REVISED (NEW) SYLLABUS OF 3rd SEMESTER MECHANICAL ENGINEERING BRANCH (DRAFT)

THIRD SEMESTER

SL No	COURSE CODE	COURSE TITLE	PREFERRED SEMESTER	HOURS/WEEK			CREDITS	THEORY			PRACTICAL			TOTAL MARKS (T&P)
				L	T	P		SESSIONAL	ESE	TOTAL	INT	EXT	TOTAL MARKS	
1	MEP C-301	Manufacturing Technology	III	3	0	0	3	40	60	100				100
2	MEP C-302	Fluid Mechanics & Hydraulic Machines	III	3	0	0	3	40	60	100				100
3	MEP C-303	Material Science and Engineering	III	3	0	0	3	40	60	100				100
4	MEP C-304	Strength of Materials	III	3	0	0	3	40	60	100				100
5	MEP C-305	Engineering Thermodynamics	III	3	0	0	3	40	60	100				100
6	MEP C-306	Manufacturing Technology Laboratory	III	0	0	2	1				90	60	150	150
7	MEP C-307	Fluid Mechanics & Hydraulic Machines Laboratory	III	0	0	2	1				90	60	150	150
8	MEP C-308	Strength of Materials Laboratory	III	0	0	2	1				60	40	100	100
OPEN ELECTIVE (ANY ONE SUBJECT TO BE CHOSEN)														
9	OE-301	Engineering Econmics & Accountancy	III	2	0	0	2	40	60	100				100
	OE-302	Internet of Things	III	2	0	0		40	60	100				
	OE-303	Renwable Energy Technology	III	2	0	0		40	60	100				
10	AU-301	Indian Knowledge System	III	0	0	0		60	40	100				
TOTAL CREDITS							20							1000

Course Code	**MEPC – 301**				
Category	**Program Core Course**				
Course Title	**Manufacturing Technology**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester-III**
	3	**0**	**0**	**3**	
Pre-requisites (if any)	**Workshop technology, Mathematics, Physics.**				

Learning Objectives:

The students will be able to:

LO1	Explain the different processes carried out in casting processes.
LO2	Interpret different special casting processes.
LO3	Investigate different hot and cold working processes.
LO4	Analyze gas welding, arc welding, resistance welding etc including different modern welding methods.
LO5	Compare allied metal joining process (soldering and brazing).
LO6	Demonstrate different tool angles and utilize the knowledge of machining processes in solving simple problems.
LO7	Demonstrate different machine tools and solve simple problems related to machining process.
LO8	Interpret powder metallurgy processes and bell metal industry of Sarthebari, Assam.
LO9	Discuss unconventional machining processes.

Course Outcomes:

The students will be able to:

CO1	Describe foundry casting process.
CO2	Examine hot and cold working processes in metal forming.
CO3	Compare welding operations and allied joining processes (soldering and brazing).
CO4	Apply the concept of machining process and machine tools to solve simple problems in machining variables.
CO5	Illustrate Powder Metallurgy, Bell metal industry of Sarthebari, Assam and unconventional machining methods.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Foundry Technology:** Metal Casting Process – Definition, Steps of Casting, Types of Casting process, Defects in Casting, Inspection of Castings, Advantage and Disadvantage of Casting process; Pattern – Definition, Requirements of good pattern, Types of Pattern, Pattern Materials, Pattern colour codes, Pattern allowances; Mould Making – Definition of Mould and Moulding, Types of Moulds, Properties of Moulding sands, Types of Moulding sands, Green sand, Composition of Green sand, Different types of sand tests, Binders, Additives, Sand preparation and conditioning, Sand Mould making procedure; Core – Definition, Types of Cores, Core sand, Core prints, Core box; Melting Equipment – Types, Cupola furnace construction and working, Cupola zones, Cupola Efficiency; Optimum pouring temperature ; Pouring time or rate; Gating System – Definition, Elements of Gating system, Gate ratio, Types of riser, Requirements and location of riser; Types of Chills; Special Casting Process – Permanent Mould Castings, Centrifugal Castings, Investment Castings, Die Castings.	**10**
UNIT-II	**Metal Forming Process:** Principle of Hot Working and Cold Working; Difference between Hot working and Cold Working; Hot Working and Cold Working– Classification, Properties, Advantages and Disadvantages; Principle of Rolling; Parameters of Rolling; Types of Rolling Mills; Rolling Passes, Rolling Process Variables; Rolling Defects; Applications of Rolling; Extrusion – Description of the process, Hot and Cold Extrusion, Types of Extrusion, Advantages, Limitations and Applications of Extrusion; Wire, Rod and Tube Drawing; Tube making; Difference between Extrusion and Drawing; Forging – Forging operations, Forgeability, Forging temperature, Forgeable materials, Types of Furnaces used, Forging tools, Classification of Forging, Open-die Forging, Impression-die Forging, Closed-die	**7**

	Forging, Forging defects and remedies, Advantages, Disadvantages and Limitations;	
UNIT-III	**Welding and Material Joining Process:** Definition of welding; Weldability; Classification of Welding Process; Welding Positions; Types of Welding joints; Pressure Welding Process: Forge Welding; Concept of Resistance Welding; Butt Welding; Spot Welding; Seam Welding; Projection Welding; Percussion Welding. Fusion Welding: Gas Welding – Concept of Oxy acetylene welding, Types of gas flames, Gas Welding Techniques, Welding equipment; Electric Arc Welding – Principle of Metal Arc Welding, Metal Arc Welding equipment, A.C and D.C Metal Arc Welding with comparison, Arc Welding Voltage and Current, Polarity, Arc blow, Types of Electrodes, Specification of Electrode, Angularity of Electrodes; Carbon Arc Welding; Shielded Arc Welding; Thermit Welding; Modern Welding Techniques with its advantages and disadvantages: TIG Welding, MIG Welding, Submerged Arc Welding, Plasma Arc Welding, Electron Beam Welding, Ultrasonic Welding, Laser Beam Welding; Allied Joining Process: Soldering; Types of soldering; Brazing, Difference between Soldering and Brazing; Different Welding defects and its causes.	**8**
UNIT-IV	**Machining and Machine Tools:** **Machining:** Basic Elements of Machining, Sources of heat in metal cutting, Orthogonal and Oblique Cutting, Types of cutting tools, Parts of a single point cutting tool (SPC), Principal angles of a SPC tool, Tool signature in ORS, ASA and NRS system, Reference Planes, Chip formation, Types of Chips, Chip thickness ratio, Chip breakers and its types, Forces acting on a chip in Orthogonal Cutting, Merchant's Circle Diagram, Forces on a single Point tool in Orthogonal and Oblique cutting, Tool wear and failure, Mechanism of Tool wear, Tool life, Factors affecting Tool Life, Taylor's Tool Life equation, Types of cutting tool materials, Function and qualities of metal working fluids, Types of metal	**13**

	working fluids, Selection of cutting fluids; Simple Problems. **Machine Tools:** **Lathe Machine, Milling Machine, Shaper Machine, Planner Machine, Drilling and Grinding Machine: General Aspects –** Working principle, Function, Types, Size and Specifications, Main Parts, Tool holding devices, Work holding devices, Attachments **Other Aspects –** Lathe operations, Thread cutting mechanism, Gear cutting mechanism, Taper turning, Taper turning methods, Different machining operations, Feed Mechanisms, Taper turning methods, Screw and gear cutting mechanism, Cutting speed, feed, depth of cut, Machining time, Simple problems; Milling machine mechanism, Indexing and Indexing methods, Milling operations, Milling Process, Milling cutters; Shaper & Planer mechanism, Shaper & Planer operations; Cutting speed, Feed, Depth of cut and Machining time of Shaper & Planer, Shaper Vs Planer, Simple problems; Drilling Machine mechanism, Drilling machine operations, Twist drill nomenclature, Drilling operations, Cutting speed, Feed, Depth of cut and Machining time, Simple problems; Types of grinding, Centreless grinding Methods of feeding work, Grinding operations, Abrasives and bonds, Grain or Grit, Grade, Wheel shape and size, Standard marking system, Selection of grinding wheel, Dressing and truing, Glazing and Loading.	
UNIT-V	**Miscellaneous Manufacturing and Machining Process:** **Powder Metallurgy:** Methods of producing metal powders, Characteristics of Metal powders, Blending, Briquetting, pre-sintering, sintering; Secondary operations – Sizing, Coining, Machining etc.; Application of Powder Metallurgy; Advantages, Disadvantages and Limitation of Powder Metallurgy. **Bell metal industry of Sarthebari, Assam**: Historical background of origin of bell metal industry of Sarthebari, Bell metal products in Sarthebari, Artisans and their job role in bell metal production, Bell metal production process, Advantages and disadvantages of bell metal.	**7**

	Unconventional Machining Processes: Ultrasonic Machining – Introduction, Principle, process, Advantages, Dis-advantages Limitations, Applications; Chemical Machining – Fundamental principle, Machining process, Applications, Advantages, Dis-advantages; Electric Discharge Machining – Introduction, Basic EDM circuit, Principle of EDM process, Metal Removing Rate, Dielectric fluid, Applications, Advantages ,Dis-advantages; Laser Beam Machining – Introduction, Machining process Advantages, Disadvantages, Applications.	
Total Contact Hours		**45**

Table of Specification for Manufacturing Technology (Theory)

Sl No	**Contact Hours (34)**	**Units**	**Objective**			**Short Answer Type**				**Long Answers Type**						**Total Marks**
			R	**U**	**AP**	**R**	**U**	**AP**	**AN**	**R**	**U**	**AP**	**AN**	**E**	**C**	
1	**10**	**Unit I**	1	1	0	0	3	0	0	3	3	0	0	0	0	**11**
2	**7**	**Unit II**	1	1	0	0	0	3	0	0	0	3	3	0	0	**11**
3	**8**	**Unit III**	1	1	0	0	0	3	0	0	0	3	3	0	0	**11**
4	**13**	**Unit IV**	1	1	5	3	0	0	0	0	3	3	0	0	0	**16**
5	**7**	**Unit V**	1	1	0	0	3	0	0	3	3	0	0	0	0	**11**
Total Marks			**5**	**5**	**5**	**3**	**6**	**6**	**0**	**6**	**9**	**9**	**6**	**0**	**0**	**60**

NB: R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

	Annexure-I (Manufacturing Technology)									
Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	**Unit I**	10	18.33	4	7	0	0	0	0	11
2	**Unit II**	7	18.33	1	1	6	6	0	0	11
3	**Unit III**	8	18.33	1	1	6	0	0	0	11
4	**Unit IV**	13	26.66	4	4	8	0	0	0	16
5	**Unit V**	7	18.33	4	7	0	0	0	0	11
Total Marks				14	20	20	6	0	0	60

Reference Book List:

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	Workshop Technology	Hajra Choudhury	Volume I & II
2	A Text Book of Manufacturing Technology (Manufacturing Process)	Er. R.K.Rajput	Laxmi Publications (P) Ltd., New Delhi
3	Manufacturing Technology (Volume-I and Volume-II)	P N Rao	Tata McGrew Hill Publications, New Delhi
4	Manufacturing Processes	H.N.Gupta, R.C.Gupta and Arun Mittal	New Age International (P) Ltd., New Delhi
5	Introduction to Basic Manufacturing Process and Workshop Technology	Rajender Singh	New Age International (P) Ltd., New Delhi
6	Elements of Workshop Technology (Volume 1 & 2)	S.K.Hajra Choudhury	Media Promoters & Publishers (P) Ltd., Mumbai
7	A Course in Workshop Technology (Volume 1 & 2)	B.S Raghuwanshi	Dhanpat Rai & Co. (P) Ltd., New Delhi
8	Manufacturing Process	U.K.Singh & M.Dwivedi	New Age International (P) Ltd., New Delhi
9	Workshop Technology (Manufacturing Processes)	Dr. R. K. Singal	Volume I, II & III, S. K. Kataria & Sons

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Course Code	**MEPC – 302**				
Category	**Program Core Course**				
Course Title	**Fluid Mechanics & Hydraulic Machines**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester-III**
	3	0	0	3	
Pre-requisites (if any)	Applied physics, Mathematics, Engineering Mechanics.				

Learning Objectives:

The students will be able to:

LO1	Analyze classification and properties of fluid along with Newton's Law of viscosity.
LO2	Investigate Newtonian and Non-Newtonian fluids and apply Archimedes' Principle in solving problems.
LO3	Calculate fluid pressure to measure it on piezometer, simple and differential manometers and apply Pascal's Law in solving problems.
LO4	Apply Bernoulli's theorem and continuity equation in various problems and understand various flow measuring devices.
LO5	Demonstrate pipe flow and open channel flow and apply Chezy's equation to calculate velocity of flow.
LO6	Investigate fundamental quantities, secondary quantities, Buckingham's Pi theorem and apply the methods of dimensional analysis in solving problems.
LO7	Analyze the impact of forces on different types of vanes and apply its concept in solving problems.
LO8	Demonstrate different types of hydraulic turbines and pumps including draft tube theory along with cavitation and slip of pumps.

Course Outcomes:

The students will be able to:

CO1	Analyze fluid properties, including density, viscosity, surface tension and compressibility.
CO2	Apply fluid-statics and kinematics principles to compute hydrostatic pressure, center of pressure, buoyancy, stability and flow measurement.

CO3	Calculate major losses in pipe flow and apply Chezy's equation to measure discharge in open channel flow.
CO4	Investigate hydrodynamic forces on stationary as well as moving flat plates and vanes via dimensional analysis.
CO5	Explain the working principle of hydraulic turbines and pumps.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Fluid Statics** Definition of fluid, classification fluid, Properties of fluids – units and dimensions, Newton's Law of Viscosity, Newtonian and Non-Newtonian Fluid, Archimedes' Principle, Stability of immersed & floating bodies, metacenter & determination of metacentric height. Simple problems on properties of fluid.	**5 hours**
UNIT-II	**Measurement of Fluid pressure:** Fluid pressure, Pressure head, Intensity of Pressure, Concept of absolute vacuum, gauge pressure, atmospheric pressure and absolute pressure. Pressure measuring devices– piezometer, simple and differential manometers – simple problems. Pascal's Law, Hydrostatic Law, concept of Total pressure and center of pressure on immersed bodies (horizontal, vertical & inclined) – Simple problems.	**8 hours**
UNIT-III	**Fluid Kinematics:** Classifications of fluid flow (laminar & turbulent), steady & unsteady flow, uniform & non uniform flow, compressible & non compressible flow, rotational &irrotational flow, Continuity Equation for compressible and incompressible fluid, Bernoulli's Theorem, Application of Bernoulli's Theorem – Venturimeter , orificemeter, Pitot-tube – simple problems on Bernoulli's Theorem and its application.	**8 hours**
UNIT-IV	**Pipe flow and Open channel flow:**	

	Major and minor losses in pipe flow, Darcy's equation to find major head loss in pipe flow, Hydraulic gradient and total energy line, Reynold's number to find type of flow, Open channel flow, Hydraulic mean depth, Orifice, Vena- Contracta, Hydraulic constants, Chezy's equation to find velocity of flow, Notch.	**4 hours**
UNIT- V	**Dimensional Analysis:** Fundamental quantities, Secondary quantities, Dimensional homogeneity, Methods of dimensional analysis, Rayleigh's method, Buckingham's π theorem, Method of selecting repeating variables – simple problems, Types of forces acting in moving fluids, Dimensionless numbers	**4 hours**
UNIT-VI	**Basics of Turbo-machinery** Force exerted by a jet on a stationary vertical flat plate, inclined flat plate, Force exerted by a jet on a moving plate, Force exerted by a jet of water on a series of vanes. Simple problems	**6 hours**
UNIT-VII	**Hydraulic Turbines & Pumps** General layout of a hydroelectric power plant, Hydraulic Turbines – Head and efficiency, Classification, Impulse and Reaction turbine, Pelton wheel, Francis turbine, Propeller turbine and Kaplan turbine – work done, efficiencies, draft tube theory, surge tank, water hammer. Pumps – Classification, Centrifugal and Reciprocating pumps – working, work done, heads and efficiencies, Cavitation in centrifugal pump, Slip of reciprocating pump, Air- vessel.	**10 hours**
Total Contact Hours		**45**

Table of Specification for Fluid mechanics & Hydraulic machines

Sl No	Contact Hours (45)	Units	Objective			Short Answer Type				Long Answers Type						Total Marks
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	5	Unit I	1	1	1	0	3	3	3	0	6	6	6	0	0	**7**
2	8	Unit II	1	1	1	3	3	3	0	6	6	6	0	0	0	**11**
3	8	Unit III	1	1	1	3	3	3	0	6	6	6	0	0	0	**11**
4	4	Unit IV	1	1	0	3	3	3	0	0	6	6	6	0	0	**9**

5	4	Unit V	1	0	1	0	3	3	3	0	0	6	6	0	0	**6**
6	6	Unit VI	1	1	1	3	3	3	0	5	5	5	0	0	0	**5**
7	10	Unit VII	1	1	1	3	3	3	0	6	6	6	0	0	0	**11**
Total Marks			**5**	**5**	**5**	**5**	**5**	**3**	**0**	**0**	**6**	**14**	**12**	**0**	**0**	**60**

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	Annexure-I Fluid Mechanics and Hydraulic machines									
Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	Unit I	5	**11.67**	10	10	10	0	0	0	**7**
2	Unit II	8	**18.33**	10	10	10	0	0	0	**11**
3	Unit III	8	**18.33**	10	10	10	0	0	0	**11**
4	Unit IV	4	**15.00**	4	10	9	6	0	0	**9**
5	Unit V	4	**10.00**	1	3	9	9	0	0	**6**
6	Unit VI	6	**8.33**	9	9	9	0	0	0	**5**
7	Unit VII	10	**18.33**	10	10	10	0	0	0	**11**
Total Marks				**10**	**16**	**22**	**12**	**0**	**0**	**60**

<u>Reference Book List</u>:

Sl No.	Book Name	Author Name	Publishing House,Volume, ISBN
1	Fluid Mechanics & Hydraulic machines	R.K.Rajput	S. Chand & company, 2012 edition, ISBN-13: 978-8121916660
2	Fluid Mechanics & Hydraulic machines	R.K Bansal	Laxmi Publications, 11th edition, ISBN-13: 978-8131808153
3	Fluid Mechanics & Hydraulic machines	D.S Kumar	S.K. Kataria, 2012 edition, ISBN-13: 978-9380027654
4	Fluid Mechanics	Yunus .A. Changel Henry Hue	Mc Graw Hill Publication, standard edition, ISBN-13: 978-9355322043
5	Fluid Mechanics	Frank M. White	Mc Graw Hill Publication, 8th edition, ISBN- 978-9385965494

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Course Code	**MEPC – 303**				
Category	**Program Core Course**				
Course Title	**Material Science and Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester-III**
	3	0	0	3	
Pre-requisites (if any)	Physics, Mathematics, Chemistry.				

Learning Objectives:

The students will be able to:

LO1	Demonstrate different types of lattices, crystal structure and calculate atomic radius.
LO2	Illustrate classification, composition, application and impurities of pig iron and cast iron.
LO3	Show the purpose of alloying and effect of alloying elements along with types and application of different alloy steels.
LO4	Demonstrate the properties and application of few non- ferrous metals along with some alloys of non- ferrous metals.
LO5	Demonstrate different mechanical properties of metals.
LO6	Demonstrate different aspects of corrosion and few surfaces finishing process.
LO7	Apply phase diagram on heat treatment process.
LO8	Demonstrate properties, limitation, advantages and applications of plastics and some advanced materials used in engineering.

Course Outcomes:

Upon successful completion of the course, students will be able to:

CO1	Apply the knowledge about crystal structures and atomic bonds.
CO2	Demonstrate classification of ferrous metals, non-ferrous metals, cutting tool materials and composites along with their properties.
CO3	Illustrate mechanical properties of metal and also demonstrate the principle of corrosion, their types and its preventive methods along with the various surface engineering processes.
CO4	Apply phase diagram on heat treatment of metals.
CO5	Explain and then demonstrate classification, properties, applications of plastic, rubber and advanced materials.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Crystal structures and Bonds:** Unit cell and space lattice: Crystal system: Bravais lattice, Seven basic crystal structure for different metals, Crystal structure for cubic crystal – Simple cubic, BCC, FCC and HCP, Coordination number for Simple Cubic, BCC and FCC; Atomic radius – Definition and its calculation for Simple Cubic, BCC and FCC; Atomic Packing Factor for Simple Cubic, BCC and FCC; Miller indices and Simple problems.	**(5 hours)**
UNIT-II	**Ferrous metals and its alloys:** Introduction, Selection of iron ores, Flow sheet for production of iron and steel; Iron ores: Pig iron – Classification, Composition, Application and Effects of impurities on Iron. Cast Iron – classification, composition, properties and application; Wrought Iron – Properties, composition and its applications; Comparison of cast iron, wrought iron and Pig iron. Comparison of mild steel and high carbon steel. Standard commercial grades of steel as per BIS and AISI. Alloy Steels – Purpose of alloying; Effects of alloying elements; Important alloy steels – Silicon Steel, High Speed Steel (HSS), Chromium steel, heat resisting steel, Stainless Steel (SS) – Types of SS and its application.	**(7 hours)**
UNIT-III	**Non-ferrous metals and its Alloys:** Properties and application of aluminium, copper, tin, lead, zinc, magnesium, cobalt and nickel; Copper alloys: Brasses, bronzes – composition, properties, and applications, Aluminium alloys: Duralumin, hindalium, magnelium – composition, properties and application; Nickel alloys: Inconel, monel, nickel-silver – composition, properties and applications; Magnesium alloys – Dow metal, electron metal – composition , properties and applications Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.	**(9 hours)**

UNIT-IV	**Mechanical Properties** Introduction: Definition of mechanical properties – Elasticity, Plasticity, Ductility, Brittleness, Stiffness, Toughness, Hardness, Machineability, Malleability, Creep, Fatigue strength, Fracture or breaking stress.	**(6 hours)**
UNIT-V	**Corrosion & Surface Engineering:** Nature of corrosion and its causes; Electrochemical reactions; Factors affecting corrosion - Environment , Material properties and physical conditions; Types of corrosion; Corrosion control and prevention – Material selection, environment control and design, Corrosion inhibitors; Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating methods; Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Industrial applications	**(6 hours)**
UNIT-VI	**Heat Treatment** **Phase diagram – Iron-carbon phase diagram, Ferrous metals and its Alloys:** Isomorphs, eutectic and eutectoid systems; Iron-Carbon binary diagram; Solid solutions and its types Austenite, Martensitic Transformation – Simplified Transformation Cooling Curves. Purpose of heat treatment, Various heat treatment processes and its applications – hardening, tempering, quenching, annealing, normalizing, Case hardening, aging, stress relieving and surface hardening,	**(6 hours)**
UNIT-VII	**Plastic and Advanced Engineering Materials:** Definition, properties, advantages, limitation and applications of plastics, Classification – thermoplastic and thermosetting plastics and their applications, Various trade names of plastics, Food grade plastics. Rubber classification - Natural and synthetic. Selection of rubber. Advanced Materials: Properties and application – Composites; Ceramics; Nanomaterials – Carbon nano tubes, Graphene,	**(6 hours)**

	Quantum dots; Bio-Materials – Hydrogels, Bio-degradable polymers, Bio-active glass; Energy materials – Lithium Ion, Super capacitor materials, Solid oxide fuel cells; High Entropy alloys; Functional Materials – Shape memory alloys, Thermoelectric materials, Piezoelectric materials; Advanced structural materials – Titanium alloys, High strength steels, Carbon fibre reinforced polymer.	
Total Contact Hours		**(45 hours)**

Table of Specification for Material Science and Engineering:

Sl No	**Contact Hours (42)**	**Units**	**Objective**			**Short Answer Type**				**Long Answers Type**						**Total Marks**
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	6	Unit I	1	1	1	3	3	3	0	6	6	6	0	0	0	7
2	6	Unit II	1	1	1	3	3	3	0	6	6	6	0	0	0	12
3	9	Unit III	1	1	1	3	3	3	0	6	6	6	0	0	0	12
4	6	Unit IV	1	1	1	3	3	3	0	6	6	6	0	0	0	7
5	6	Unit V	1	1	1	3	3	3	0	6	6	6	0	0	0	7
6	6	Unit VI	1	1	1	3	3	3	0	6	6	6	0	0	0	10
7	3	Unit VII	1	1	1	3	3	3	0	6	6	6	0	0	0	5
Total Marks			**7**	**5**	**3**	**5**	**7**	**3**	**0**	**6**	**14**	**10**	**0**	**0**	**0**	**60**

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Annexure-I (Material Science and Engineering):

Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	Unit I	6	**11.67 %**	10	10	10	0	0	0	**7**
2	Unit II	6	**20.00 %**	10	10	10	0	0	0	**12**
3	Unit III	9	**20.00 %**	10	10	10	0	0	0	**12**
4	Unit IV	6	**11.67 %**	10	10	10	0	0	0	**7**
5	Unit V	6	**11.67 %**	10	10	10	0	0	0	**7**
6	Unit VI	6	**16.67 %**	10	10	10	0	0	0	**10**

7	Unit VII	3	**8.33 %**	10	10	10	0	0	0	**5**
Total Marks				**18**	**26**	**16**	**0**	**0**	**0**	**60**

Reference Book List:

Sl. No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	A Text Book of Material Science & Metallurgy	O.P. Khanna	Dhanpath Rai and Sons, New Delhi.
2	Material Science & Engineering	R.K. Rajput	S.K. Kataria & Sons, New Delhi, 2004.
3	Material Science	R.S. Khurmi	S. Chand & Co. Ltd., New Delhi, 2005.
4	Fundamentals of Engineering Thermodynamics	Moran, Shapiro	Wiley India
5	Thermodynamics: An Engineering Approach	Yunus A. Cengel	McGraw Hill Education

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Course Code	**MEPC – 304**				
Category	Program Core Course				
Course Title	Strength of Materials				
Scheme and Credits	L	T	P	Credits, C	Semester-III
	3	0	0	3	
Pre-requisites (if any)	Mathematics, Engineering Mechanics, Physics.				

Learning Objectives:

Students will be able to:

LO1	Calculate stress, strain and other mechanical properties and find engineering stress and thermal stress of uniform and composite section.
LO2	Calculate shear force and bending moment to draw SFBM diagram under various load condition.
LO3	Apply the concept of theory of bending and deflection of beams to calculate bending stress, safe load, modulus of section, moment of resistance of various beams under different loads.
LO4	Calculate polar MI, strength of solid and hollow shaft and design a shaft based on strength and rigidity.
LO5	Analyze deflection for closed coil helical spring and apply the concept to calculate stiffness, safe load, size of coil and deflection.
LO6	Calculate buckling load based on Euler's column theory and find equivalent length and slenderness ratio.
LO7	Determine longitudinal and hoop stress on thin cylindrical shell and derive expression for longitudinal and hoop stress to calculate safe thickness and safe working pressure.
LO8	Determine rivet failure by calculating strength and efficiency under primary and secondary load.

Course Outcomes:

On successful completion students will be able to:

CO1	Determine normal stress and strain in uniform and composite section bodies under axial loading.

CO2	Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams of beams with UDL and Point loads.
CO3	Calculate bending stress and deflections in beams using simple bending theory.
CO4	Analyse torsion in solid and hollow shafts and determine helical-spring dimensions for a given safe load.
CO5	Examine stress in thin cylindrical shells under internal pressure and assess failure criteria for columns, struts and rivetted joints.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Simple Stresses and Strains:** Types of forces; Stress, Strain and their nature; Mechanical properties of common engineering materials; Significance of various points on stress – strain diagram for M.S. and C.I. specimens; Significance of factor of safety; Relation between elastic constants; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces; Thermal stresses in bodies of uniform section and composite sections; Related numerical problems on the above topics.	**7**
UNIT-II	**Shear Force & Bending Moment Diagrams:** Types of beams with examples: a) Cantilever beam, b) Simply supported beam, c) Over hanging beam, d) Continuous beam, e) Fixed beam; Types of Loads – Point load, UDL and UVL; Definition and explanation of shear force and bending moment; Calculation of shear force and bending moment and drawing the S.F and B.M. diagrams by the analytical method only for the following cases: a) Cantilever with point loads, b) Cantilever with uniformly distributed load, c) Simply supported beam with point loads, d) Simply supported beam with UDL, e) Over hanging beam with point loads, at the centre and at free ends, f) Over hanging beam with UDL throughout, g) Combination of point and UDL for the above; Related numerical problems.	**10**
UNIT-III	**Theory of Simple Bending and Deflection of Beams:** Explanation of terms: Neutral layer, Neutral Axis, Modulus of	**8**

	Section, Moment of Resistance, Bending stress, Radius of curvature; Assumptions in theory of simple bending; Bending Equation $M/I = \sigma/Y = E/R$ with derivation; Problems involving calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of cross- section; Definition and explanation of deflection as applied to beams; Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems.	
UNIT-IV	**Torsion in Shafts and Springs:** Definition and function of shaft; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion; Derivation of the equation $T/J=f_s/R=G\theta/L$; Problems on design of shaft based on strength and rigidity; Numerical Problems related to comparison of strength and weight of solid and hollow shafts; Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation); stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.	**6**
UNIT-V	**Columns and Strut:** Introduction to columns and struts, Failure of column and strut, Eulers' Column Theory with assumptions, sign convention and limitations, End conditions of Column, Equivalent Length of Column, Slenderness ratio, Empirical formula for Columns – Rankine formulae; Simple Numerical Problems.	**5**
UNIT-VI	**Thin Cylindrical Shells:** Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell; Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells; Related numerical Problems for safe thickness and safe working pressure.	**4**
UNIT-VII	**Riveted Joints:** Introduction to Riveted joint, Types of Riveted joints, Failure of a Riveted Joint, Strength of a Riveted joint, Efficiency of a	**5**

	Riveted joint, Primary and secondary load on Rivet, Eccentric loading, Design of a Riveted joint.	
Total Hours		**45**

Table of Specification for Strength of Materials (Theory)

Sl No	Contact Hours (45,etc)	Units	Objective			Short Answer Type				Long Answers Type						Total Marks
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	**7**	**Unit I**	1	1	1	3	3	0	0	0	6	6	0	0	0	9
2	**10**	**Unit II**	1	1	1	3	3	0	0	0	6	6	0	0	0	10
3	**8**	**Unit III**	1	1	1	3	3	0	0	0	6	6	0	0	0	14
4	**6**	**Unit IV**	1	1	1	3	3	0	0	0	6	6	6	0	0	7
5	**5**	**Unit V**	1	1	1	3	3	0	0	0	6	6	0	0	0	8
6	**4**	**Unit VI**	1	1	1	3	3	0	0	0	6	6	0	0	0	6
7	**5**	**Unit VII**	1	1	1	3	3	0	0	0	6	6	6	0	0	6
Total Marks			**5**	**5**	**5**	**6**	**9**	**0**	**0**	**0**	**6**	**18**	**6**	**0**	**0**	**60**

NB:R: Remember, **U:**Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

	Annexure-I (Strength of Materials – Theory)									
Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	**Unit I**	7	15.00 %	4	10	7	0	0	0	**9**
2	**Unit II**	10	16.67 %	4	10	7	0	0	0	**10**
3	**Unit III**	8	23.33 %	4	10	7	0	0	0	**14**
4	**Unit IV**	6	11.67 %	4	10	7	6	0	0	**7**
5	**Unit V**	5	13.33 %	4	10	7	0	0	0	**8**
6	**Unit VI**	4	10.00 %	4	10	7	0	0	0	**6**
7	**Unit VII**	5	10.00 %	4	10	7	6	0	0	**6**
Total Marks			**100 %**	**11**	**20**	**23**	**6**	**0**	**0**	**60**

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Reference Book List: (Atleast 5 nos.)

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	Strength of Materials	S. P. Timoshenko	CBS Publishers, Vol. I & II, 1986, ISBN 978-8123910307 & 978-8123910772
2	Strength of Materials	S. S. Rattan	Tata-McGraw-Hill Education Private limited, 2011, 2nd Edition, ISBN 978-0-07-107256-4
3	Strength of Materials	R. S. Khurmi	S. Chand & Co., Multicolour edition, 2008, ISBN 81-219-2822-2
4	A Textbook on Strength of Materials	R. K. Rajput	S. Chand & Co., Revised Edition, 2018, ISBN 9789352533695
5	Strength of Materials	S. Ramamrutham	Dhanpat Rai Publishing House, Reprint, 2015, ASIN: B0B12XKQLY
6	A Textbook on Strength of Materials	Dr. R.K.Bansal	Laxmi Publications (P) Ltd., New Delhi
7	Strength of Materials	U.C.Jindal	Umesh Publications, New Delhi

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Course Code	**MEPC – 305**				
Category	**Program Core Course**				
Course Title	**Engineering Thermodynamics**				
Scheme and Credits	**L**	**T**	**P**	**Credits, C**	**Semester-III**
	3	0	0	3	
Pre-requisites (if any)	Mathematics, Physics, Chemistry.				

Learning Objectives:

The students will be able to:

LO1	Illustrate concept of system and surroundings as applied to thermodynamic system.
LO2	Interpret Zeroth Law of Thermodynamics including heat and specific heat.
LO3	Demonstrate Ideal Gas equation and Gas Equation in solving problems.
LO4	Apply First Law of Thermodynamics and Steady Flow Energy Equation to various steady flow processes.
LO5	Relate Kelvin – Plank statement and Clausius statement and its equivalence to solve simple problems on the Second Law of Thermodynamics and also calculate entropy.
LO6	Demonstrate P-V and T-S diagram of different air standard cycle to solve simple problems.
LO7	Interpret different properties of steam and utilize steam tables to solve problems.
LO8	Interpret classification of fuels and calculate calorific values using Dulong's formula.

Course Outcomes:

Upon successful completion of the course, the students will be able to:

CO1	Demonstrate the fundamentals of the first and second laws of thermodynamics and their application to the close and open systems.
CO2	Apply Ideal Gas Equation and Gas Equation to solve simple practical problems for various thermodynamic process.
CO3	Illustrate different air standard cycles to calculate cycle efficiency for each air standard cycle at different pressures and temperatures points in the cycle.
CO4	Apply the knowledge of steam properties and Mollier chart in solving practical engineering problems related to thermal and energy systems.

CO5	Illustrate the Higher Calorific Value (HCV) and Lower Calorific Value (LCV) of fuels using Dulong's formula.

Detailed Syllabus:

Units	Detailed Contents	Contact Hour
UNIT-I	**Introduction to Thermodynamics:** Definition, Scope and applications of Thermodynamics in Engineering, Concept of Macroscopic and Microscopic viewpoints, Concepts of Thermodynamic System, Surroundings and Boundary, Types of thermodynamic systems – closed, open and isolated systems with examples, Properties of a system – Intensive and Extensive properties with examples, Concepts of Work, Sign conventions, Different types of work (Boundary Work, shaft work), Concept of temperature, Temperature Scales, Thermodynamic Equilibrium, Process, Types of Process – Reversible, Irreversible. Concept of Quasi-Static Process, Zeroth Law of Thermodynamics, Introduction to Heat, Specific Heat, Specific heat of liquid, solid and gases,	**(6 hours)**
UNIT-II	**Laws of perfect gases:** Ideal Gas Equation and its application, Characteristic Gas Equation, Universal Gas Constant and its relationship with Molar mass of a gas, Specific heats of Ideal Gases, Derivation of the relationship between the two specific heats and characteristic gas constant, Simple problems on gas equation.	**(3 hours)**
UNIT-III	**First Law of Thermodynamics and its Consequences:** First law of thermodynamics for a closed system undergoing a cycle and change of state, Internal energy, Joule's law, Enthalpy, Application of first law to various Thermodynamic processes for a closed system – isobaric, isochoric, isothermal, adiabatic, polytropic. First law applied to a control volume (open system) – Introduction of Steady Flow Energy Equation (SFEE) and its derivation. Application of SFEE to various steady flow devices - nozzle, diffuser, turbine, compressor, boiler, throttling device etc., Limitations of the First Law, Perpetual Motion Machine of the	**(9 hours)**

	first kind, Simple problems on conversion of heat into work and vice versa.	
UNIT-IV	**Second Law of Thermodynamics:** Kelvin-Plank statement and Clausius statement of the second law of thermodynamics, Equivalence of Kelvin-Plank and Clausius statements, Heat engine, Heat pump and Refrigerator, Carnot's Theorem, Perpetual Motion Machine of the Second kind, Clausius inequality, Entropy –Introduction and its significance, Simple problems on the above topics.	**(6 hours)**
UNIT-V	**Air standard cycles:** Introduction to Air Standard Cycles, Assumptions of Air Standard Cycle, P-V and T-S Diagrams and derivation of Thermal efficiency for Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, Rankine cycle, Comparison of Otto, Diesel and Dual Cycles, Simple problems on the above cycles.	**(6 hours)**
UNIT-VI	**Properties of steam:** Steam and its formation at constant pressure: wet, dry, saturated and super-heated steam, Saturation pressure and temperature, Dryness fraction, Degree of superheat, Sensible heat, Latent heat, Total heat, Simple problems to determine specific volume, enthalpy, internal energy and entropy of wet, dry and superheated steam at a given pressure using steam tables.	**(6 hours)**
UNIT-VII	**Fuels and Combustion:** Definition and classification of fuels, Calorific values (HCV and LCV), Calculation of HCV and LCV using Dulong's formula, Bomb Calorimeter, Boy's gas calorimeter.	**(3 hours)**
Total Contact Hours		**(45 hours)**

Table of Specification for Thermodynamics:

Sl No	**Contact Hours (42)**	**Units**	**Objective**			**Short Answer Type**				**Long Answers Type**						**Total Marks**
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	6	**Unit I**	1	1	1	3	3	3	0	6	6	6	0	0	0	**8**
2	3	**Unit II**	1	1	1	3	3	3	0	6	6	6	0	0	0	**7**
3	9	**Unit III**	1	1	1	3	3	3	0	6	6	6	0	0	0	**11**

4	6	**Unit IV**	1	1	1	3	3	3	0	6	6	6	0	0	0	**11**
5	6	**Unit V**	1	1	1	3	3	3	0	6	6	6	0	0	0	**8**
6	6	**Unit VI**	1	1	1	3	3	3	0	6	6	6	0	0	0	**8**
7	3	**Unit VII**	1	1	1	3	3	3	0	6	6	6	0	0	0	**7**
Total Marks			**5**	**5**	**5**	**5**	**7**	**3**	**0**	**6**	**6**	**18**	**0**	**0**	**0**	**60**

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Annexure-I (Thermodynamics):										
Sl No.	**Units**	**Time Allotted (Hrs)**	**Percentage Weightage**	**R**	**U**	**AP**	**AN**	**E**	**C**	**Total Marks**
1	Unit I	6	13.33 %	10	10	10	0	0	0	**8**
2	Unit II	6	11.67 %	10	10	10	0	0	0	**7**
3	Unit III	9	18.33 %	10	10	10	0	0	0	**11**
4	Unit IV	6	18.33 %	10	10	10	0	0	0	**11**
5	Unit V	6	13.33 %	10	10	10	3	0	0	**8**
6	Unit VI	6	13.33 %	10	10	10	0	0	0	**8**
7	Unit VII	3	11.67 %	10	10	10	0	0	0	**7**
Total Marks				**16**	**18**	**26**	**0**	**0**	**0**	**60**

NB: R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

Reference Book List:

Sl. No.	**Book Name**	**Author Name**	**Publishing House, Volume, ISBN**
1	Engineering Thermodynamics	PK Nag	McGraw Hill Education
2	A Textbook of Thermal Engineering	RS Khurmi	S Chand
3	Applied Thermodynamics	RK Rajput	Laxmi Publications
4	Fundamentals of Engineering Thermodynamics	Moran, Shapiro	Wiley India
5	Thermodynamics: An Engineering Approach	Yunus A. Cengel	McGraw Hill Education

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Practical

Course Code	**MEPC-306**				
Category	**Program Core Course**				
Course Title	**Manufacturing Technology Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
	0	0	2	1	
Pre-requisites (if any)	**Workshop technology.**				

Learning Objectives:

The students will be able to:

LO1	Demonstrate machine tools.
LO2	Build simple castings by preparing green sand moulds.
LO3	Practice various welding techniques using Gas Metal Arc Welding process.
LO4	Practice turning operations, gear cutting operations, key ways cutting, slot cutting etc. on machine tools.
LO5	Perform drilling operations on a metal specimen.
LO6	Grind single point cutting tool or multi point cutting tool on a tool and cutter grinder.
LO7	Apply surface finishing operation on a metal specimen.

Course Outcomes:

The students will be able to:

CO1	Select appropriate tools, equipment and machines to complete a given job.
CO2	Utilize the techniques of foundry technology in preparing green sand moulds for casting process or build simple items using sheet metal forming or rolling process.
CO3	Perform various welding techniques using Gas Metal Arc Welding process.
CO4	Experiment with various machining operations on any of the machine tools like Lathe machine, Milling machine, Shaper machine, Planer machine and Drilling machine.
CO5	Apply surface finishing operation on a grinding machine and also build a single point cutting tool/ multipoint cutting tool.

List of Practices:

Sl. No.	Topics For Practices	Hours

1	To study the following machine tools (i) Lathe machine (ii) Shaper machine (iii) Planer machine (iv) Drilling machine (v) Grinding machine.	**4**
2	(i) To prepare green sand mold and casting of metal / other available materials after preparation of suitable molds for simple machine elements (i) Connecting rod (ii) Solid bearing (iii) V-Pulley/Gear Pulley. Or To manufacture a simple sheet metal components using shearing and bending operations. Or To study and observe the plain and grooved rolling techniques through demonstration.	**5**
3	To join plates and pipes using Gas Metal Arc Welding and practice the following joints. (i) Arc welding (i) Lap Joint (ii) Butt Joint (iii) T- Joint Or Spot welding (i) Lap Joint Or Gas welding (i) Lap Joint (ii) Butt Joint	**5**
4	(i) To practice rough turning, facing, step turning, groove cutting, chamfering & knurling on a given MS specimen. (ii) To practice taper turning on a given MS specimen through Compound Rest Swiveling Method and Tailstock Offset Method. (iii) To practice external and internal thread cutting or gear cutting on a given metal specimen using a lathe machine. Or To practice milling operation for making spur gear or helical gear. (iv) To practice shaping of groove splines on a shaping machine. Or To shape a square head and hexagonal head on a shaping machine. Or To practice shaping of 'T' slots on a shaping machine. Or Shaping step block cut dovetail to angles 60, 90, 120 degrees	**12**

	Or (v) Simple planning exercise cutting 'T' slots (one model) (vi) To practice drilling operation by drilling Three different sized holes for different materials maintaining uniform distance between them. Or To practice the operation Drilling Reaming, Boring, Counterboring, Countersinking and Tapping on a given flat MS plate.	
5	(i) To practice surface finishing process like surface grinding and cylindrical grinding on a given metal specimen. Or Grinding flat surface on a surface grinder using magnetic chuck and clamping devices (ii) To grind a single point cutting tool with tool and cutter grinder. Or Grinding of milling cutters on a tool and cutter grinder.	**4**
Total Hours		**30**

Reference Book Lists:

Sl No.	Book Name	Author Name	Publishing House,Volume, ISBN
1	Workshop Technology	Hajra Choudhury	Volume I & II
2	Introduction to Manufacturing Processes	P N Rao	Volume I & II, Tata McGrew Hill Publications
3	Manufacturing Practices	Dr. R. K. Singal	S. K. Kataria & Sons
4	Workshop Technology (Manufacturing Processes)	Dr. R. K. Singal	Volume I, II & III, S. K. Kataria & Sons
5	A Textbook of Workshop Technology (Manufacturing Processes)	R.S. Khurmi & J.K. Gupta	S. Chand

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Course Code	**MEPC-307**				
Category	**Program Core Course**				
Course Title	**Fluid Mechanics & Hydraulic Machines Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
	0	0	2	1	
Pre-requisites (if any)	Applied Physics, Mathematics, Engineering Mechanics.				

Learning Objectives:

The students will be able to:

LO1	Experiment on Bernoulli's theorem.
LO2	Apply concept of buoyancy in determination of metacentric height.
LO3	Make use of flow meter to measure discharge.
LO4	Apply the concept of open channel flow and flow through pipes to determine co-efficient of discharge, major and minor head loss and co-efficient of friction.
LO5	Study performance of reciprocating and centrifugal pump.
LO5	Study impact of jet on moving and fixed vane,
LO6	Study performance of impulse and reaction turbine.

Course Outcomes:

The students will be able to:

CO1	Experiment on verification of Bernoulli's theorem and determine metacentric height of a floating ship model.
CO2	Carry out experiment to measure discharge with flow meter in closed and open channel flow
CO3	Carry out experiment to determine major head loss, minor head loss or co-efficient of friction for flow of fluids through pipe and also performance of reciprocating or centrifugal pump.
CO4	Carry out test to determine performance pf impulse and reaction turbine and also determine impact of jet on fixed and moving plate.

List of Practices:

Sl. No.	Topics For Practices	Contact Hours
1	To verify Bernoulli's theorem using Bernoulli's Apparatus.	**3**
2	To determine metacentric height by metacentric height apparatus.	**4**
3	To determine coefficient of discharge of flow using Orifice meter and Venturi meter. Or To determine co-efficient of discharge through open channel flow over a notch.	**4**
4	To determine major and minor losses with the aid of pipe flow apparatus. Or To determine coefficient of friction of flow through various pipes.	**4**
5	To conduct test at various heads of a given reciprocating pump on a Reciprocating Pump Test Rig and find its efficiency.	**4**
6	To determine pressure head of a centrifugal pump.	**4**
7	To determine impact of jet on a fixed and moving plate.	**4**
8	(i) To conduct performance test on impulse turbine (Pelton turbine) on a test rig. (ii) To conduct performance test on reaction turbine (Kaplan turbine) on a test rig. Or To conduct performance test on Francis turbine on a test rig.	**4**
Total Contact Hours		**30**

Reference Book Lists:

Sl No.	Book Name	Author Name	Publishing House ,Volume, ISBN
1	Fluid Mechanics & Hydraulic machines	R.K. Rajput	S. Chand & company, 2012 edition, ISBN-13: 978-8121916660

2	Fluid Mechanics & Hydraulic machines	R.K Bansal	Laxmi Publications, 11th edition, ISBN-13: 978-8131808153
3	Fluid Mechanics & Hydraulic machines	D.S Kumar	S.K. Kataria, 2012 edition, ISBN-13: 978-9380027654
4	Fluid Mechanics	Yunus .A. Changel Henry Xue	Mc Graw Hill Publication, standard edition, ISBN-13: 978-9355322043
5	Fluid Mechanics	Frank M. White	Mc Graw Hill Publication, 8th edition, ISBN- 978-9385965494

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Course Code	MEPC – 308				
Category	Program Core Course				
Course Title	Strength of Materials Laboratory				
Scheme and Credits	L	T	P	Credits	Semester-III
	0	0	2	1	
Pre-requisites (if any)	Mathematics, Engineering Mechanics, Strength of Materials.				

Learning Objectives:

Students will be able to:

LO1	Illustrate mechanical properties of a material.
LO2	Experiment on compressive strength and find toughness of material.
LO3	Experiment with torsion testing machine and find shear modulus, stiffness and shear strength of a material.
LO4	Illustrate buckling of column and strut and find buckling load.
LO5	Experiment to find deflection of beams and bending stress of a given material.

Course Outcomes:

On successful completion students will be able to:

CO1	To carry out test on Universal Testing Machine to study mechanical properties of a material.
CO2	To carry out test on Compressive Testing Machine to find mechanical properties of a material or find impact strength through Izod test
CO3	To carry out test on Torsion Testing Machine to find mechanical properties in twisting of a material or find shear strength, shear modulus, stiffness of a given material.
CO4	To carry out test to study on buckling of column and strut or find impact strength through Charpy test.
CO5	To carry out test to study bending stress and deflection of a simply supported beam or find hardness number of a given material.

List of Practices:

Sl. No.	Topics For Practices	Hours
1	To determine mechanical properties such as modulus of elasticity, yield strength, ductility, percentage elongation, percentage reduction in area for a given specimen on Universal Testing Machine. Also plot stress-strain diagram for the given specimen.	5
2	To determine compressive strength for a given specimen on a Compression Testing Machine	5
3	To determine Hardness number of a metal specimen on Rockwell Hardness Tester, Brinell Hardness Tester and Vickers Hardness Tester	5
4	To determine the shear modulus or modulus of rigidity and stiffness of a spring of given material on a spring testing machine.	5
5	To determine shear strength of a given specimen by double shear test.	5
6	To find materials resistance to twisting loads, shear modulus and shear strength for a given specimen on a Torsion Testing Machine.	5
7	To determine Impact toughness (strain energy) for a given specimen through Izod Test and Charpy Test.	5
8	To study the deflection of a simply supported beam and compare the experimental values of deflection with the theoretical values.	5
9	To study bending stress distribution across the section of a beam for a given specimen on a Beam Apparatus.	5
10	To study the buckling of a column on Buckling of Strut apparatus under various boundary condition and compare the experimental buckling loads with Euler's buckling formula.	5
Total Hours		**30**

Reference Book Lists: (Atleast 5 nos.)

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	Strength of Materials	S. P. Timoshenko	CBS Publishers, Vol. I & II, 1986, ISBN 978-8123910307 & 978-8123910772

2	Strength of Materials	S. S. Rattan	Tata-McGraw-Hill Education Private limited, 2011, 2nd Edition, ISBN 978-0-07-107256-4
3	Strength of Materials	R. S. Khurmi	S. Chand & Co., Multicolour edition, 2008, ISBN 81-219-2822-2
4	A Textbook on Strength of Materials	R. K. Rajput	S. Chand & Co., Revised Edition, 2018, ISBN 9789352533695
5	Strength of Materials	S. Ramamrutham	Dhanpat Rai Publishing House, Reprint, 2015, ASIN: B0B12XKQLY

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9. COURSE TITLE::ENGINEERING ECONOMICS AND ACCOUNTANCY

Course Title	:	Engineering Economics and Accountancy
Course Code	:	OE 301
Semester	:	Third
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Nil
Course Category	:	Open Elective

LEARNING OBJECTIVES:

LO1	:	To introduce the students to some important economic and accounting terms.
LO2	:	To acquaint the students with some economic laws and banking organizations etc.
LO3	:	To make the students capable of recording business transaction under double entry system.
LO4	:	To introduce the students about financial statements.

COURSE OUTCOME: After the end of the course, students will be able to:

CO1	:	Define some important economic and accounting terms.
CO2	:	Explain some basic economic laws.
CO3	:	Explain double entry system of book keeping.
CO4	:	Record business transactions under double entry system of book keeping.
CO5	:	Define Financial Statements.

TEACHING SCHEME: (in hours/week)

Theory			**Practical (credit)**
Lecture	Tutorial	Total credits	
2	0	2	0

TEACHING SCHEME: (in hours)

Theory			**Practical**
Lecture	Tutorial	Total	Practical
30	0	30	0

EXAMINATION SCHEME:

Theory				Practical				Total Marks
ESE		IA		ESE		IA		
Full Marks	Pass Marks	Full Marks	Pass Marks	Full Marks	Pass Marks	Full Marks	Pass Marks	100
60	24	40	16	0	0	0	0	

DETAILED COURSE CONTENT

Unit	**Chapter Title**	**Contents**	**Hours**
Part A: Engineering Economics			
1	Introduction to Economics	Introduction to Economics : 1.1Definition of Economics, its utility and definition of engineering economics 1.2 Meaning and concepts of utility, National income, inflation and wants.	2hrs
2	Demand and Supply	2.1 Meaning of demand, The Law of demand and demand schedule 2.2 Meaning of supply and The Law of supply	2hrs
3	Production	3.1 Meaning and factors of production and meaning of production function	2hrs

		3.2 Factors determining efficiency of labour	
4	Banking Organisations	4.1 Central Bank – its functions 4.2 Commercial banks – its functions	2hrs
5	Pricing	5.1 Objectives of pricing policy 5.2 price determinants 5.3 Price discrimination	2hrs
B. Accountancy			
6	Introduction to Book-Keeping and Accounting	6.1 Definition & objectives of Book- keeping 6.2 Need and advantages of Book- keeping 6.3 Definition of Accounting 6.4 Difference between Book- keeping and Accounting 6.5 Double Entry System – main features 6.6 Advantages and disadvantages of 6.7 Double Entry System 6.8 Concept of Computerized Accounting Software 6.9 Need for Computerized Accounting 6.10 Difference between Manual and Accounting and Computerized Accounting	4hrs
7	Transaction	7.1 Definition 7.2 Meaning of Account 7.3 Classification of Accounts: Traditional Approach, Modern Approach 7.4 Meaning of Debit and Credit 7.5 Rules of Debit and Credit	2hrs
8	Journal and Ledger	8.1 Meaning Journal 8.2 Recording of Transactions in Journal 8.3 Meaning of Ledger 8.4 Objectives and utility of Ledger 8.5 Posting and balancing of Ledger 8.6 Distinction between Journal and Ledger 8.7 Names of different Books of Accounts	4hrs
9	Cash Book	9.1 Meaning and importance of Cash Book 9.2 Characteristics and advantages of Cash Book 9.3 Discount – Trade Discount and Cash Discount 9.4 Different types of Cash Book:-Single Column Cash Book, Double Column Cash Book, Triple Column Cash Book 9.5 Bank Reconciliation Statement –Basic idea	4hrs
10	Trial Balance & Errors in Accounting	10.1 Meaning and objects of Trial Balance 10.2 Main features and advantages of Trial Balance 10.3 Preparation of Trial Balance 10.4 Types of errors in accounting.	3hrs
11	Components of Final Accounts:	11.1 Meaning and objectives of trading Account 11.2 Contents of Trading Account 11.3 Meaning and objectives of Profit and Loss Account 11.4 Contents of Profit and Loss Account 11.5 Meaning of depreciation, revenue expenditure and capital expenditure 11.6 Contents of Balance	3hrs
Total Contact Hours			**30**

Table of Specification															
Units	Allotted Hours	Objective			Short Answer Type				Long Answers Type						Total Marks
		R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1.	2hrs	1			2										3
2.	2hrs		1				2								3
3.	2hrs	2	1												3
4.	2hrs								4						4
5.	2hrs	2	1												3
6.	4hrs	2			2					4					8
7.	2hrs									5					5
8.	4hrs	1				2						6			9
9.	4hrs		1					2				6			9
10.	3hrs	1	1		2		2								6
11.	3hrs	1			2	2		2							7
Total	30 hrs														
Total Marks		**15**			**20**				**25**						**60**

NB:R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

REFERENCE BOOK LIST:

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	Introductory Micro Economics	Sandeep Garg	DhanpatRai Publication Pvt. Ltd. New Delhi
2	Introductory Macro Economics	Sandeep Garg	DhanpatRai Publication Pvt. Ltd. New Delhi
3	Theory and Practice of Accountancy	B. B. Dam R. A. Sarda R. Barman B. Kalita	Capital Publishing Company, Guwahati – 5
4	Book-Keeping & Accountancy	Juneja, Chawla &Saksena	Kalyani Publisher, New Delhi – 110002
5	Tally. ERP 9 For Beginners	Tally Solutions Pvt. Ltd.	Sahaj Enterprises, Bangalore

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COURSE TITLE: ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

Course Code:	Subject Title	Semester	Hours Per Week			Credit
			L	T	P	
AU-301	Essence of Indian Knowledge and Tradition	III	2	0	0	0

Pre-requisites: Nil

Learning Objectives:

1. To introduce the foundational elements of Indian Knowledge Systems (IKS).
2. To explore the scientific and technological heritage of India in ancient times.
3. To build awareness of traditional Indian philosophy, ethics, and medicine.
4. To encourage appreciation for the relevance of IKS in modern contexts.
5. To develop basic research interest in India's indigenous knowledge base and innovations.

Course Outcome (CO): After completion of this course, the students will be able to:

CO	Statement of Course Outcomes
CO1	Explain the concept, scope, and sources of Indian Knowledge Systems.
CO2	Identify significant contributions of ancient India to science, technology, and mathematics.
CO3	Understand traditional Indian governance, education, and core societal values.
CO4	Understand traditional wellness systems and sustainable living practices rooted in Indian Knowledge Systems.
CO5	Appreciate Traditional Indian Knowledge and its relevance in modern contexts.

Syllabus:

Unit No.	Description	Contact Hours
I	**Fundamentals of Indian Knowledge System(IKS):** • Definition, Importance, and Scope of IKS • Overview of major IKS Texts: Vedas, Upanishads, Puranas etc. • Classification of knowledge in Indian traditions: Vidyas (Science) and Kalas (Arts)	4
II	**Science and Technological Heritage:** • Mathematics: Sulbasutras, Contributions of Aryabhatta, Bhaskaracharya • Astronomy and Cosmology: SuryaSiddhanta, Planetary	12

	motion, Concept of Time • Metallurgy and Material Sciences: Iron Pillar, Woltz Steel, Ayurvedic alloys • Chemistry of Dyes, Pigments and Chemicals • Civil Engineering and Architecture: Temple architecture, Town planning and water • management	
III	**Governance, Society and Education Systems:** • Ancient Indian Polity and Administration • Education systems: Gurukula, Nalanda, Takshashila • Value based education: Satya, Ahimsa, Seva • Role of Teacher and Student in Society	6
IV	**IKS in Holistic Wellness and Sustainable Living:** • Foundations of Ayurveda, Yoga and Siddha • Holistic health and wellness practices • Agriculture, Animal husbandry, Sacred groves, Sacred water bodies; Land, Water and Soil Conservation and Management practices.	4
V	**The Modern Relevance of Indian Knowledge Systems:** • Practices of Traditional Indian Knowledge in Modern Science and Engineering • IKS and Entrepreneurships: Organic Farming ,Ayurveda based Start-ups • Government initiatives: National Education Policy 2020, IKS Division under AICTE	4
	Total Contact Hours	30

Suggested Books and Other Study Materials:

1. "Indian Knowledge Systems"-Kapil Kapoor and Avadhesh Kumar Singh.
2. "Ancient Indian Leaps into Mathematics"- B.S.Yadav.
3. "Science and Technology in Ancient India"- O.P.Jaggi.
4. "The Positive Sciences of the Ancient Hindus"- Brajendranath Seal.
5. AICTE Model Curriculum for IKS(Available online)

- NPTEL/SWAYAM courses on IKS
- AICTE-IKS Portal(https://iksindia.org/)
- Digital Library of India (https://dli.gov.in)

Table of Specification for Essence of Indian Knowledge and Tradition (Theory)

Sl No	Contact Hours	Units	Objective			Short answer type				Long answer type						Total Marks
			R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1	4	Unit I	1	1	1	1	2	0	0	0	0	2	0	0	0	8
2	12	Unit II	3	1	1	2	2	0	0	1	2	3	9	0	0	24
3	6	Unit III	1	1	0	2	1	0	0	2	1	1	3	0	0	12
4	4	Unit IV	1	1	0	1	1	0	0	2	1	1	0	0	0	8
5	4	Unit V	1	1	1	2	0	0	0	0	1	2	0	0	0	8
	30	Total Marks	7	5	3	8	6	0	0	5	5	9	12	0	0	60

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Annexure-1: Essence of Indian Knowledge and Tradition (Theory)

SI No	Units	Time Allotted (Hrs)	Percentage Weightage	R	U	AP	AN	E	C	Total Marks
1	I	4	13.33%	2	3	3	0	0	0	8
2	II	12	40.00%	6	5	4	9	0	0	24
3	III	6	20.00%	5	3	1	3	0	0	12
4	IV	4	13.33%	4	3	1	0	0	0	8
5	V	4	13.33%	3	2	3	0	0	0	8
	Total	30	100%	20	16	12	12	0	0	60

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Curriculum Development cell, State Council for Technical Education, Directorate of Technical Education, Assam

Sl. No.	Name	Designation
1	Shri Dhrubajyoti Borah, ACS	Director of Technical Education, Assam
2	Dr. Indrani Gogoi	Joint Director of Technical Education, Assam
3	Dr. Mrinalini Das	Controller of Examination, State Council for Technical Education, DTE, Assam
4	Mr. Ankush Borgohain	Training cum Placement Officer, DTE, Assam
5	Shri Ashok Das	Principal, Assam Textile Institute
6	Dr. Utpal Baruah	Principal, Kamrup Polytechnic
7	Shri Boobool Sarma	Assistant Controller of Examination, SCTE, DTE, Assam

Academic Expert Committee for Mechanical Engineering

Sl No.	Name	Institute	Designation
1	Mr. Ram Krishna Pathak (Member Secretary)	Dibrugarh Polytechnic, Dibrugarh	Member Secretary
2	Mr. Ramen Bharali, Principal (i/c)	Lakhimpur Polytechnic, Bihpuria	Member
3	Mr. Jitumoni Deka, Principal (i/c)	Chirang Polytechnic, Bijni	Member
4	Mrs. Bijulee Goswami, HOD (Retd)	Golapara Polytechnic, Goalpara	Member
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6	Ms. Mimli Das, Lecturer	Assam Engineering Institute, Guwahati	Member