solution of a system of nonlinear equations, Numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multi-step methods, predictor-corrector methods, order of convergence, Finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations. Exposure to MATLAB
7	**Texts/References**	S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980

8	**Name (s) of the instructor (s)**	Amlan K. Barua, Sagnik Sen
9	**Name (s) of other departments / Academic Units to whom the course is relevant**	Any branch of science and engineering
10	**Is/Are there any course(s) in the same/ other academic unit(s) whichis/ are equivalent to this course? If so, please give details.**	No
11	**Mandatory Pre-requisite(s) - specify course number(s)**	Calculus, MA101 & Linear Algebra, MA 106
12	**Recommended Pre-requisite(s) - specify course number(s)**	None
13	**Mention 8 to 12 keywords/phrases about this course that would facilitate automated course recommendation and course interdependency** (These may or may not be from the syllabus content)	Scientific computing, numerical methods, interpolation,numerical integration, nonlinear equations, numerical ordinary differential equations
14	**Justification/ Need for introducing the course**	This is a first course in numerical methods and introducestopics like interpolation, numerical integration and solution of nonlinear equations. These topics, along with numerical linear algebra, formulate the basis for computer aided engineering (CAE), therefore, any student motivated to learn and work in CAE would benefit from this course. Also this course serves as a pre- requisite for more advanced courses like finite element, finite volume etc. where the ideas formulated in this course is used routinely.

Name of Academic Unit: Mechanical Engineering
Level: B.Tech./DD
Programme: B.Tech./DD

i	**Title** of the course	**ME 212 Fluid Mechanics Lab**
ii	Credit Structure (**L-T-P-C**)	**(0-0-3-3)**
iii	**Type** of Course	Core course
iv	Semester in which normally to be offered	IV
v	Whether **Full or Half Semester** Course	Full
vi	**Pre-requisite(s)**, if any (For the students) – *specify course number(s)*	ME 203 Fluid Mechanics
vii	Course **Content***	**List of Experiments:** • Flow over a circular cylinder (Part A) • Flow over a circular cylinder (Part B) • Submerged non-impinging and impinging jets • Characterization of a submerged axisymmetric air jet • Energy losses due to pipe fitting (Minor losses) • Visualization of flow around a cylinder placed inside a circular pipe • Flow over a circular cylinder (Part A) • Flow over a circular cylinder (Part B) • Submerged non-impinging and impinging jets • Characterization of a submerged axisymmetric air jet • Energy losses due to pipe fitting (Minor losses) • Visualization of flow around a cylinder placed inside a circular pipe
Viii	Texts/References	Yunus A. Cengel, John M. Cimbala, Fluid Mechanics, Tata McGraw Hill Education, 2011. F.M.White, Fluid Mechanics, Seventh Edition, Tata McGraw Hill Education, 2011. Philip J.Pritchard, Alan T.Mcdonald,Robert W.Fox, Introduction to Fluid Mechanics, Wiley, 2009. John F. Douglas, J. M. Gasoriek, Lynne Jack and John Swaffield, Fluid Mechanics, Pearson, 2008.
ix	Name(s) of **Instructor(s)** ***	DVP, SVP
x	Name(s) of **other Departments/ Academic Units to whom** the course is **relevant**	Nil
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are **equivalent** to this course? If so, please give details.	No
xii	**Justification/ Need** for introducing the course	This is a core course for B.Tech./DD in the Mechanical engineering major.