Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
MA0U20D	Probability, Statistics and Numerical Methods	BSC	3	1	0	4	2020

i) COURSEOVERVIEW:

This course introduces students to the modern theory of probability and statistics, covering important models of random variables and techniques of parameter estimation and hypothesis testing. A brief course in numerical methods familiarises students with some basic numerical techniques for finding roots of equations, evaluating definite integrals ,solving systems of linear equations, and solving ordinary differential equations which are especially useful when analytical solutions are hard to find.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Identify the different discrete random experiments and find the probabilities of their occurrence	Apply
CO 2	Identify the different continuous random experiments and find the probabilities of their occurrence	Apply
CO 3	Use statistical inference to draw conclusions concerning characteristics of a population based on attributes of samples drawn from thepopulation	Apply
CO 4	Find roots of equations, definite integrals and interpolating polynomial on given numerical data using standard numerical techniques	Apply
CO 5	Apply standard numerical techniques for solving systems of equations, ordinary differential equations and for fitting curves on given numerical data	Apply

iii) SYLLABUS

Discrete random variables and their probability distributions, Binomial distribution, Poisson distribution, Discrete bivariate distributions, Expectation -multiple random variables.

Continuous random variables and their probability distributions-Uniform, exponential and normal distributions, Continuous bivariate distributions, Expectation-multiple random variables, i.i.d random variables and Central limit theorem.

Population and samples, Sampling distribution of the mean and proportion . Test of hypotheses
Concerning mean and proportion. Confidence interval.
Roots of equations- Newton-Raphson, regulafalsi methods. Interpolation-finite differences,

Newton’s forward and backward formula, Newton’s divided difference method, Lagrange’s method. Numerical integration.

Solution of linear Systems-Gauss-Siedal and Jacobi iteration methods. Curve fitting-method of least squares, Solution of ordinary differential equations-Euler and Classical Runge-Kutta method of second and fourth order, Adams- Moulton predictor-correction method

iv) a) TEXT BOOKS

1. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 8th edition, Cengage,2012
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10 th Edition, John Wiley & Sons,2016.

b) REFERENCES

1. HosseinPishro-Nik, Introduction to Probability, Statistics and RandomProcesses, Kappa Research, 2014 (Also available online at www.probabilitycourse.com)
2. Sheldon M. Ross, Introduction to probability and statistics for engineers and scientists, 4th edition, Elsevier,2009.
3. T. VeeraRajan, Probability, Statistics and Random processes, Tata McGraw-Hill, 2008
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition,2010.

v) COURSE PLAN

Module	Contents	No. of hours
I	Discrete random variables and probability distributions, expected value, mean and variance (discrete) Binomial distribution-mean, variance, Poisson distribution-mean, variance, Poisson approximation to binomial-Discrete bivariate distributions, marginal distributions, Independence of random variables (discrete), Expected values	12
II	Continuous random variables and probability distributions, expected value, mean and variance (continuous)-Uniform, exponential and normal distributions, mean and variance of these distributions Continuous bivariate distributions, marginal distributions, Independent random variables, Expected values, Central limit theorem.	12
III	Population and samples, Sampling distribution of single mean and single proportion(large samples) Confidence interval for single mean and single proportions (large samples) Hypothesis testing basics, large sample test for singlemean and single proportion Large sample test for equality of means and equality of proportions of two populations-t-distribution and small sample t-test for single mean and pooled t-test for equality of means	12

IV	Errors in numerical computation-round-off, truncation and relative error, Solution of equations – Newton-Raphson method and Regula-Falsi method. Interpolation-finite differences, Numerical integration-Trapezoidal rule and Simpson's 1/3rd rule (Proof or derivation of the formulae not required for any of the methods in this module)	12
V	Solution of linear systems-Gauss-Siedal method, Jacobi iteration method Curve-fitting-fitting straight lines and parabolas to pairs of data points using method of least squares -Solution of ODE-Euler and Classical Runge - Kutta methods of second and fourth order- Adams-Moulton predictor-corrector methods	12
	Total hours	**60**

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ME1U20D	ENGINEERING THERMODYNAMICS	PCC	3	1	0	4	2020

i) PRE-REQUISITE: ES0U10C Basics of Civil and Mechanical Engineering.

ii) COURSE OVERVIEW:

The course deals with the science of energy transfer, mainly in the format of Heat and Work. It deals with the concepts of entropy, available energy etc. associated with energy transfers. The subject focuses on phase transformation process of pure substances as well.

iii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO1	Explain the basic concepts of thermodynamics and properties of pure substances.	Understand
CO2	Apply the energy conservation principles in open and closed systems.	Apply
CO3	Examine a thermodynamic system based on the entropy change associated with it.	Analyze
CO4	Make use of steam tables and mollier chart to study property variations during phase change processes.	Apply
CO5	Analyse ideal gases and mixtures using thermodynamic principles and state equations	Apply
CO6	Correlate different thermodynamic properties of an ideal gas and gas mixtures	Understand

iv) SYLLABUS

Zeroth law of thermodynamics and thermometry. First law of Thermodynamics applied to closed and open system. Transient flow. Second Law of Thermodynamics. Carnot cycle, Corollaries of second law. Carnot's theorem and its corollaries. Clausius Inequality. Entropy- its effects and applications. Availability and irreversibility - Properties of pure substances. Ideal Gases, Gas mixtures. Thermodynamic Relations –Clapeyron Equation, equations for internal energy, enthalpy and entropy, specific heats. Throttling process and inversion curve

v) (a) TEXT BOOKS

1) Yunus A Cengel and Boles M.A., *'Thermodynamics'*, 7 th Edition, Tata McGraw Hill, 2009, ISBN-13:978-0-07-107254-0;ISBN-10:0-07-107254-3

2) D. S. Kumar. , *'Applied Thermodynamics'*, S.K. Kataria, 2010.

3) Holman J.P, *Thermodynamics*, McGraw Hill,2004.

(b) REFERENCES

1)Nag P. K., *'Engineering Thermodynamics'*, Tata McGraw Hill, 5th Edition, 2011, ISBN- 9789352606429

2). Moran, M.J., and Shapiro, H.N., *Fundamentals of Engineering Thermodynamics*, 6th ed., John Wiley & Sons, 2008.

3)G.VanWylen, R.Sonntag and C.Borgnakke, *Fundamentals of Classical Thermodynamics*, JohnWiley& Sons,2012.

vi) COURSE PLAN

Module	Contents	No. of hours
I	Role of Thermodynamics and it's applications in Engineering and Science–Basic Concepts Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic System and Control Volume, Surrounding, Boundaries, Types of Systems, Universe, Thermodynamic properties, Process, Cycle, Thermodynamic Equilibrium, Quasi – static Process, State, Point and Path function. Zeroth Law of Thermodynamics, Measurement of Temperature, reference Points, Temperature Scales.	**10**
II	Energy - Work – Pdv work and other types of work transfer, free expansion work, heat and heat capacity. Joule's Experiment- First law of Thermodynamics - First law applied to Non flow Process- Enthalpy- specific heats- PMM1, First law applied to Flow Process, Mass and Energy balance in simple steady flow process. Applications of SFEE, Transient flow –Filling and Emptying Process, limitations of the First Law.	**12**

III	Second Law of Thermodynamics, Thermal Reservoir, Heat Engine, Heat pump – Kelvin-Planck and Clausius Statements, Equivalence of two statements, Reversibility, Irreversible Process, Causes of Irreversibility, PMM2, Carnot's theorem and its corollaries, Absolute Thermodynamic Temperature scale. Clausius Inequality, Entropy- Entropy changes in various thermodynamic processes, principle of increase of entropy and its applications, Entropy generation, Entropy and Disorder, Reversible adiabatic process- isentropic process, Third law of thermodynamics, Available Energy, Availability and Irreversibility- Second law efficiency.	**14**
IV	Pure Substances, Phase Transformations, Triple point, properties during change of phase,T-v, p-v and p-T diagram of pure substance, p-v-T surface, Saturation pressure and Temperature, T-h and T-s diagrams, h-s diagrams or Mollier Charts, Dryness Fraction, steam tables. Property Calculations using steam tables. The ideal Gas Equation, Characteristic and Universal Gas constants, Deviations from ideal Gas Model: Equation of state of real substances, Vander Waals Equation of State, Virial Expansion, Compressibility factor, Law of corresponding state, Compressibility charts.	**12**
V	Mixtures of ideal Gases – Mole Fraction, Mass fraction, Gravimetric and volumetric Analysis, Dalton's Law of partial pressure, Amagat's Laws of additive volumes, Gibbs-Dalton's law Equivalent Gas constant and Molecular Weight, Properties of gas mixtures: Internal Energy, Enthalpy, specific heats and Entropy, Introduction to real gas mixtures- Kay's rule. General Thermodynamic Relations – Combined First and Second law equations – Helmholtz and Gibb's functions - Maxwell's Relations, Tds Equations. The Clapeyron Equation, equations for internal energy, enthalpy and entropy, specific heats, Throttling process, Joule Thomson Coefficient, inversion curve.	**12**
	Total hours	**60**

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ME1U20E	MANUFACTURING PROCESS	PCC	3	1	0	4	2020

i) PREREQUISITE: ME1U20C Metallurgy and Material Science

ii) COURSE OVERVIEW:

Goal of this course is to give the students an exposure to various manufacturing processes like casting, forming and welding. They will also gain an understanding on various work holding techniques.

iii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Explain various casting, rolling and joining techniques as per required applications	Understand
CO 2	Apply concepts of various manufacturing processes to solve simple problems	Apply
CO 3	Identify the most suitable metal forming technique for a given condition	Apply
CO 4	Explain the different clamping techniques used in engineering applications	Understand

iv) SYLLABUS

Casting: Characteristics of sand, patterns, cores, chaplets, simple problems. Solidification of metals. Elements of gating system. Special casting process. Defects in castings. Superalloy production methods.

Welding: welding metallurgy, destructive and non-destructive tests of welded joints. Resistance welding. Arc welding. Thermit welding. Friction welding. Oxyacetylene welding. Brazing, Soldering, Adhesive bonding.

Rolling: principles, types of rolls and rolling mills, mechanics of flat rolling, defects, miscellaneous rolling process. Plastic deformation of metals. Flow rules.

Forging: material characterization, classification, forging methods analysis, applications, deformation zone geometry, defects in forging. Metal extrusion: metal flow, mechanics of extrusion, defects. Wire, rod, and tube drawing: mechanics of rod and wire drawing, drawing defects. Deep drawing.

Locating and clamping methods: locating methods, locating from plane, circular, irregular surface. Locating methods and devices.Basic principles of clamping. Sheet metal operations. Press tool operations: tension, compression, tension and compression operations, applications. Fundamentals of die cutting operations, types of die construction.

v) a) TEXT BOOKS

1) Serope Kalpakjian; Steven R. Schmid, Manufacturing Engineering and Technology, 7th Edition, Publisher: Prentice Hall, ISBN-10 0-13-608168-1, ISBN- 13 978-0-13- 608168-5,2018
2) Rao, P.N. Manufacturing Technology Foundry, Forming and Welding, 2nd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi;2017
3) M. P. Groover, Principles of Modern Manufacturing, 5th edition. Wiley India Private Limited,2015.

b) REFERENCES

1) HajraChoudhury S.K., Elements of Manufacturing Technology, Vol. - I, Media Publications.2010
2) Roy. A. Lindberg, Processes and Materials of Manufacture, PHI / Pearson education, 2006
3) Paul Degarmo E, Black J.T and Ronald A. Kosher, Materials and Processes, in Manufacturing, Eight Edition, Prentice -Hall of India,1997.

vi) COURSE PLAN

Module	Contents	No. of hours
I	Casting:- Characteristics of sand -pattern and allowances -type of patterns cores-core prints-chaplets-simple problems. Elements of gating system-gating system, pouring time, choke area - risering Caine's method-chills –simple problems. Special casting process:- shell molding, precision investment, die casting, centrifugal casting, continues casting, squeeze casting surface roughness obtainable and application of each casting process Defects in castings :- Shaping faults arising in pouring, Inclusions and sand defects, Gas defects, Shrinkage defects, Contraction defects, Dimensional errors, Compositional errors and segregation; significance of defects on Mechanical properties. Superalloy Production Methods: Vacuum Induction Melting; Electroslag Remelting; Vacuum Arc Remelting	**12**

II	Welding:-welding metallurgy, diffusion, heat affected zone, driving force for grain growth, grain size and hardness- joint quality: porosity, slag inclusions, cracks, surface damage, residual stress lamellar tears, stress reliving, heat treatment of welded joints - weldability - destructive and non destructive tests of weldedjoints Resistance welding: HAZ, process and correlation of process parameters with welded joints of spot, seam, projection, stud arc, percussion welding applications of each welding process –simple problems Arc welding:-HAZ, process and correlation of process parameters with welded joints of shielded metal arc, submerged, gas metal, flux cored, electro gas, electro slag, gas tungsten, plasma arc, electron beam, laser beam –simple problems - Thermit welding, friction welding- applications of each welding process Oxyacetylene welding:-chemistry, types of flame and its applications - brazing- soldering - adhesive bonding.	**12**
III	Rolling:- principles - types of rolls and rolling mills - mechanics of flat rolling, roll pressure distribution, neutral point, front and back tension, torque and power, roll forces in hot rolling, friction, deflection and flattening, spreading -– simpleproblems. Rolling defects-vibration and chatter - flat rolling -miscellaneous rolling process: shape, roll forging, ring, thread and gear, rotary tube piercing, tube rolling - applications – simpleproblems. Plastic deformation of metals - stress-strain relationships- State of stress - yield criteria of Tresca, von Mises, and comparisons – applications Flow rules -power and energy deformations - Heat generation and heat transfer in metal forming process -temperature in forging.	**12**
IV	Forging: material characterization; grain flow and strength - Forging:- classification - open die forging, forces and work of deformation - Forging methods analysis:- slab method only, solid cylindrical, rectangular work piece in plane strain, forging under sticking condition -simple problems-applications. Deformation zone geometry – die forging: - impression, close, coining, skew rolling etc. –simple problems– defects in forging Metal extrusion: - metal flow - mechanics of extrusion:-deformation and friction, actual forces, die angle, forces in hot extrusion – miscellaneous process- defects -–simple problems- applications. Wire, Rod, and tube drawing: - mechanics of rod and wire drawing: deformation, friction, die pressure and angle, temperature, reduction per pass, drawing flat strip and tubes- –simple problems- drawing defects swaging-applications. Deep drawing- deep drawability, simple problems - different drawing Practices	**12**

V	Locating and clamping methods: - basic principle of location; locating methods; degrees of freedom; locating from plane, circular, irregular surface –simple problems. Locating methods and devices: - pin and button locators, rest pads and plates, nest or cavitylocation. Basic principles of clamping:- strap, cam, screw, latch, wedge, hydraulic and pneumatic clamping –simple problems. Sheet metal operations: Press tool operations: shearing action, shearing operations: blanking, piercing, simple problems, trimming, shaving, nibbing, notching – simple problems - applications. Tension operations: stretch forming - Compression operations: - coining, sizing, ironing, hobbing - tension and compression operations: drawing, spinning, bending, forming, embossing – simple problems- applications. Fundamentals of die cutting operations - inverted, progressive and compound die - simple problems.	**12**
	Total hours	**60**

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ME1U20F	Fluid Machinery	PCC	3	1	0	4	2020

i) PREREQUISITE: Nil

ii) COURSEOVERVIEW:

This course provides an understanding of reciprocating and rotary fluid machinery. The course consists of hydraulic pumps, turbines, air compressors and gas turbines.

iii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO1	Explain the basic concepts and working principle of hydraulic turbines, hydraulic pump, air compressors and gas turbines.	Understand
CO2	Solve the cases of work transfer by jet on moving and fixed plates	Apply
CO3	Solve the performance parameters of different hydraulic turbines using velocitytriangles.	Apply
CO4	Apply indicator diagrams and velocity triangles to find the work done and efficiency of hydraulic pumps.	Apply
CO5	Solve the work required for different types of compressors.	Apply
CO6	Solve the performance parameters of gas turbines utilizing thermodynamic cycle.	Apply

iv) SYLLABUS

Impact of jets: Hydrodynamic thrust of jet on a fixed and moving surface ,Series of vanes - work done and efficiency, Hydraulic Turbines: Pelton wheel, Francis turbine and Kaplan turbine- Constructional features, Velocity triangles, work done and efficiencies

Characteristic curves of turbines, draft tubes, surge tanks, Cavitation, Specific speed and Unit quantities. Rotodynamic pumps- centrifugal pump, velocity triangles, work, efficiency and losses, H-Q characteristic, Cavitation, Pumps in series and parallel operations. Performance characteristics

Positive displacement pumps- reciprocating pump, work required and efficiency- indicator diagram- Air vessels and work saved, Multistage pumps, selection of pumps, hydraulic ram, Accumulator, Intensifier, Jet pumps, gear pumps, vane pump and lobe pump.

Compressors: reciprocating compressor- work with and without clearance volume, efficiencies, multistage compressor, intercooler
Centrifugal compressor-working, velocity diagram, work done
Axial flow compressors:- working, velocity diagram, Roots blower, vane compressor, screw compressor.

Gas turbines: Classification, Thermodynamic cycle of gas turbine, Effect of compressor and turbine efficiencies, Optimum pressure ratio, Comparison of gas turbine and IC engines, Analysis of open cycle gas turbine, Improvements of the basic gas turbine cycles efficiency and work output, Combustion chambers for gas turbines, pressure loss and stability loop.

v) a) TEXTBOOKS

1) Subramanya, K., Hydraulic Machines, Tata McGraw Hill, 1st edition,2017
2) Rathore, M., Thermal Engineering, Tata McGraw Hill, 1st edition,2010

b) REFERENCES

1) Ganesan, V., Gas Turbines, Tata McGraw Hill, 3rd edition,2017.
2) Sawhney G.S., Thermal and Hydraulic Machines, Prentice Hall India Learning Private Limited; 2nd edition ,2011

vi) COURSEPLAN

Module	Contents	No.of hours
I	Impact of jets: Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat and curve),– Series of vanes - work done and efficiency. Hydraulic Turbines : Impulse and Reaction Turbines – Degree of reaction – Pelton Wheel – Constructional features - Velocity triangles – Euler's equation – Speed ratio, jet ratio and work done, losses and efficiencies, design of Pelton wheel – Inward and outward flow reaction turbines- Francis Turbine – Constructional features –Velocity triangles, work done and efficiencies. Axial flow turbine (Kaplan) Constructional features –Velocity triangles- work done and efficiencies	**12**
II	Characteristic curves of turbines – theory of draft tubes – surge tanks – Cavitation in turbines – Governing of turbines – Specific speed of turbine , Type Number– Characteristic curves, scale Laws – Unit speed – Unit discharge and unit power. Rotary motion of liquids – free, forced and spiral vortex flows Rotodynamic pumps- centrifugal pump impeller types,-velocity triangles manometric head- work, efficiency and losses, H-Q characteristic, typical flow system characteristics, operating point of a pump. Cavitation in centrifugal pumps- NPSH required and available- Type number-Pumps in series and parallel operations. Performance characteristics- Specific speed-Shape numbers – Impeller shapes based on shape numbers.	**12**

III	Positive displacement pumps- reciprocating pump – Single acting and double acting- slip, negative slip and work required and efficiency- indicator diagram- acceleration head - effect of acceleration and friction on indicator diagram – speed calculation- Air vessels and their purposes, saving in work done to air vessels multi cylinder pumps. Multistage pumps-selection of pumps pumping devices-hydraulic ram, Accumulator, Intensifier, Jet pumps, gear pumps vane pump and lobe pump.	**12**
IV	Compressors: classification of compressors, reciprocating compressor- single stage compressor, equation for work with and without clearance volume, efficiencies, multistage compressor, intercooler, free air delivered (FAD). Centrifugal compressor-working, velocity diagram, work done, power required, width of blades of impeller and diffuser, isentropic efficiency, slip factor and pressure coefficient, surging and chocking. Axial flow compressors:- working, velocity diagram, degree of reaction, performance. Roots blower, vane compressor, screw compressor.	**12**
V	Gas turbines: classification, Thermodynamic analysis of gas turbine cycles-open, closed and semi closed cycle; ideal working cycle-Brayton cycle-P-v and T-s diagram, thermal efficiency. Effect of compressor and turbine efficiencies. Optimum pressure ratio for maximum specific work output with and without considering machine efficiencies. Comparison of gas turbine and IC engines, Analysis of open cycle gas turbine, Improvements of the basic gas turbine cycles-regeneration, intercooling and reheating-cycle efficiency and work output-Condition for minimum compressor work and maximum turbine work. Combustion chambers for gas turbines. pressure loss in combustion process and stability loop.	**12**
	Total hours	**60**

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
HS0U20A	Professional Ethics	HSC	2	0	0	2	2020

i) COURSEOVERVIEW:

To enable students to create awareness on ethics and human values.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Infer the core values that shape the ethical behaviour of a professional.	Understand
CO 2	Apply philosophical concepts discussed in the course to personal and contemporary issues.	Apply
CO 3	Explain the role and responsibility of engineer in technological development without compromising personal ethics and legal ethics.	Understand
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.	Apply
CO 5	Demonstrate the concept of Corporate Social Responsibility, and explore its relevance to ethical business activity	Understand
CO 6	Apply the knowledge of human values and social values to contemporary ethical values and global issues.	Apply

iii) SYLLABUS

Morals, values and Ethics – Integrity- Academic Integrity-Work Ethics- Service Learning- Civic Virtue- Respect for others- Living peacefully-Caringand Sharing- Honestly- Courage- Cooperation commitment- Empathy-Self Confidence -Social Expectations.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy- Profession and Professionalism- Models of professional Roles-Theories about right action –Self-Interest-Customs and Religion- Uses of Ethical Theories.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality- Role of confidentiality in moral Integrity-Conflicts of interest- Occupational crime- Professional rights- Employee right- IPR Discrimination.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and Advisors-Moral leadership.

iv) TEXT BOOKS

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi, 2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited, New Delhi, 2006.

OTHER REFERENCES

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, NewDelhi,2014.
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, NewJersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics-Concepts and cases, Wadsworth Thompson Learning, Unitedstates,2005.
4. http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

(v) COURSE PLAN

Module	Contents	No. of hours
I	Morals, values and Ethics, Integrity, Academic Integrity, Work Ethics Service Learning, Civic Virtue, Respect for others, Living peacefully Caring and Sharing, Honesty, Courage, Co-operation commitment Empathy, Self Confidence, Social Expectations	6
II	Senses of Engineering Ethics, Variety of moral issues, Types of Inquiry-Moral dilemmas, Moral Autonomy, Kohlberg's theory Gilligan's theory, Consensus and Controversy, Profession & Professionalism, Models of professional roles, Theories about right action-Self-interest-Customs and Religion, Uses of Ethical Theories	6
III	Engineering as Experimentation, Engineers as responsible Experimenters-Codes of Ethics, Plagiarism, A balanced outlook on law-Challenger case study, Bhopal gas tragedy	6
IV	Collegiality and loyalty, Managing conflict, Respect for authority Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest-Occupational crime, Professional rights, Employee right, IPR, Discrimination	6

V	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics-Role in Technological Development, Moral leadership-Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	6
	Total Hours	**30**

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
NC0U20B	CONSTITUTION OF INDIA	MNC	2	0	0	---	2020

i) PREREQUISITE: Nil

ii) PREAMBLE:

The study of the Constitution of India enables the students to

1) Understand the fundamental rights & duties and directive principles
2) Understand the functions of Executive, Legislature and Judiciary of the Union and the States
3) Understand the relation between the Union and the States
4) Provides the student the knowledge and strength to face the society and people.

iii) COURSE OUTCOMES:

After the completion of the course, the student will be able to:

CO 1	Explain the historic background of the constitution of India and its features.
CO 2	Describe the fundamental rights, duties and directive principles of state policy.
CO 3	Discuss the machinery of executive, legislature and judiciary of the Union and the States.
CO4	Explain the relation between the Union and the States.
CO 5	Demonstrate national and patriotic spirit as responsible citizens of the country.

iv) SYLLABUS

Definition, historical background, features, preamble, territory, citizenship. State, fundamental rights, directive Principles, fundamental duties. The machinery of the union government. Government machinery in the states, The system, Statutory Institutions, miscellaneous provisions.

v) a) TEXT BOOKS

1. M. Laxmikanth, Indian Polity, McGraw Hill Education India, 6/e, 2019.
2. D. D. Basu, Introduction to the Constitution of India, Lexis Nexis, New Delhi, 24/e,2019.
3. P. M. Bhakshi, The Constitution of India, Universal Law, 14/e, 2017.

b) REFERENCES

1. Ministry of Law and Justice, TheConstitution of India, Govt. of India, New Delhi, 2019.
2. J. N. Pandey, The Constitutional Law of India, Central Law agency, Allahabad, 51/e,2019.
3. M. V.Pylee, India's Constitution, S. Chand and Company, New Delhi, 16/e, 2016.

vi) COURSE PLAN

Module	Contents	No. of hours
I	Definition of constitution, historical back ground, salient features of the constitution. Preamble of the constitution, union and its territory. Meaning of citizenship, types, termination of citizenship.	4
II	Definition of state, fundamental rights, general nature, classification, right to equality, right to freedom, right against exploitation. Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences. Directive principles of state policy, classification of directives, fundamental duties.	7
III	The Union Executive, the President, the Vice President, the Council of Ministers, the Prime Minister, Attorney-General, functions. The parliament, composition, Rajyasabha, Loksabha, qualification and disqualification of membership, functions of parliament. Union judiciary, the supreme court, jurisdiction, appeal by special leave.	7
IV	The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories. The State Legislature, composition, qualification and disqualification of membership, functions. The state judiciary, the high court, jurisdiction, writs jurisdiction.	6
V	Relations between the Union and the States, legislative relation, administrativerelation,financialRelations,InterStatecouncil,finance commission. Emergency provision, freedom of trade commerce and intercourse, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals. Official language, elections, special provisions relating to certain classes, amendment of the Constitution.	6
	Total hours	30

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ME1U28B	FM and HM LAB	PCC	0	0	3	2	2020

i) PRE-REQUISITE: ME1U20B Mechanics of Fluids

ii) COURSE OVERVIEW:

Objective of the course is to develop a platform where the students can enhance their engineering knowledge in the fluid mechanics domain by applying the theoretical knowledge acquired

iii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Determine the coefficient of discharge of flow measuring devices	Apply
CO 2	Calibrate various flow measuring devices	Apply
CO 3	Evaluate the losses in pipes	Apply
CO 4	Determine the metacentric height and stability of floating bodies	Apply
CO 5	Determine the efficiency and plot the characteristic curves of different types of pumps and turbines	Analyze

iv) LIST OF EXPERIMENTS

1. Determination of coefficient of discharge and calibration of notches
2. Determination of coefficient of discharge and calibration of orificemeter
3. Determination of coefficient of discharge and calibration of venturimeter
4. Determination of hydraulic coefficients of orifice
5. Determination of Chezy's Constant and Darcy's coefficient on pipe friction apparatus
6. Bernoulli's experiment
7. Determination of metacentric height and radius of gyration of floating bodies
8. Performance test on positive displacement pumps
9. Performance test on centrifugal pumps
10. Performance test on gear pump

11. Performance test on impulse turbine
12. Performance test on Francis turbine
13. Performance test on Kaplan turbine
14. Speed variation test on impulse turbine

v) REFERENCES

1) Yunus A. Cenegel, John M. Cimbala; *Fluid Mechanics- Fundamentals and Applications*, 4th edition, McGraw Hill, 2019

2) Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, John W. Mitchell*Fluid Mechanics*, John Wiley and sons, 9th Edition,2016

3) ModiP.N and Seth S.M, *Hydraulics and Fluid Mechanics Including Hydraulic Machines*, Standard Book House, New Delhi, 22nd Edition,2019

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ME1U28C	MACHINE TOOLS LAB- I	PCC	0	0	3	2	2020

i) PRE-REQUISITE: EST 120 Introduction to Civil & Mechanical Engineering

ii) COURSE OVERVIEW:

The main objective of this lab is to practice on machine tools and identify, manipulate and control various process parameters during machining processes in manufacturing industry.

iii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Identify various process parameters and their influence on surface properties of various metals.	Understand
CO 2	Recommend appropriate speed, feed and depth of cut for various processes on lathe machine.	Apply
CO 3	Position, hold and locate work material and cutting tools in various basic machine tools.	Apply
CO 4	Choose suitable welding process for different metals.	Understand
CO 5	Choose appropriate heat treatment process for different metals.	Understand

iv) LIST OF EXPERIMENTS

Exercise No.	Description of exercises
I	**Exercises on centre lathe**:- Facing, plain turning, step turning and parting – groove cutting, knurling and chamfering - form turning and taper turning – eccentric turning, multi-start thread, square thread and internal thread etc. Measurement of **cutting temperature and tool life** in turning and machine tool **alignment test** on lathe machine.
II	**Exercises on Drilling machine**- drilling, boring, reaming etc. Measurement of cutting forces in drilling process and correlate with varying input parameters
III	**Exercises on Shaping machine: -** flat surfaces, grooves and key ways**.**
IV	**Exercises on Slotting machine: -** flat surfaces, grooves and key ways**.**
V	**Exercises on Milling machine: -** face milling, end milling – spur and helical gear cutting – milling of keyways etc. Machine tool alignment test on milling machine

VI	**Exercises on Grinding machine** Exercise on surface grinding, cylindrical grinding. Measurement of cutting forces and roughness in grinding process and correlate with varying input parameters.
VII	**Exercises on Welding** Study and demonstration of arc and gas welding: - butt welding and lap welding of M.S. sheets.
VIII	**Planing and Broaching machine** Study and demonstration of planning and broaching machine.
IX	**Metallurgy** Specimen preparation, etching & microscopic study of Steel, Cast iron and Brass and Grain size measurement. **Heat treatment study**: –Effect on mechanical properties and microstructure of Steel, Cast Iron and Brass. Studies of various quenching mediums, **Carryout heat treatments on steel**based on ASM handbook vol.4 and observe the hardness obtained.

v) REFERENCES

1) Acharkan. N., Machine Tool Design Vol. 1 to 4, MIR Publication,2000.
2) HMT, Production Technology, Tata McGraw Hill,2001
3) W. A. J. Chapman, Workshop Technology Part I, ELBS & Edward Arnold Publishers,1956
4) G. S. Sawhney, Mechanical Experiments and Workshop Practice, Dreamtech Press, 2019.