PART – B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
Cutting of Gear Teeth using Milling Machine.

Scheme of Examination:
ONE question from part -A:	**30** Marks
ONE question from part -B:	**10** Marks
Viva -Voice:	**10** Marks

Total : 50 Marks

ENGINEERING MATHEMATICS – IV

Sub Code	:	10MAT41	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

PART-A

UNIT-1
Numerical Methods- 1

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, Taylor's series method, modified Euler's method, Runge-kutta method of fourth-order. Milne's and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

6 Hours

UNIT-2
Numerical Methods – 2

Numerical solution of simultaneous first order ordinary differential equations: Picard's method, Runge-Kutta method of fourth-order.

Numerical solution of second order ordinary differential equations: Picard's method, Runge-Kutta method and Milne's method.

6 Hours

UNIT-3
Complex variables – 1

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions.

Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.

7 Hours

UNIT-4
Complex variables – 2
Conformal Transformations: Bilinear Transformations. Discussion of Transformations: $w = z^2$, $w = e^z$, $w = z + (a^2 / z)$. Complex line integrals- Cauchy's theorem and Cauchy's integral formula.

7 Hours

PART-B

UNIT-5
Special Functions
Solution of Laplace equation in cylindrical and spherical systems leading Bessel's and Legendre's differential equations, Series solution of Bessel's differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

7 Hours

UNIT-6
Probability Theory - 1
Probability of an event, empherical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye's theorem.

6 Hours

UNIT-7
Probability Theory- 2
Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions.

7 Hours

UNIT-
Sampling Theory
Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student's t-distribution. Chi -Square distribution as a test of goodness of fit

6 Hours

36

TEXT BOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

REFERENCE BOOK:
1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers.

APPLIED THERMODYNAMICS

Subject Code	**: 10ME43**	**IA Marks**	**: 25**
Hours/Week	**: 04**	**Exam Hours**	**: 03**
Total Hours	**: 52**	**Exam Marks**	**: 100**

PART-A

UNIT - 1
Combustion thermodynamics: Theoretical (Stoichiometric) air and excess air for combustion of fuels. Mass balance, actual combustion. Exhaust gas analysis. A./ F ratio, Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, Combustion efficiency, adiabatic flow temperature.

07 Hours

UNIT- 2
Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles.

06 Hours

UNIT - 3

I.C. Engine: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.

06 Hours

UNIT - 4

Vapour Power Cycles: Carnot vapour power cycles, drawbacks as a reference cycle, Simple Rankine cycle, description, T- S diagram, analysis for performance , comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycle, open and closed feed water heaters, Reheat Rankine cycle.

07 Hours

PART-B

UNIT - 5

Reciprocating Compressors: Operation of a single stage reciprocating compressors, work input through P-V diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multistage compressor, saving in work, optimum intermediate pressure, inter- cooling, minimum work for compression.

06 Hours

UNIT - 6

Gas turbine and Jet propulsion: Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency, Jet propulsion and Rocket propulsion.

07 Hours

UNIT - 7

Refrigeration: Vapour compression refrigeration system ; description, analysis, refrigerating effect, capacity , power required, units of refrigeration, COP , Refrigerants and their desirable properties. Air cycle refrigeration;

reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system, steam jet refrigeration.

06 Hours

UNIT - 8
Psychometry: Atmospheric air and psychometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidities and the relation between the two enthalpy and adiabatic saturation temperature. Construction and use of psychometric chart . Analysis of various processes; heating, cooling , dehumidifying and humidifying. Adiabatic mixing of moist air. Summer and winter air conditioning.

07 Hours

Data Hand Book :
1. **Thermodynamic data hand book,** B.T. Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroiya, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOKS:
1. **Basic and applied Thermodynamics**, P.K. Nag, 2nd Ed., Tata McGraw Hill Pub.Co,2002
2. **Applied Thermodynamics**, Rajput, Laxmi Publication
3. **Applied Thermodynamics**, B.K. Venkanna, Swati B. Wadavadagi, PHI, New Delhi, 2010

REFERENCE BOOKS:
1. **Thermodynamics , An engineering approach**, Yunus, A. Cengel and Michael A.Boies, 6th Ed., Tata McGraw Hill pub. Co., 2002,
2. **Fundamental of Classical Thermodynamics,** G.J. Van Wylen and R.E. Sontang Wiley eastern.

KINEMATICS OF MACHINES

Subject Code	: 10ME44	**IA Marks**	: 25
Hours/Week	: 04	**Exam Hours**	: 03
Total Hours	: 52	**Exam Marks**	: 100

PART – A

UNIT - 1
Introduction: Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine.
Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

07 Hours

UNIT - 2
Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.
Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

06 Hours

UNIT - 3
Velocity and Acceleration Analysis of Mechanisms (Graphical Methods)
Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles .in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

07 Hours

UNIT - 4

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method

Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

06 Hours

PART – B

UNIT - 5

Velocity and Acceleration Analysis of Mechanisms (Analytical Methods): Analysis of four bar chain and slider crank chain using analytical expressions. (Use of complex algebra and vector algebra)

06 Hours

UNIT - 6

Spur Gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification.

07 Hours

UNIT - 7

Gear Trains: Simple gear trains, Compound gear trains for large speed. reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

07 Hours

UNIT - 8

Cams: Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

06 Hours

TEXT BOOKS:
1. **"Theory of Machines",** Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines",** Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006

REFERENCE BOOKS:
1. **"Theory of Machines & Mechanisms**", J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambekar, PHI, 2007

Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself.

MANUFACTURING PROCESS – II
(Metal Removing Process)

Subject Code	**: 10ME45**	**IA Marks**	**: 25**
Hours/Week	**: 04**	**Exam Hours**	**: 03**
Total Hours	**: 52**	**Exam Marks**	**: 100**

PART – A

UNIT - 1
Theory of Metal Cutting: Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation, Types of Chips. Merchants circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis. Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.

07 Hours

UNIT - 2
Cutting Tool Materials: Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors

affecting heat generation. Heat distribution in tool and work piece and chip. Measurement of tool tip temperature.

07 Hours

UNIT - 3
Turning (Lathe), Shaping and Planing Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Planing Machine, Driving mechanisms of lathe, shaping and planing machines, Different operations on lathe, shaping machine and planing machine. Simple problems on machining time calculations

07 Hours

UNIT - 4
Drilling machines: Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials.
Introduction to CNC machines- Principles of operation. Axes of NC machine-Coordinate systems. Basics of Manual part programming methods.

06 Hours

PART – B

UNIT - 5
Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations.
Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.

06 Hours

UNIT - 6
Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centerless, cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters. Dressing and truing of grinding wheels.

07 Hours

UNIT - 7:

Broaching process - Principle of broaching. Details of a broach. Types of broaching machines-constructional details. Applications. Advantages and Limitations.

Finishing and other Processes Lapping and Honing operations – Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application.

06 Hours

UNIT - 8

Non-traditional machining processes: Need for non traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.

06 Hours

TEXT BOOKS:
1. **Workshop Technology,** Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. **Production Technology,** R.K.Jain, Khanna Publications, 2003.
3. **Production Technology,** HMT, Tata Mc Graw Hill, 2001.

REFERENCE BOOKS:
1. **Manufacturing Science**, Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. **Fundamentals of Metal Machining and Machine Tools,** G. Boothroyd, McGraw Hill, 2000.