Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Science & Technology

Scheme of Examination and Evaluation

Bachelor of Technology (Mechanical Engineering) (Choice Based Credit System)

III Semester B. Tech (Mechanical Engineering)

Sr No	Course Code	Category	Course Title	Teaching Scheme (Hours/Week)			Credits	Examination Scheme								
								Theory					Practical			
				L	T	P		Duration of Exam (Hrs)	Max. Marks College Assessment	Max. Marks University Assessment	Total Marks	Min. Passing Marks	Max. Marks College Assessment	Max. Marks University Assessment	Total Marks	Min. Passing Marks
1	BTME301T	Basic Science course	Applied Mathematics – III	3	-	-	3	3	30	70	100	45	-	-	-	-
2	BTME302T	Professional core courses	Manufacturing Processes	3	-	-	3	3	30	70	100	45	-	-	-	-
3	BTME302P	Professional core courses	Manufacturing Processes Lab	-	-	2	1	-	-	-	-	-	25	25	50	25
4	BTME303T	Professional core courses	Fluid Mechanics	3	-	-	3	3	30	70	100	45	-	-	-	-
5	BTME304T	Professional core courses	Kinematics of Machines	3	-	-	3	3	30	70	100	45	-	-	-	-
6	BTME305P	Professional core courses	Machine Drawing & Solid Modelling	-	1	2	2	-	-	-	-	-	50	50	100	50
7	BTME306T	Professional core courses	Material Science & Engineering	3	-	-	3	3	30	70	100	45	-	-	-	-
8	BTME307P	Project work, seminar and internship in industry or elsewhere	Skill Development (Basics of Computer aided drafting)		-	2	1	-	-	-	-	-	50	-	50	25
9	BTME308P	Mandatory Course	Sports / Yoga / NSS/NCC	-	-	2	Audit (0)	College Assessment in Grades O, A, B, C (Evaluation is to be done out of 50 marks, Evaluation guidelines mentioned in the syllabus of concerned course)								
Total				**15**	**1**	**8**	-	-	**150**	**350**	**500**	-	**125**	**75**	**200**	-
Semester Total				**24**			**19**	**Marks 700**								

RTM Nagpur University - Mechanical Engineering
B. Tech 3rd Semester
Applied Mathematics – III (BTME301T)
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	**Applied Mathematics – III**	3	-	-	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	A primary objective is to introduce and develop advanced mathematical skills of students that are imperative for effective understanding of engineering subjects.
2	The topics covered will equip them with the techniques to understand advanced level Mathematics and its applications that would enrich logical thinking power.
3	Understand the impact of scientific and engineering solutions in a global and societal context.
4	Create the groundwork for post-graduate courses, specialized study, and research in mathematics.
Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Apply Laplace Transform to solve ordinary differential equations, Integral equations and Integro-differential Equations.
CO2	Apply Fourier series in the analysis of periodic functions in terms sine and cosine encountered in engineering problems and Fourier Transform to solve integral equations.
CO3	Learn the concept of differentiating, integrating and expanding of analytic functions in complex numbers and their applications such as evaluation of integrals of complex functions
CO4	Solve partial differential equations of first order, higher order with constant coefficients and of second order using method of separation of variables.
CO5	Analyze real world scenarios to recognize when matrices are appropriate, formulate problems about the scenarios, creatively model these scenarios in order to solve the problems using multiple approaches. .

SYLLABUS	
Contents	**No of hours**
Unit I **LAPLACE TRANSFORM** Definition, Properties (Statement only), Evaluation of integrals by Laplace transform, Inverse Laplace transform using partial fraction method and properties of Laplace transform, Convolution theorem (Statement only), Laplace transform of periodic functions (Statement only), Unit step function and unit impulse function (Statement only), Applications of Laplace transform to solve ordinary differential equations, Integral equations & Integro-differential equations.	08
Unit II **FOURIER SERIES & FOURIER TRANSFORM** **Fourier Series:** Periodic functions and their Fourier expansions, Even and odd functions, Change of interval, Half range expansions. **Fourier Transform:** Definition and Properties (excluding FFT), Fourier integral theorem, Applications of Fourier transform to solve integral equations.	08
Unit III **FUNCTIONS OF COMPLEX VARIABLES** Analytic function, Cauchy-Riemann conditions, Harmonic function (Excluding orthogonal system), Milne-Thomson method, Cauchy integral theorem & integral formula (Statement only), Taylor‟s & Laurent‟s series (Statement only), Zeros and singularities of analytic function, Residue theorem (Statement only).	08
Unit IV **PARTIAL DIFFERENTIAL EQUATIONS** Partial differential equations of first order first degree i.e. Lagrange‟s form, Linear homogeneous equations of higher order with constant coefficients, Method of separationsof variables, Simple applications of Laplace transform to solve partial differential equations (One dimensional only).	08
Unit V **MATRICES** Linear dependence of vectors, Eigen values and Eigen vectors, Reduction to diagonal form, Singular value decomposition, Sylvester’s theorem (Statement only), Largest eigen value and corresponding eigen vector by iteration method.	08

Text/Reference Books:

(1) Advanced Engineering Mathematics (Wiley), Erwin Kreyzig.
(2) Higher Engineering Mathematics (Khanna Publishers), B. S. Grewal.
(3) Advanced Engineering Mathematics (S. Chand), H. K. Dass.
(4) Applied Mathematics for Engineers and Physicists, L. A. Pipes and L. R. Harville.
(5) Advanced Mathematics for Engineers, Chandrika Prasad.
(6) A text book of Engineering Mathematics (Laxmi Publication), N. P. Bali & M. Goyal.

RTM Nagpur University- Mechanical Engineering
B. Tech 3rd Semester
Manufacturing Processes (BTME302T)
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	Manufacturing Processes	3	-	-	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	To understand the pattern making, gating system, moldings process and casting process.
2	To expose the students to the principles of the metal joining methods.
3	To study metal forming techniques, rolling, drawing, sheet metal forming, shearing operations and knowledge about process behavior.
4	To learn about plastics, ceramics and glass along with properties, types, applications and shaping

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Understand the importance of manufacturing processes, techniques of pattern making and molding with their properties. Design gating system along with selection ofdifferent types of melting furnaces and special casting process.
CO2	Get acquainted with the basic concept of joining process, welding process and its types, defects and application.
CO3	Get acquainted with the forming process for metal, mechanics of forming process along with different types of rolling machine.
CO4	Understand and define press working process along with its classification, types and terminology, different types of dies and introduction to shaping operation.
CO5	Understand introduction to plastics, ceramics and glasses, its properties, application, forming and its shaping.

SYLLABUS	
Contents	**No of hours**
Unit I **Pattern Making & Moulding:** - Pattern making: Types, materials used, Pattern making allowances, color codes. **Moulding sand:** Composition, molding sand properties, Sand testing - Grain fineness, moisture content, clay content and permeability test. **Core making:** - Types, core material & its properties. **Gating System & Casting Processes:** - Elements of gating systems, riser. **Melting furnaces** - Types, Cupola, **Casting defects** - Types, Causes & remedies **Types of casting:** Investment Casting, Centrifugal Casting, Slush Casting, Die Casting, Shell moulding and CO_2 moulding.	08
Unit II **Joining Processes:** - Welding, brazing and Soldering Broad classification of welding processes, types and Principles. Electrodes, weldability of Metals, Welding equipments. Fixtures, Arc Welding & Gas Welding Processes, TIG Welding, MIG Welding, Spot Welding, Plasma Arc welding and Electron Laser Beam welding. Inspection, Defects in various joints and their remedies.	08
Unit III **Forming Process for metals:**- Rolling, Forging, Extrusion, Drawing, Types & classification, Applications, Principles of all processes	08
Unit IV **Sheet metal working**: - Classification, types of presses, press terminology, Force analysis in press working (PROBLEMS NOT EXPECTED) , Die cutting operation, types of dies, Die and punch allowance, introduction to shaping operations, bending, forming and drawing. ,	08
Unit V Introduction to Plastics, Properties & types, applications, Forming & Shaping of plastics –Extrusion, injection moulding, Blow moulding, wire drawing, Compression moulding, Transfer moulding, Embossing, Calendaring. Ceramic Structure, Properties, and Applications, Shaping Ceramics, Glasses Structure, Properties, and Applications, Forming and shaping of glass, Composite materials, Processing of metal matrix and ceramic matrix composites (overview) ,	08

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students as assignments.

References:

Text Books Recommended:

1. Workshop Practice, H. S. Bawa, Tata Mc-Graw Hill
2. Manufacturing Engineering & Technology, Kalpakjian, Pearson
3. Modern Materials and Manufacturing Process, R. Gregg Bruce, John E. Neely,Pearson Education
4. Degarmon's Materials and Processes in Manufacturing, 11th Ed. Black, Ronald A Kohser, Wiley India
5. Workshop Technology (Volume I), Hajra Chaudhary, Media Promoters &Publishers
6. Workshop Technology (Vol. I & II), B. S. Raghuwanshi, Dhanpat Rai & Co.
7. Manufacturing technology (Vol. I), P. N. Rao, Tata Mc-Graw Hill
8. Manufacturing Science, Ghosh & Malik, East West Press.
9. Textbook of Production Engineering, P.C. Sharma, S. Chand & Co.
10. "ASM Metals Hand Book on Casting", 1992.
11. Parmer R.S; "Welding Processes& Technology", Khanna Publishers, 1994.
12. Lancaster J.F., George Allen and Unwin, 1991, "Metallurgy of Welding".
13. Metals Hand Book, Vol 6, 8th edition, ASM, 1971.
14. AWS Welding Hand Book,Vol 1 to 4 AWS.

Reference Books Recommended:

1. Workshop Technology, Vol I & II, WAJ Chapman, Elsevier Butterworth-Heinemann.
2. Manufacturing Processes, M. Begman.
3. Processes & Materials of Manufacturing, R. Lindberg, Allyn & Bacon.

RTM Nagpur University Mechanical Engineering
B. Tech 3rd Semester
Manufacturing Processes Lab (BTME302P)
Syllabus (Practical)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	Manufacturing Processes Lab	-	-	2	1	25	25	50

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Think in core concept of their engineering application by studying various topics involved in branchspecific applications.
CO2	Understand the relevance and importance of the Different manufacturing techniques and real lifeapplication in industry.
CO3	Design the gating and riser system needed for casting and requirements to achieve defect free casting.
CO4	Analyze the welding process behavior and requirements to achieve sound welded joint while weldingdifferent similar and dissimilar engineering material
CO5	Understand the plastic, glass and ceramic Processing

Sr. No.	List of Practical's
01	Study of Cupola Furnace.
02	Study of Moulding Techniques
03	Study of Casting Process
04	Study of Pattern Making
05	Study of Joining Processes
06	Study of Forming Processes
07	Study of Drawing Processes
08	One Job – Pattern Making
09	One Job – Casting
10	One Job – on TIG/ MIG/ Resistance welding
11	Demonstration on Plastic, Glass and Ceramic Processing (Industrial Visit)

Suggested References:

1. Workshop Technology, Vol I & II, WAJ Chapman, Elsevier Butterworth-Heinemann.
2. Manufacturing Processes, M. Bagman.
3. Processes & Materials of Manufacturing R. Lindberg, Allyn & Bacon

RTM Nagpur University - Mechanical Engineering
B. Tech 3rd Semester
FLUID MECHANICS (BTME303T)
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	Fluid Mechanics	3	-	-	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	Understand fluid properties and differentiate various fluid flow types.
2	Analyze fluid statics principles and determine pressure distribution on surfaces and buoyancy of bodies.
3	Explore fluid dynamics equations and their applications in fluid flow scenarios.
4	Differentiate laminar and turbulent flows and apply dimensional analysis techniques in fluid mechanics.
5	Calculate energy losses in pipes and analyze lift and drag forces on immersed bodies.

Course Outcomes

After successful completion of this course the student will be able to:

CO1	Analyze fluid behaviors based on properties and identify fluid flow types in practical applications.
CO2	Apply fluid statics principles to assess pressure distributions, determine buoyancy, andanalyze stability.
CO3	Demonstrate proficiency in solving fluid dynamics problems using the Navier-Stokesequation, Bernoulli's equation, and related principles in various engineering scenarios.
CO4	Differentiate laminar and turbulent flows, apply dimensional analysis techniques,and interpret dimensionless parameters.
CO5	Calculate energy losses in pipes, understand fluid behavior in series and parallelconfigurations, and analyze lift and drag forces.

SYLLABUS	
Contents	**No of hours**
Unit I **Fluid Properties: -** Types of fluids, Mass Density, Specific Weight, Specific Gravity, Newton's Law of Viscosity, Dynamic Viscosity, Stroke's Theorem, Surface Tension, Capillarity, Compressibility, Vapour pressure. **Fluid Kinematics: -** Types of Flow- steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible, rotational, irrotational.	08
Unit II **Fluid Statics: -** Pressure, Measurement of pressure using manometers, Hydrostatic law, Pascal's law, Pressure at a point, Total pressure, Centre of pressure, Pressure on a plane (Horizontal, vertical, Inclined) and Curved Surfaces, Archimedes's principle, Buoyancy and stability of floating and submerged bodies, Metacentric height. ,	08
Unit III **Fluid Dynamics: -** Introduction to Navier-Stroke's Equation, Euler equation of motion along a stream line, Bernoulli's equation, application of Bernoulli's equation to pitot tube, venturi meter and orifice meter. ,	08
Unit IV **Laminar And Turbulent Flow: -** Definition, Relation between pressure and shear stresses, Laminarflow through round pipe, turbulent flow and velocity distribution. **Dimensional Analysis: -** Dimensional Analysis, Dimensional Homogeneity, Rayleigh method & Buckingham's pi Theorem. ,	08
Unit V **Flow Through Pipes: -** TEL, HGL, Energy losses through pipe, Darcy-Weisbach equation, Minor losses in pipes, TEL, HGL, pipes in series and parallel, Siphons, Transmission of power. **Flow around Immersed Bodies: -** Lift and Drag, Classification of Drag, Flow around circular cylinder and Aerofoil, Development of lift on Aerofoil. ,	08

References:
Text Books Recommended:

1. Fluid Mechanics, Dr. R.K. Bansal, Laxmi Publication (P) Ltd. New Delhi
2. Engineering Fluid Mechanics, Kumar K.L., S. Chand & company Ltd. Eurasia
3. Fluid Mechanics & Hydraulic Machines, R.K. Rajput, S. Chand & Company Ltd.
4. Hydraulic and Fluid Mechanics, Modi P.N. and Seth S.M., Standard Book House.
5. Fluid Mechanics & Fluid Power Engineering – D. S. Kumar, S.K. Kataria & Sons

.

Reference Books Recommended:

1. Introduction to Fluid Mechanics, James E.A., John and Haberm W.A., Prentice Hall of India
2. Fluid Mechanics, Jain A.K., Khanna Publication
3. Fluid Mechanics, Manish R. Moroliya & N.Z. Adkane, Sara Book Publications.
4. Engineering Fluid Mechanics, Garde R.J. and Miraj Goankar, Nemchand & Bros,Roorkee, SCITECH,Publication (India) Pvt. Ltd.
5. Fluid Mechanics and Fluid Power Engineering, Dr. D.S. Kumar, S.K. Kataria& sons
6. Fluid Mechanics, Frank M. White, McGraw Hill Publication
7. Fluid Mechanics, Cengel & Cimbla, Tata McGraw Hill
8. Fluid Mechanics, Streeter V.L. and Wylie E.B., McGraw Hill International Book co.
9. Fluid Mechanics with Engineering Applications, E. Finnemore & Franzini, Tata Mc-Graw Hill
10. Hydraulic Machines-Theory and Design, V. P. Vasandani, Khanna Publishers
11. Fluid Mechanics, A. K. Jain, Khanna Publishers
12. Hydraulic & Compressible Flow Turbo-machines, A. T. Sayers, Mc-Graw Hill

RTM Nagpur University - Mechanical Engineering
B. Tech 3rd Semester
Kinematics of Machines (BTME304T)
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	Kinematics of Machines	3	-	-	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	Make student conversant with the process of motion transformation, develop ability to critically analyze the machines, mechanisms and controlling devices, and contrive newmechanisms.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Perform kinematic and dynamic analysis (Displacement, Velocity, acceleration, Inertia forces) of a given mechanism using graphical method.
CO2	Understand the concept of compliant mechanisms.
CO3	Contrive or synthesize new mechanisms for specific requirements.
CO4	Construct cam profiles and analysis the follower motion.
CO5	Understand Geometry of gear, its types, analysis of forces and motions of gear teeth. Study of gear trains.

SYLLABUS	
Contents	**No of hours**
Unit I - INTRODUCTION Basic concept of mechanism, link, kinematics pairs, kinematics chain, mechanism, Difference between machine and mechanism, Inversions, machine, simple & compound chain, Degrees of freedom, Estimation of degree of freedom of mechanism by Grubber's criterion and other methods. Harding's notations, Classification of four bar chain , Class-I & Class-II, Kutzbach's criteria, Various types of mechanism such as Geneva wheel, Pawl and ratchet mechanism, Exact straight line mechanism, Approx. straight line mechanism, Pantograph mechanism. Introduction to compliant mechanisms	08
Unit II- KINEMATIC ANALYSIS Kinematic analysis of simple mechanisms using vector algebra (Graphical method). Concept of Corioli's component of acceleration. Velocity analysis using Instantaneous center of Rotation method, Kennedy's theorem.	08
Unit III – KINEMATIC SYNTHESIS a. Synthesis of mechanisms, Graphical b. Synthesis of mechanisms analytical technique. Restricted to design of crank rocker and slider crank mechanism only.	08
Unit IV - Cams and followers a. Types of cams and followers, types of follower motion, velocity and acceleration diagrams, Construction of cam profile. b. Introduction to cams with specified contours (No analytical treatment).	08
Unit V – Gears and Gear trains a. Classification of gears, Types of gears, Spur gears - terminology, conjugate gear tooth action and law of gearing, involute and cycloidal profile , contact ratio, Interference and under cutting, methods of avoiding interference, minimum number of teeth,. b. Helical gears: Nomenclatures, center distance, force analysis. Spiral Gears, Worm and worm Gears, Bevel Gears; their terminologies, center distance, force analysis and efficiency, Gear Trains.	08

References:

Text Books Recommended:

1. Theory of Machine, S. S. Rattan, Tata McGraw Hill.
2. Mechanism and Machine Theory, J.S. Rao & Dukki Patti, New Age International (P) Ltd, Publishers.
3. Theory of Machines, P L Ballaney, Khanna Publications.

Reference Books Recommended:

1. Theory of Machines and Mechanisms, J. E. Shigley and J. J. Uicker, Oxford University Press.
2. Theory of Machines, Sadhu Singh, Pearson publications.
3. Advanced Mechanism Design–Analysis and Synthesis, A.G.Erdman and G.N.Sandor, Vol. I and II,Prentice – Hall.
4. "Mechanisms and Mechanical Devices Source Book", Neil Sclater, Nicholas P Chrironis, McGraw-Hill.
5. Kinematics and Linkage Design, A. S. Hall, Jr., Prentice – Hall.
6. Mechanism Synthesis and Analysis, A. H. Soni, McGraw Hill.

RTM Nagpur University - Mechanical Engineering
B. Tech 3rd Semester
Machine Drawing and Solid Modeling (BEME305P)
Syllabus (Practical)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	Machine Drawing and Solid Modeling	-	1	2	2	50	50	100

Sr. No.	Course Objective The objective of this course is–
1	To make students conversant with machine drawing standards, techniques, symbols, notations, creation of 2-D and 3-D detailing of parts, GD&T, drawing reading, productiondrawing and process sheet.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Interpret and describe basic elements of standard machine drawing like lines, dimensions, tolerances, symbols etc.
CO2	Create 2-D detailing, sectional views of machine elements from given isometric view.
CO3	Understand and apply concepts of GD&T for creating part and assembly drawing.

SYLLABUS	
Contents	**No of hours**
Unit I **Basic Drawing Standards:** Drawing Sheets, Name Blocks, Types of Lines, Types of Dimensioning, Applying Tolerances, Standard Components and their representations, Standard Features, Machining Symbols, Welding Symbols, Surface Finish Symbols, Heat Treatment, Manufacturing Instructions, Allowances, Materials.	05
Unit II **Orthographic projections:** 2-D orthographic projection of machine elements, Sectional views, Dimensioning and detailing.	05
Unit III **GD & T:** Concepts of Limit, Fits and Tolerances (Standard, types, application and selection for assembly and manufacturing method), Surface Finish requirement for assembly, Manufacturing Method, Geometry suitable for assembly. Principals and practical applications of geometrical dimensioning andtolerance.	05

Sr. No.	**List of Tutorials**
01	Drawing Sheets, Name Blocks, Types of Lines, Standard dimensioning methods, Applying Tolerances.
02	Standard Components and their representations, Standard Features.
03	Machining Symbols, Welding Symbols, Surface Finish Symbols.
04	Heat Treatment, Manufacturing Instructions, Allowances, Materials.
05	2-D orthographic projection of machine elements
06	2-D orthographic projection of machine elements
07	Sectional views
08	Dimensioning and detailing.
09	Limit, Fits and Tolerances (Standard, types, application and selection for assembly and Manufacturing method)
10	Geometrical dimensioning and tolerances (symbols, applications) datum's, referencing.
11	Industrial Drawing Reading: Students to be give industrial (production) drawing of different components, they will be asked to study the drawing thoroughly, understand and interpret the meanings of symbol and notations and there importance.

References:

Text Books Recommended:

1. Naryana K.L., Kannaiah R., Venkata Reddy K “Machine Drawing”, New Age Int.Pub.
2. Naryana K.L., Kannaiah R., Venkata Reddy K “Production Drawing ", New Age Int.Pub.
3. N.D.Bhatt “Machine Drawing; Ed”, Charotar Publishing House.

Reference Books Recommended:

1. PSG College of Technology “Design data”, DPV Printers, Coimbature, 1 2000.
2. “Engg. Drawing practice for schools & colleges”, Bureau of Indian Standards, 1 Ed.; , 2002.st 1998

RTM Nagpur University - Mechanical Engineering
B. Tech 3rd Semester
Material Science and Engineering (BTME306T)
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	Material Science and Engineering	3	-	-	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	To impart Knowledge for analyzing different Microstructure and Crystalline nature of metals.
2	To impart knowledge of Iron-Iron carbide equilibrium diagram and microstructure ofcommercial steels and Cast Iron.
3	To provide the knowledge of various heat treatment processes.
4	To provide basic knowledge of non-ferrous alloys.
5	To impart basic knowledge of powder Metallurgy for Powder metallurgical components.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Student will be capable to distinguish micro structure and analyze the effect to crystalline nature of metals, construct and analyze Iron-Iron carbide equilibrium diagram.
CO2	Student will be able to study the commercial steels with their applications and properties.
CO3	Student will be able to analyze and implement suitable heat treatment processes.
CO4	Student will be able to analyze the Cast Iron and their properties.
CO5	Student will be able to perceive the basics of powder Metallurgy for powder metallurgical components.

SYLLABUS	
Contents	**No of hours**
Unit I **Engineering Materials:** Classification, properties and applications of various engineering materials. Crystalline nature of metals, especially microscopic and macroscopic examinations of metals. Solidification of metals, cooling curves, alloys and solid solutions, types and their formations, modified Gibbs's phase rule, Lever rule for phase mixtures and their application in system. **Study of equilibrium diagrams:** Different phases and various invariant reactions in Iron-Iron carbide equilibrium diagram, critical temperatures. Microstructure of slowly cooled steels. Estimation of carbon from microstructures, structure property relationship as per the variations in carbon content. ,	08
Unit II **Plain Carbon Steels:** Classification and application of plain carbon steels. Alloy steels, examples of alloy steel, Effect of alloying elements on properties of steels, Austenite and ferrite stabilizers, Hadfield Manganese Steel, ball Bearing Steels, HCHC steels etc. **Tool Steels:** Classification, composition, application and commercial heat treatment practice for HSS, Secondary hardening, red hardness. **Stainless Steels** - Classification, composition, application and general heat treatment practice for Stainless Steels. Classification and applications of steels sensitization of stainless steels and weld decay. ,	08
Unit III **Heat treatment** and its importance. Annealing, Normalizing, Hardening, Quench Cracks, Hardenability test. Limitations of Fe-Fe3C diagram, TTT diagram and its construction and related Heat Treatment Processes such as Austempering, Martempering, and Patenting. Retained Austenite, Effects and elimination of retained austenite, Tempering. Case/Surface hardening treatments such as Carburizing, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening. Hardenability test. ,	08
Unit IV **Cast Iron** – Classification, White cast Iron, Gray Cast Iron, Nodular Cast Iron, Malleable Cast Iron, and Chilled and alloy Cast Iron. (Production route, Composition, Microstructure and applications) Effects of various parameters on structure and properties of Cast Iron, Alloycast Iron such as Ni-resist, Ni-hard. **Non-Ferrous Alloys** – Study of non-ferrous alloys such as brasses (Cu-Zn diagram), defects in brasses, Bronzes (Cu- Sn diagram), Aluminum Alloys (e.g., Al-Si diagram),modified Al-Si diagram, Bearing materials. ,	08

Unit V **Powder Metallurgy:** Powder manufacture and Conditioning, Production of Sintered Structural Components, Self-lubricating bearing, Cemented Carbides, Ceramics, Sintered Carbide cutting tools. Process of powder metallurgy, advantages and limitations of powder metallurgy ,	08

References:
Text Books Recommended:

1. Material Science & Engineering,V.R.Raghavan,1974.
2. Material Science & Engineering, WilliamCallister,1985.
3. Material Science and Metallurgy for Engineers, V. D. Kodgire, 2011
4. Material Science& Engineering, R.K.Rajput, 2009.
5. Material Science& Engineering, An Introduction,6th Edition, Donald Askeland,1984.

RTM Nagpur University- Mechanical Engineering
B. Tech 3rd Semester
Skill Development -
(Basics of Computer Aided Drafting) (BTME307P)
Syllabus (Practical)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	Skill Development- (Basics of ComputerAided Drafting)	-	-	2	1	50	-	50

Sr. No.	COURSE OBJECTIVE
1	Students will be able to use Software (AUTOCAD) for creation of 2D models, and Drawings.

COURSE OUTCOME

Students will learn
- How to create simple parts, assemblies and drawings.
- How to use different feature-based tools to build, review and modify a model.
- How to create and analyze assemblies and how to produce a drawing with different views.
- Learn how to dimension the drawing and annotate the views.

Skill Development-(Basics of Computer Aided Drafting)

Contents

Module I: Sketcher - Creating Profiles.
PLM Objects, Sketch Support, Simple elements, constraining sketches, simple and complexprofiles, transforming sketches, saving documents.
Practice-1 : Hands on Session on Sketcher Workbench.

Module II: Part Design -Creating Basic Features.
Extruded Features, revolved features, holes, threads, taps, drafts, fillets, chamfers, shelling andstiffeners, relational dimensions.
Practice-2 : Hands on Session on Sketch Based Features & Dress Up Features.

Module III: Reviewing & Modifying.
Measuring the model, re using the data, editing features.
Practice-3 : Hands on Session on Measuring Tools & Editing Features.

Module IV: Finalizing Design.
Adding parameters, reusing features, rendering, weight calculation.
Practice-4: Hands on Session on Parametric Design.

Module V: Creating & Managing Products.
Positioning Components, constraining Components, Analyzing weight distribution, replacing and revising parts.
Practice-5: Hands on Session on Assembly Design.

Module VI: Creating Drawings 4.
Creating Drawing, Modifying, dimensioning, Annotations, Finalizing & Printing
Practice-6 : Hands on Session on Drawing Conventions.

Module VII: Master ExerciseHeat Sink, PC Card Slide.
Practice-7 : Modeling of Heat Sink.

Text Books/ Reference Books/ Reference Material

1. Mechanical Design Fundamentals : Dassault Systemes Companion Learning Space Material

RTM Nagpur University - Mechanical Engineering
B. Tech 3rd Semester
SPORTS (BTME308P)
Syllabus (Practical)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	SPORTS	-	-	2	-	-	-	-

Sr. No.	COURSE OBJECTIVE
1	Through sports, students should able to build a wide range of abilities and skills such as leadership, confidence, teamwork, patience, self-reliance, trust, and many more which facilitate the overall development of an individual
2	Students should learn to manage time between their lectures, sports, and personal life.

EXPECTATION FROM INSTITUTES

1. Provide sports facilities
2. Provide platforms for participation in events
3. Develop interest for sports amongst students
4. Conduct regular events (every month) in college for all indoor and outdoor sports

RTM Nagpur University - Mechanical Engineering
B. Tech 3rd Semester
YOGA (BTME308P)
Syllabus (Practical)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	YOGA	-	-	2	-	-	-	-

Sr. No.	COURSE OBJECTIVE
1	To introduce basic wellness principles and practices of Yoga to students
2	To bring awareness of the fundamentals of Yoga for wellness in their daily lives
3	To bring peace and harmony in the society at large by introducing the Yogic way of life.

EXPECTATION FROM TRAINERS

1. Brief to origin of Yoga.
2. History and Development of Yoga: Vedic Period, Classical Period, Post classical period, Modern Period.
3. Etymology and Definitions of Yoga in classical Yoga texts.
4. Meaning, Aim and Objectives of Yoga.
5. Misconceptions about Yoga.
6. True Nature of Yoga.
7. Principles of Yoga.
8. Basis of Yoga.

RTM Nagpur University - Mechanical Engineering
B. Tech 3rd Semester
National Service Scheme (NSS) (BTME308P)
Syllabus (Practical)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	National Service Scheme (NSS)	-	-	2	-	-	-	-

COURSE OBJECTIVE

- Understand the community in which they work.
- Understand themselves in relation to their community.
- Identify the needs and problems of the community and involve them in problem-solving.
- Develop among them a sense of social and civic responsibility.
- Utilize their knowledge in finding practice solutions to individual and community problems.
- Develop competence required for group-living and sharing of responsibilities.
- Gain skills in mobilizing community participation.
- Acquire leadership qualities and democratic attitudes
- Develop capacity to meet emergencies and natural disasters.
- Practice national integration and social harmony

EXPECTATION FROM TRAINERS

1. To assist and guide the NSS unit for implementation of NSS programs at college level
2. To advise in organizing camps, training and orientation programs for the NSS volunteers
3. To visit the NSS units for monitoring and evaluation.
4. To ensure implementation of NSS regular activities and special camping programs

RTM Nagpur University- Mechanical Engineering
B. Tech 3rd Semester
National Cadet Corps (NCC) (BTME308P)
Syllabus (Practical)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	National Cadet Corps (NCC)	-	-	2	-	-	-	-

ABOUT NCC

1. NCC is the Indian military cadet corps wing of the Indian armed forces.
2. NCC offers training to the students of schools and colleges.
3. This is not compulsory training for all students.

Sr. No.	OUTCOMES EXPECTED
1	During the training of NCC, candidates should get the basic military training. This trainingshould be conducted to develop the interest of young students in all three forces; the army, the navy and the air force of India. Students should be able to check their abilitiesto join the Indian Defence Services.

Sr. No.	AIM
1	To create an organized, trained and motivated youth, create soldiers for the nation, develop the leadership skills in the youth.

EXPECTATION FROM INSTITUTES

- Create awareness amongst students about NCC
- Make understand the students about the importance of NCC
- Conduct regular Drills and Training exercises
- Conduct Regular exams
- Arrange for Training Camps