RTM Nagpur University
Mechanical Engineering
Machining Processes Syllabus (Theory)
Course code- BEME401T

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	**Machining Processes**	03	00	00	03	30	70	100	03

Sr. No.	Course Objective The objective of this course is–
1	Understand basic mechanism of metal removal processes.
2	Working mechanisms of various machine tools and machining principles.
3	To know surface finishing and allied processes.
4	Understand the importance of machining processes and be able to apply the suitable machining processes for an engineering product.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Understand fundamentals of metal cutting
CO2	Understand basic construction and operations of lathe shaping, planning
CO3	Understand basics of milling and milling cutters. slotting
CO4	To know about the surface finishing processes.
CO5	Understand the basic of drilling, boring, reaming and broaching.

Machining Processes (Theory) SYLLABUS	
Contents	No of hours
Unit I **Introduction to Machining Parameters**: Introduction to machining, Tool materials, nomenclature and tool geometry of single point cutting tool, tool materials properties, classification, HSS, carbide tool, coated tools, diamond coated tool. Theory of Metal Cutting: Introduction. Orthogonal and Oblique cutting. Mechanics of Metal Cutting. Merchant's circle, Chip formation, cutting force calculations, cutting fluids, cutting speed, feed and depth of cut on power requirement, Estimation of tool life.	09
Unit II Lathe: Introduction, types, construction of simple lathe, mechanism and attachments for various operations, machine specifications, basis for selection of cutting speed, feed and depth of cut, time estimation for turning operations such as facing, step turning, taper turning, threading, knurling. Introduction to Capstan, Turret Lathe and fundamentals of NC. **Shaper:** Introduction, types, specification, description of machines, cutting parameters. Mechanism of shaper: Quick return mechanism, Crank & slotted link mechanism, Table feed mechanism, attachments for shaper, work holding devices, shaper operations. **Planer:** Introduction, specifications, description, types of planner, open side planner, pit planner Mechanism for planner: Driving mechanism, feeding mechanism, planner cutting tools, cutting parameters.	10
Unit III **Milling:** Introduction. Specification, types, column & knee type milling machine, fixed bed type milling machines, production milling machines, special purpose milling machines such as thread milling Machines, profile milling machine, Gear Milling. Hobbing machines. Mechanisms & Attachments for Milling, Cutting parameters, Types of milling operations, Types of milling cutters, Tool geometry & their specifications. Indexing - simple, compound and differential. **Slotter:** Introduction, specifications, description, type of drives for slotter, types of slotting machines -production slotter, puncher slotter, tool room slotter, slotter tools.	09
Unit IV **Grinding**: Operations, grinding wheel, specifications & selection, cylindrical & centreless grinding operation, surface grinding, tool & cutter grinding, time estimation for grinding operations. **Super finishing process:** Honing, Lapping, super finishing, polishing, buffing, 'metal spraying, galvanizing and electroplating. Process parameters and attainable grades of surface finish, surface measurement.	09

Unit V **Drilling:** introduction, tools for drilling, classification of drills, twist drills, drill size and specifications, tipped drills, type of drilling machines-portable drilling machine. bench drilling machine, right drilling machine, radial drilling machine, universal drilling machine, multisided drilling machine. Drilling machines operations, time estimation for drilling. **Reaming:** Introduction, description of reamer, type of reaming operations. **Boring:** Introduction, types of boring machine, horizontal boring machine, vertical boring machine, jig machine, micro boring. boring operations. **Broaching:** Introduction, type of broaches, nomenclature of broaches. types of broaching machines.	09

Sr. No.	List of Tutorials
01	Based on above syllabus

References:

Text Books Recommended:

1. Workshop technology (Vol. II), V. S. Raghuwanshi, Dhanpat Rai & Sons
2. Manufacturing Science, Ghosh & Mallik, East West Press
3. Manufacturing technology (Metal cutting & Machine tools) Vol. II, P. N. Rao, Tata Mc-Graw Hill
4. Workshop technology, H. S. Bawa, Tata Mc-Graw Hill
5. Introduction to Manufacturing Processes, J. A. Schey, Tata Mc-Graw Hill
6. Workshop Technology (Volume II), Hajra Chaudhary, Media Promoters & Publishers

Reference Books Recommended:

1. Manufacturing Engineering & Technology, S. Kalpakjian & S.R. Schmid
2. Technology of Machine Tools, Krar & Oswald
3. Manufacturing Processes, M. Begman
4. Processes & Materials of Manufacture, R. Lindberg
5. Production Technology, HMT

RTM Nagpur University
Mechanical Engineering
Machining Processes Syllabus (Practical)
Course code- BEME401P

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
IV	Machining Processes	00	00	02	01	25	25	50

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Understand basic cutting tools.
CO2	Working of lathe and turning operation
CO3	Shaping and planning operation
CO4	Milling and drilling operation
CO5	Grinding and surface finishing

List of Practical's

Minimum Eight out of following shall be performed:

Sr. No.	List of Practical's
01	Study of Single Point Cutting Tool.
02	Study of Various forces on single point cutting tools.
03	Study of multiple point cutting tools (milling, drilling)
04	Study of Lathe Machine.
05	Study of Shaper mechanisms.
06	Study of milling machine
07	One Job on Milling.
08	One Job on Drilling, Boring
09	One Job on Thread Cutting, Taper Turning.
10	One Job on Surface Grinding.

Suggested References:

1. Manufacturing Engineering & Technology, S. Kalpakjian & S.R. Schmid
2. Technology of Machine Tools, Krar & Oswald
3. Manufacturing Processes, M. Begman
4. Processes & Materials of Manufacture, R. Lindberg Production Technology, HMT

RTM Nagpur University
Mechanical Engineering-IV Sem
Fluid Mechanics & Hydraulic Machines Syllabus (Theory)
Subject code –BEME402T

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	Fluid Mechanics & Hydraulic Machines	3	1	-	4	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	To classify fluid & their Properties under static and dynamic condition and apply the equations to various hydraulic components and working principles of various measuring devices.
2	To establish the relationship between various properties & apply mathematical treatment to various problems related to fluid system & their Design.
3	To introduce various principles & design of hydraulic Machines i.e. Turbines. Centrifugal and Positive Displacement Pump .
4	To explain the working Principles of Fluid mechanics and their Practical applications in designing the fluid systems
5	To appreciate the application of Similitude in the design of Hydraulic Machines.

Course Outcomes	
After successful completion of this course the student will be able to :	
CO1	Classify and explain fluid their properties, fluid in rest condition, types of flow & flow measuring devices and mathematical application of equations on hydraulic components.
CO2	Explain behavior of fluid in motion condition and application of Bernoullie's equation to fluid flow measuring devices.
CO3	Apply dimensional analysis to design hydraulic machines and different losses of fluid flow through pipes.
CO4	(i) classify different layout of hydro-electric power plant and (ii) analyze design characteristics of hydraulic machines i.e. turbines (impulse and reaction), Pelton turbine , Francis turbine, propeller turbine and Kaplan turbine
CO5	Explain the working principle & design of Centrifugal and reciprocating pump & practical application of similitude & model testing.

Fluid Mechanics & Hydraulic Machines SYLLABUS(Theory)	
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. Introduction of Fluid Kinematics, Types of Flow- steady, unsteady, uniform, non-uniform, laminar, turbulent. **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	09
UNIT-II 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, orifices, orifice meter. Laminar And Turbulent Flow :- Definition, Relation between pressure and shear stresses, Laminar flow through round pipe, Turbulent flow and velocity distribution. ,	09
UNIT-III Flow Through Pipes Flow Through Pipes :TEL, HGL, Energy losses through pipe, Darcy-Weisbach equation, Minor losses in pipes, TEL, HGL, Moody diagram, pipes in series and parallel, Siphons, Transmission of power. Dimensional Analysis, Dimensional Homogeneity, Rayleigh method & Buckingham's pi – Theorem. Introduction to Similitude and model testing.	09
UNIT-IV Theory of turbo machines Turbo Machine classification**,** Elements of hydro-electric power plant, **Impulse Turbine**:- principles of operation , constructional features, Velocity Diagram and Analysis, Design parameters, Performance characteristics, Governing. **Reaction or pressure Turbine**:- principles of operation, Classification , Degree of reaction, comparison over Pelton Turbine, Draft tube, Cavitation in Turbine, **Francis Turbine**, :- Types, Constructional features, Installations, Velocity Diagram and analysis, Design parameters, Performance characteristics, Governing. **Propeller Turbine, Kaplan Turbine**: -Constructional features, Velocity Diagram and analysis, ,	10
UNIT- V Hydrodynamic pumps:- Centrifugal pumps:- Principle of operation, Classification, Component of Centrifugal Pump, Various heads, Velocity triangles and their analysis, N.P.S.H., Cavitation's in pumps, Installation and operation, Performance characteristics, Introduction to self-priming pumps Reciprocating pump : Basic principle, Classification, Main Components, Slip, Work Done, Indicator Diagram, Cavitation's, Air vessels,,	09

Sr. No.	List of Tutorials
01	Applications based on fluid properties such as block sliding over an inclined plane, capillary phenomenon etc.
02	Study of Manometers
03	Study of stability of floating bodies and submerged bodies
04	Determination of coefficient of discharge of flow meters
05	Verification of Bernoulli's equation
06	Losses in pipes (Hagen Pois. Equation)
07	Design of Pelton Turbine and Francis Turbine
08	Design of Propeller & Kaplan Turbine
09	Design of Centrifugal Pump
10	Design of Reciprocating Pump

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. Publication House
4. Fluid Mechanics & Hydraulic Machines, R.K. Rajput, S. Chand & Company Ltd.
5. Hydraulic and Fluid Mechanics, Modi P.N. and Seth S.M., Standard Book House.
6. Fluid Mechanics & Fluid Power Engineering – D. S. Kumar, S.K. Kataria & Sons
7. Publications

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. Engineering Fluid Mechanics, Garde R.J. and Miraj Goankar, Nem chand & Bros,Roorkee, SCITECH, Publication (India) Pvt. Ltd.
4. Fluid Mechanics and Fluid Power Engineering, Dr. D.S. Kumar, S.K. Kataria & sons
5. Fluid Mechanics, Frank M. White, McGraw Hill Publication
6. Fluid Mechanics, Cengel & Cimbla, Tata McGraw Hill

7. Fluid Mechanics, Streeter V.L. and Wylie E.B., McGraw Hill International Book co.
8. Fluid Mechanics with Engineering Applications, E. Finnemore & Franzini, Tata Mc-Graw Hill
9. Hydraulic Machines-Theory and Design, V. P. Vasandani, Khanna Publishers
10. Fluid Mechanics, A. K. Jain, Khanna Publishers
11. Hydraulic & Compressible Flow Turbo-machines, A. T. Sayers, Mc-Graw Hill

RTM Nagpur University
MECHANICAL ENGINEERING
FLUID MECHANICS & HYDRAULIC MACHINES Syllabus (Practical)
Subject code-BEME402P

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
IV	FLUID MECHANICS & HYDRAULIC MACHINES	-	-	02	01	25	25	50

Course Outcomes	
After successful completion of this Practical course the student will be able to	
CO1	Explain what is Stability condition of floating bodies, Law of conservation of Energy.
CO2	Apply Frictional losses and Hydraulic co-efficient in the pipe flow.
CO3	Estimate the Performance characteristics of Pelton Turbine
CO4	Estimate the Performance characteristics of Francis Turbine & Kaplan Turbine.
CO5	Estimate the Performance characteristics of Centrifugal Pump & Reciprocating Pump.

Sr. No.	List of Practical's
01	To determine the metacentric height of given floating vessel.
02	To verify Bernoulli's theorem.
03	To find friction losses in pipe.
04	To find the value of co-efficient of given venture meter fitted in a pipe.
05	To find the value of co-efficient of Discharge for a given orifice meter.
06	Performance characteristics of Pelton wheel.
07	Performance characteristic of Francis Turbine.
08	Performance characteristic of Kaplan Turbine.
09	Performance characteristic of Variable Centrifugal speed pump
10	Performance characteristic of Reciprocating pump.
11	To find Reynold's Number

Suggested References:

1. Fluid Mechanics, Frank M. White, McGraw Hill Publication
2. Hydraulic Machines-Theory and Design, V. P. Vasandani, Khanna Publishers
3. Fluid Mechanics, John F. Douglas, Pearson
4. Introduction to Fluid Mechanics, James E.A., John and Haberm W.A., Prentice Hall of India

RTM Nagpur University
Mechanical Engineering
Material Science & Engineering (Theory)
Course code- BEME403T

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	Material Science & Engineering	3	00	00	3	30	70	100	3hrs.

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 of commercial steels and Cast Iron.
3	To provide the knowledge of various heat treatment processes.
4	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 microstructure and analyze the effect of Crystalline nature of metals, construct and analyze Iron-Iron carbide equilibrium diagram.
CO2	Student will be able to study the commercial steels.
CO3	Student will be able to analyze and implement suitable heat treatment processes.
CO4	Student will be able to analyze the Cast Iron.
CO5	Student will be able to perceive the basics of powder Metallurgy for powder metallurgical components.

Material Science & Engineering (Theory) **SYLLABUS**	
Contents	No of hours
Unit I: **Introduction to materials**, classification of materials. Properties and applications of materials. Crystalline nature of metals, specially microscopic and macroscopic examinations of metals. 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** and invariant reactions. Iron-Iron carbide equilibrium diagram, critical temperatures. Microstructure of slowly cooled steels. Estimation of carbon from microstructures; structure property relationship.	10 hrs.
Unit II: Classification and application of plain carbon steels. Examples of alloy steel such as Hadfield Manganese Steel, ball Bearing Steels, etc. Tool Steels – Classification, composition, application and commercial heat treatment practice for HSS, Secondary hardening. Stainless Steels - Classification, composition, application and general heat treatment practice for Stainless Steels. Classification and applications of steels. Effect of alloying elements. ,	10 hrs.
Unit III: Heat treatment and its importance. Annealing, Normalizing, Hardening, Quench Cracks, Hardenability test. TTT diagram and its construction and related Heat Treatment Processes such as Austempering, Martempering, Patenting etc. Retention of Austenite, Effects and elimination of retained austenite, Tempering. Case / Surface hardening treatments such as Carburizing, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening.	9 hrs.
Unit IV: Cast Iron – Classification, White cast Iron, Gray Cast Iron, Nodular Cast Iron, Malleable Cast Iron, Chilled and alloy Cast Iron. (Production route, Composition, Microstructure and applications) Effects of various parameters on structure and properties of Cast Iron, Alloy cast Iron such as Ni-resist, Ni-hard. Non-Ferrous Alloys – Study of non-ferrous alloys such as brasses (Cu-Zn diagram), Bronzes (Cu-Sn diagram), Aluminum Alloys (e.g. Al-Si & Al-Cu diagram), Bearing materials.	9 hrs.
UNIT V: Powder Metallurgy: Powder manufacture and Conditioning, Production of Sintered Structural Components, Self lubricating bearing, Cemented Carbides, Ceramics, Sintered Carbide cutting tools.	9 hrs.

Sr. No.	List of Tutorials
01	Study of microstructure and analyze the effect of Crystalline nature of metals.
02	To construct & study of Iron-Iron carbide equilibrium diagram.
03	Study the commercial steels.
04	Analyze and implement suitable heat treatment processes.
05	Study of Cast Iron.
06	Study of powder Metallurgy for powder metallurgical components.

References:

Text Books Recommended:

1. Material Science & Engineering, V. R. Raghavan,1974.
2. Material Science & Engineering, William Callister,1985.
3. Material Science & Engineering, R. K. Rajput,2009.
4. Material Science & Engineering, An Introduction, 6 th Edition, Donald Askeland, 1984..

Reference Books Recommended:

1. Introduction to Physical Metallurgy 29st revised edition, 2009 Sidney H.Avner McGraw-Hill,1964.
2. Engineering Physical Metallurgy and Heat Treatment 21st revised edition, 1988 Yu Lakhtin Mir publishers, Moscow, Russia.
3. Introduction to Engineering Metallurgy 21st revised edition, 2007 Dr. B K Agrawal Tata Mc-GraHill.
4. Metallurgy for Engineers 4th Revised edition 1987 E C Rollason E. Arnold.

RTM Nagpur University
Mechanical Engineering
MECHANICS OF MATERIAL Syllabus (Theory)
BEME404T

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	MECHANICS OF MATERIAL	3	1	2	4	30	70	100	03

Sr. No.	Course Objective The objective of this course is–
1	To study different types of stresses, strain and deformation induced in the mechanical components due to external loads.
2	To study Shear force and Bending moment, Stresses in beam under various loading conditions.
3	To understand phenomena of Deflection of Beam and Strain Energy.
4	To design and analyse shaft for various loading conditions
5	To understand design process and failure phenomena of Column & Struts.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Demonstrate fundamental knowledge about various types of loading and stresses induced
CO2	Draw the SFD and BMD for different types of loads and support conditions.
CO3	Estimate the strain energy in mechanical elements. And analyse the deflection in beams.
CO4	Can design shaft for various loading conditions.
CO5	Understand theory of failure and effective designing of column and struct.

MECHANICS OF MATERIAL SYLLABUS (Theory)	
Contents	No of hours
Unit I Concept of simple stresses and strains: Introduction, stress, strain, types of stresses, stress and strain diagram for brittle & ductile material, elastic limit, Hooks law, modulus of elasticity, modulus of rigidity, factor of safety, analysis of tapered rod, analysis of composite section, thermal stress and strain. Longitudinal strain & stress, lateral stresses and strains, Poisson's ratio, volumetric stresses and strain with uni-axial, bi-axial & tri-axial loading, bulk modulus, relation between Young's modulus and modulus of rigidity, Poisson's ratio and bulk modulus Principal stresses and strains:- Definition of principal planes & principal stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plane in mutually perpendicular two planes, when member is subjected to shear stress and direct stresses in two mutually perpendicular planes, Mohr's circle for representation of principal stresses ,	12 Hrs.
Unit II Shear force and bending moment: - Types of beam (cantilever beam, simply supported beam, overhung beam etc.), Types of loads (Concentrated and UDL), shear force and bending moment diagrams for different types of beams subjected to different types of loads, sign conventions for bending moment and shear force, shear force and bending moment diagrams for beams subjected to couple, Relation between load, shear force and bending moment. Stresses in beams: - Pure bending, theory of simple bending with assumptions & expressions for bending stress, derivation of bending equation, bending stresses in symmetrical sections, section modulus for various shapes of beam sections. Shear stresses in beams: - Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress. ,	10Hrs
Unit III Deflection of beams:- Deflection & slope of cantilever, simply supported, overhung beams subjected to concentrated load, UDL, Relation between slope, deflection & radius curvature Macaulay's method to determine deflection of beam. Strain energy & impact loading: - Definition of strain energy stored in a body when it is subjected to gradually applied load, suddenly applied loads & impact loads. Strain energy stored in bending & torsion . ,	12Hrs

Unit IV Torsion of circular shafts: - Derivation of torsion equation with the assumptions made in it. Torsion shear stress induced in the shaft, when it is subjected to torque. Strength and rigidity criterion for design of shaft. Torque transmitted by solid & hollow circular shaft. Equivalent twisting and bending moment in shaft when it is subjected to bending moment, torque & axial load.	8Hrs
Unit V Column & Struts: - Failure of long & short column, slenderness ratio, assumptions made in Euler's column theory, end conditions for column. Expression for crippling load for various end conditions of column and derivation on column with both ends hinged. Effective length of column, limitations of Euler's formula, Rankine formula.	4Hrs

Sr. No.	List of Tutorials
01	problems on simple and principle stresses
02	problems on Mohr's circle
03	problems on Thermal stresses
04	problems on S.F. & B.M. diagrams
05	problems on Stresses in beam bending
06	problems on shear stresses
07	problems on Macaulay's methods
08	problems on shafts
09	problems on columns & struts

Assignments (Guidelines)

At least one problem on the following topic

1. Stresses in Beams (A two wheeler chassis design concept)
2. Strain energy and deflection (Determination of equivalent load due to impact on the component and its design)
3. Torsion , Column and Struts (Design of frames of solar PV roof top system using software like Stat-Pro)

Note: Preferably The assignments shall be based on live problems. Project based learning may be incorporated by judiciously reducing number of Assignments

References:

Text Books Recommended:

1. Strength of Materials by S. Ramamrutham and R. Narayanan, Dhanpat Rai Publishing Company (P) Ltd, 18th Edition 2017.

2. Strength of Materials by R.K. Bansal, Laxhmi Publications , New Delhi, 6th edition, 2017

3. Strength of Materials by S.S.Rattan, Mcgraw Hill Education, 3rd edition , 2016

Reference Books Recommended:

1. Mechanics of Materials By Beer , Johnston, Dewolf and Mazurek , Tata McGraw- Hill Education , 7th edition , 2015

2. Elements of Strength of Materials by Timoshenko, S.P. and Young, D.H., East West Press, 5th edition, 2011

RTM Nagpur University
Mechanical Engineering
Material Testing Lab- Syllabus (Practical)
BEME404P

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
IV	Material Testing Lab	00	00	2	1	25	25	50

Sr. No.	Course Objective The objective of this course is–
1	Create specimen for metallographic examination.
2	Analyze the microstructure and investigate various properties of ferrous and nonferrous Materials.
3	Test different Engineering Materials.
4	Analyze the hardenability microstructure.
5	Test Cast Iron.
6	To familiarize material behavior under different loading conditions
7	To acquaint with surface hardness measurement method
8	To familiarize with impact test methods for different materials
9	To study and analyze deflection of beams in various loading conditions.
10	To study and understand behavior of material under various loading conditions.

Course Outcomes

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

CO1	Analyze the Microstructure and investigate various properties of ferrorous and Non ferrous Materials . Analyse the stress strain behaviour of materials
CO2	Analyse the effect of tensile, shearing force and can utilized the gained while tackling real life engineering problems for different types of Materials
CO3	Understand Microstructures and their Applications for various uses
CO4	Measure torsional strength , hardness of material
CO5	Incorporate the various important concepts learnt while designing components

****NOTE**: At least 10 Experiments should be included in the Journal-At least 5 from Serial Number 1 to 7 and at least 5 from serial Number 8 to 14). This Practical load shall be equally shared by subject teachers handling subjects Material Science & Engineering and Mechanics of Materials.

Sr. No.	Material Testing Lab -List of practical's
01	To study the Metallurgical Microscopes & Preparation of specimen for metallographic examination.
02	Micro-structural examination of different types of Steels
03	Micro-structural study of White Cast Iron and Grey Cast Iron
04	Micro-structural study of Malleable Cast Iron and Nodular Cast Iron
05	Study of Universal Testing Machine
06	Determination of tensile properties of ductile material
07	Determination of properties of brittle material
08	Compression test on materials
09	Shear test on metals
10	Impact test on materials
11	Torsion test of metal shaft
12	Determination of bending strength by deflection of beam
13	Measurement of hardness with the help of Rockwell Hardness Tester
14	Measurement of hardness with the help of Brinell Hardness Tester

RTM Nagpur University
Mechanical Engineering
Professional Ethics Syllabus (Theory)
BEME405T

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	**Professional Ethics**	3	-	-	3	30	70	100	03

Sr. No.	Course Objective The objective of this course is–
1	The objective of this course is to inculcate the sense of social responsibility among learners and to make them realize the significance of ethics in professional environment so as to make them a global citizen

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Understand basic purpose of profession, professional ethics and various moral and social issues
CO2	Analyze various moral issues and theories of moral development
CO3	Realize their roles of applying ethical principles at various professional levels
CO4	Identify their responsibilities for safety and risk benefit analysis.
CO5	Understand their roles in dealing various global issues

Professional Ethics SYLLABUS (Theory)	
Contents	No of hours
Unit I Human Values, Morals, values and Ethics, Integrity, Work ethics, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage ,	08
Unit II Engineering Ethics, Senses of 'Engineering Ethics', Variety of moral issues, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory ,	07
Unit III Engineering as Social Experimentation, Engineering as Experimentation, Engineers as responsible Experimenters, Codes of Ethics, A Balanced Outlook on Law ,	07
Unit IV Safety, Responsibilities and rights, Safety and Risk, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Collective Bargaining, Professional Rights, Employee Rights	07
Unit V Global issues, Multinational Corporations, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Corporate Social Responsibility	07

References:

Text Books Recommended:

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S. Chand Publications
3. Ethics in Engineering by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill – 2003.
4. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
5. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman, and M. Jayakumaran – University Science Press.
6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan, and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill – 2013

RTM Nagpur University
Mechanical Engineering –IV Sem
SPORTS
Course Code- BEME406P

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III & IV	SPORTS	0	0	3		00	00	00	00

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 –IV Sem
YOGA
Course Code- BEME406P

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III &IV	YOGA	0	0	3		00	00	00	00

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 –IV Sem
National Service Scheme (NSS)
Course Code- BEME406P

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III & IV	National Service Scheme (NSS)	0	0	3	00	00	00	00	00

Sr. No.	COURSE OBJECTIVE
1	1. Understand the community in which they work. 2. Understand themselves in relation to their community. 3. Identify the needs and problems of the community and involve them in problem-solving. 4. Develop among them a sense of social and civic responsibility. 5. Utilize their knowledge in finding practice solutions to individual and community problems. 6. Develop competence required for group-living and sharing of responsibilities. 7. Gain skills in mobilizing community participation. 8. Acquire leadership qualities and democratic attitudes 9. Develop capacity to meet emergencies and natural disasters. 10. Practice national integration and social harmony

EXPECTATION FROM TRAINERS
5. To assist and guide the NSS unit for implementation of NSS programs at college level 6. To advise in organizing camps, training and orientation programs for the NSS volunteers 7. To visit the NSS units for monitoring and evaluation. 8. To ensure implementation of NSS regular activities and special camping programs

RTM Nagpur University
Mechanical Engineering –IV Sem
National Cadet Corps (NCC)
Course Code- BEME406P

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III &IV	National Cadet Corps (NCC)	0	0	3		00	00	00	00

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 training should 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 abilities to 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