SYLLABUS

SEMESTER-III

Diploma in Mechanical Engineering
(wef 2018 batch)

COURSE STRUCTURE
(W.E.F. 2018 Batch Students)
(Total Credits 24.0)

Diploma in Mechanical Engineering

Third Semester

Subject Code	Subject	Theory	Tutorial	Lab.	Credit
DMA 3201	Applied Mathematics	3	0	0	3
DMM 3101	Thermal Engineering	3	1	0	4
DME 3007	Manufacturing Process	3	0	0	3
DMM 3003	Applied Mechanics	3	1	0	4
DMM 3005	Mechanical Engineering Materials	3	0	0	3
DMM 3006	Machine Drawing	0	1	2	2
DME 3106	Manufacturing Process Lab.	0	0	2	1
DMM 3102	Thermal Engineering Lab.	0	0	2	1
DMM 3004	Applied Mechanics Lab.	0	0	2	1
DHU 3002	Professional Practices-II	0	0	2	1
DGA 3002/04/06/08	PT and Games/NSS/NCC/CA	0	0	3	1
	Periods per week	**15**	**3**	**13**	**-**
	Total credits	**-**	**-**	**-**	**24**
	Total periods per week	**-**	**-**	**-**	**31**

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMA 3201 APPLIED MATHEMATICS

Objective: Students will be able to

1. Develop the essential skills for using Matrices and Determinant to solve system of linear equations.
2. Learn to use First order ODEs necessary for modeling engineering problems.
3. Acquire necessary ability to use Second or Higher Order ODEs to design engineering models.
4. Learn and appreciate Partial Differentiation and its applications.
5. Learn and apply Vector Calculus to solve technical problems.

Module-I:
Determinant and Matrices with Solution of System Linear Equations
Definition of a matrix of order *m* x *n* and types of matrices. Algebra of matrices such as equality, addition, subtraction, scalar multiplication, and transpose of a matrix.
Definition and expansion of determinants of order 2 and 3. Minor, cofactor of an element in a matrix, adjoint of matrix and inverse of matrix by adjoint method.
Solution of simultaneous equations containing 2 and 3 unknowns with applications.

Module-II:
Ordinary Differential Equations (ODE) of First Order
Definitions of ODE and meaning of solution of ODE. Formation of ODE.
Solution of ODE of first order and first degree: Variable separable method, Homogenous equations, Equations reducible to homogenous form, Exact equations, Linear equations, Bernoulli equations.

Module-III:
Linear Differential Equations of Second and Higher Order
Definition of linear ODE. The operator 'D'. Auxiliary Equations (A.E.) and rules of finding Complementary Function (C.F.).
The inverse Operator $\frac{1}{f(D)}$. Rules for finding the Particular Integral (P.E.).

Module-IV:
Partial Differentiation and Multiple Integrals
Functions of two or more variables. Partial derivatives of first and higher order.
Differentiation of composite functions. Jacobians and its properties.
Evaluation of double integral. Change of order of integration.
Finding area and volume using double integration. Change of variables from Cartesian to polar.

Module-V:
Vector Calculus
Definition Vector functions and its derivative. Velocity and acceleration.
Concepts of Scalar and Vector Fields. Gradient of scalar field. Directional Derivative and its geometrical interpretation. Properties of Gradient.
Divergence and Curl of a vector function and their properties. Physical interpretation of divergence and curl.

Text Books:

1. N.P. Bali and Manish Goyal. "A Textbook of Engineering Mathematics". Laxmi Publications Pvt. Ltd.
2. R. S. Agarwal, "Senior Secondary School Mathematics for Class 12", Bharati Bhavan Publishers & Distributers.

Reference Books:

1. B. S. Grewal. Higher Engineering Mathematics. Khanna Publication, New Dehli.
2. Erwin Kreyszig. Advanced Engineering Mathematics. John Wiley & Sons, Inc.
3. Murray R Spiegel. Vector Analysis and an Introduction to Tensor Analysis. Schaum's Outline series. McGraw-Hill.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 3101 THERMAL ENGINEERING

OBJECTIVE: Students will be able to

1 Know basic concepts of thermal engineering.
3. Significance of thermodynamic properties in order to analyse a thermodynamic system from macroscopic view point.
4. Computing work and heat transfers across system boundaries.
5. Applying first and second law of thermodynamics in closed and open systems involving steady flow.
6. Know about different laws and processes.
7. Learn about turbine, nozzle and compressor.

Module –I:

Concepts and Terminology:

Basic Concepts, Zeroth law of Thermodynamics and its significance, Concept of heat and work. Properties of steam, Properties of Ideal gas. Macroscopic and microscopic views of study, concept of continuum Thermodynamic properties of a system (Pressure, volume, temperature and units of measurement) Intensive and extensive properties, State and Process Thermodynamic equilibrium.

Energy and Work Transfer:

Conceptual explanation of energy, work and heat, work transfer Path and point Function, Displacement work, forms of work transfer, Modes of Heat Transfer, introductory concepts of Conduction convection and Radiation, Sensible and latent heat, Specific heat, energy and its resources. Quasi static process.

Module –II:

First Law of Thermodynamics:

First Law of thermodynamics Energy as system property, forms of stored energy First law for a closed system undergoing a cyclic process First law for a closed system undergoing change of state Concept of Enthalpy, First law applied to steady flow processes, Steady Flow Energy Equation and its application to nozzle, turbine and compressor, Perpetual motion machine of first kind.

Module –III:

Second law of Thermodynamics:

Limitations of first law Thermal reservoir Concept of heat engine, heat pump and refrigerator Statement of Second law of thermodynamics (Clausius and Kelvin Planck), Perpetual motion machine of second kind, Carnot cycle Application of second law in heat engine, heat pump, refrigerator and determination of Efficiencies and C.O.P, Elementary knowledge of Entropy and Enthalpy and Third law of Thermodynamics.

Module –IV:

Principles of Steam Turbine and Nozzle:

Types of nozzle flow of steam through nozzles, steady flow energy equation in nozzles, principle of operation of steam turbine, types of steam turbine, difference between steam turbine and steam engine, difference between impulse turbine and reaction turbine.

Module-V:

Thermodynamic Cycles and Air Compressor:

Otto-cycle, Diesel-cycle, Joule/Brayton-cycle.

Introduction, classification, application, construction and working of single stage compressor, calculation of power.

Text Books:

1. An Introduction to Thermodynamics	P.K. Nag
2. Engineering Thermodynamics	R.K. Rajput.
3. Thermal Engineering	P.L. Ballaney.

Reference Books:

1. Engineering Thermodynamics	Arora & Domkundwar
2. Engineering. Thermodynamics	Dr. D. S. Kumar

Syllabus of Diploma in Engineering (Mechanical Engineering)

DME 3007 MANUFACTURING PROCESS

OBJECTIVE: Students will be able to

1. Learn basic ideas about foundry, pattern and its kinds.
2. Understand various sands, their properties, gating system.
3. Basic idea about different melting furnaces like cupola, electric arc furnace.
4. Will be able to know about special casting processes other than conventional methods.
5. Know the safety practices while working in workshop.

Module – I Foundry: Introduction to foundry, advantages and disadvantages, Pattern: pattern making, Type of patterns, pattern materials.
Sand Moulding & Core making : Introduction, mould material, sand grains, types of sand, sand properties, sand preparation, testing of moulding sand, types of mould, sand moulding techniques, conventional sand moulding, CO_2 moulding, Moulding materials, Cores: Core making materials, types of cores, Core prints. Gating System – Parts of the gating system – pouring basin, sprue, runner, riser.

Module-II Melting furnaces and casting defects: Arc furnace: types, operational features, advantages and disadvantages, Cupola: construction, different zones, working principle, advantages and disadvantages and efficiency of cupola, Cleaning of casting, Casting defects & Remedies.

Module-III Welding processes:
Concepts, principle, application, advantages and disadvantage of Oxy-acetylene gas welding, Shielded metal arc welding, Electric resistance welding, Spot, Seam, Projection and Butt welding. Defects in welding. Concept of Brazing and Soldering.

Module-IV Introduction and classification of machine tool:
Basic concept of machining, different type of tool material, Cutting fluid (Classification and purpose), Types of chip, Orthogonal and Oblique cutting. Lathe Machine: Type of Lathe machine, Specification of lathe machine, Type of accessories and attachment used, Types of operation which can be performed.

Module-V Drilling, Shaper and Milling Machine:
Classification, specification, type of operations performed in shaper, drilling and milling machine, type of work holding and tool holding mechanism, up milling and down milling, types of milling cutter.

Text Books:

1. Elements of Workshop Technology, Vol. I & II - Hazra S. K. and Chaudhary
2. Workshop Technology by Raghuwanshi B. S.

Reference Books:

1. Workshop Technology Vol. I & II by Gupta K. N. and Kaushin J. P.
2. Workshop Practice Vol. I & V by Atherton W. H.
3. Principle of Foundry Technology – K. P. Sinha
4. Manufacturing Technology Vol. I & II – O. P. Khanna
5. Welding Technology – O.P. Khanna
6. Production Technology – R. K. Jain
7. Workshop Technology-S.K.Garg

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 3005 MECHANICAL ENGINEERING MATERIALS

OBJECTIVES: Students will be able to

1. Understand the properties of engineering materials like metals and non-metals, ferrous and non - ferrous metals.
2. Know the phase diagram to find temperatures for heat treatment process.
3. Understand heat treatment process and its applications.
4. Learn non- destructive testing methods.
5. Know powder metallurgy methods and its applications.

Module –I: Engineering materials and their properties

Material classification into ferrous and non- ferrous category and alloys, Properties of Materials: Physical and Chemical Performance requirements Material reliability and safety, Elementary description of Nano Materials, Smart materials, polymer, Composite and Polymer materials.

Module-II: Crystal imperfections

Crystal defines, classification of crystals, ideal crystal and crystal imperfections, Classification of imperfection: Point defects, line defects, surface defects and volume defects, Types and causes of point defects: Vacancies, Interstitials and impurities, Types and causes of line defects: Edge dislocation and screw dislocation, Effect of imperfection on material properties, Deformation by slip and twinning, Effect of deformation on material properties

Module –III: Ferrous and Non Ferrous Materials and alloys

Characteristics and application of ferrous materials Classification, composition and application of low carbon steel, medium carbon steel and High carbon steel Alloy steel: Low alloy steel, high alloy steel, tool steel and stainless steel Tool steel: Effect of various alloying elements such as Cr, Mn, Ni, V, Mo, W. Properties, applications and chemical composition of Copper alloys (naval brass, muntz metal, gun metal and bronze), Aluminum alloys (Y-alloy and duralumin).

Module –IV: Iron – Carbon system

Concept of phase diagram and cooling curves Features of Iron-Carbon diagram with salient micro-constituents of Iron and Steel, Bearing and spring materials, Introduction to Corrosion, types of Corrosion, Corrosion resisting, Special Cutting Tool Materials – High speed steel, Diamond, Stellates & Tungsten Carbide

Module-V: Heat Treatment

Introduction to heat treatment process such as Annealing, normalizing, hardening, tampering- their principle, applications, advantages and limitations. Surface hardening: Different methods like case hardening, flame hardening, induction hardening, carburizing and nitriding- their principle, applications, advantages and limitations. Effect of heat treatment on properties of steel Hardenability of steel, Powder Metallurgy & Non-destructive Testing Advantages, limitations and applications of Powder Metallurgy for engineering products. Brief Description of Process of Powder Metallurgy – Powder making.

Text Books:

1. O. P. Khanna "A Textbook of Material Science and Metallurgy" Dhanpat Rai & Sons
2. R. K. Rajput "Engineering Materials and Metallurgy" S. K. Khatri & Sons.

Reference Book:

1. S. K. Hazra and Choudhary" Material Science and Processes" Indian Book Distribution Co.

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 3003 APPLIED MECHANICS

OBJECTIVE: Students will be able to

1. Know basic concepts about force system.
2. Learn to find the resultant of given force system.
3. Find the reactions of beam.
4. Find the centre of gravity of composite solids Find M.A., V.R.
5. Efficiency and establish law of machine.
6. To know about different laws and processes.

Module-I: Force System Fundamentals: - Definitions of mechanics, statics and dynamics, scalar and vector, Engineering Mechanics law, principle of transmissibility, Triangle and parallelogram and polygon law, Resolution of forces, Resultant of a forces system, Moment of a force, Definition, geometrical meaning of moment of a force, classification of moments according to direction of rotation, sign convention, law of moments Varignon's theorem of moment, Couple.

Module-II: Equilibrium:
Definition, conditions of equilibrium, analytical and graphical conditions of equilibrium for concurrent, non-concurrent and parallel force system, free body and free body diagram, General condition of equilibrium, Action & reactions, Equilibrium of a particle under Three Forces,

Module-III: Centroid and Moment of inertia:
Centroid**:** Definition of centroid. Moment of an area about an axis, Centroid of basic geometrical figures such as square, rectangle, triangle, circle, semicircle and quarter circle. Centroid of composite figure, Center of gravity such as cylinder, sphere, hemisphere, cone, cube, and rectangular block , Radius of Gyration, parallel and perpendicular axis of Theorem, moment of inertia of standard forms and moment of inertia of composite Materials.

Module-IV: Friction:
Definition of friction, force of friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction angle of repose and coefficient of friction. Cone of friction, types of friction, and laws of friction, advantages and disadvantages of friction, Equilibrium of bodies on level plane external force applied horizontal and inclined up and down. Equilibrium of bodies on inclined plane

Module-V: Simple Machines:
Definitions of simple machine, compound machine, load, effort, mechanical advantage, velocity ratio. Input on a machine, output of a machine, and efficiency of a machine, expression for mechanical advantage, velocity ratio and efficiency of a machine. Ideal machine, ideal effort and ideal load, friction in machines, effort lost in friction and frictional load. Law of machine, maximum mechanical advantage and maximum efficiency of a machine, reversibility of a machine, condition for reversibility of a machine, self-locking machine.

Text Books:
1. Engineering Mechanics - Beer – Johnson
2. Engineering Mechanics - Basu

Reference Books:
1. Engineering Mechanics – R K Bansal

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 3006 MACHINE DRAWING

OBJECTIVE: Students will be able to

1. Develop ability towards recognizing significance of standardized representations
2. Understand various fastening elements and offer engineering drawing thereof in manual mode.
3. Learn geometrical constraints and function of components in assemblies such as bearings and screw jack.
4. Know functional requirement of major components and offer engineering drawing in manual mode thereof.
5. Know about different joints.

Module-I: Conventional-presentations

(a) Materials C.I., M.S, Brass, Bronze, Aluminum, wood, Glass, Concrete, and Rubber, (b) Long and short break in pipe, rod and shaft. (c) Ball and Roller bearing, pipe joints, cocks, valves, internal / external, threads. (d) Various sections- Half, removed, revolved, offset, partial and aligned sections. (e) Knurling, serrated shafts, splined shafts, and chain wheels. (f) Springs with square and flat ends, Gears, sprocket wheel (g) Countersunk & counter bore. (h) Tapers.

Module-II: Limits, Fits and Tolerances

Characteristics of surface roughness- Indication o machining symbol showing direction of lay, roughness grades, machining allowances, manufacturing methods. 2. Introduction to ISO system of tolerencing, dimensional tolerances, and elements of interchangeable system, hole & shaft based system, limits, fits & allowances. 3. Geometrical tolerances, tolerances of form and position and its geometric representation.

Module-III: Details to Assembly

1. Introduction. 2. Couplings – Universal couplings & Oldham's Coupling 3. Bearing – Foot Step Bearing & Pedestal Bearing, 4. Lathe tool Post, 5. Machine vice, 6. Screw Jack.

Module-IV: Assembly to Details

1. Introduction – 2. Pedestal Bearing, 3. Lathe Tail Stock, 4. Drilling Jig, 5. Piston & connecting rod,6. Gland and Stuffing box Assembly, 7. Fast & loose pulley, Bolt, nut and threads, Screws and rivet.

Module-V: Pipe joint

Conventional symbols, Union joint, Nipple joint, Cotter and spigot joint, Knuckle joints and Universal joints. Pipe Vice, Valve – Not more than eight parts.

Text Books:

Name of Authors	Titles of the Book Edition
N.D.Bhatt	Machine Drawing
IS Code SP 46 (1988)	Code of practice for general engineering Drawing.
Practice	

Reference Books:

L.K.Narayanan	P.Kannaich, Production Drawing

DME 3106 MANUFACTURING PROCESS LAB.

LIST OF EXPERIMENTS

1. Identification and Specification of Lathe machine.
2. Do some lathe operations on the given job.
3. Identification and Specification of Drilling machine.
4. Do some drilling operations on the given job.
5. Identification and Specification of Shaper machine.
6. Do some shaping operations on the given job.
7. Identification and Specification of Milling machine.
8. Do some milling operations on the given job.
9. To make a job like (nut & bolt) using all the above four machines.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 3004 APPLIED MECHANICS LAB.

LIST OF EXPERIMENTS

a. To verify the Polygon Law of Forces, with the help of force polygon apparatus.
b. To verify the parallelogram law of forces.
c. To study Lami's theorem using universal force table apparatus.
d. To verify the forces in the different members of a jib crane.
e. To find out centre of gravity of regular laminas.
f. To find out centre of gravity of irregular laminas.
g. To find moment of inertia of flywheel.
h. Comparison of coefficient of friction of various pairs of surfaces & determination of angle of repose.
i. To find the mechanical advantage, velocity ratio and efficiency in the case of Screw Jack.
j. Deflections of a truss-horizontal deflections & vertical deflections of various joints of a pin-jointed truss.
k. To find the mechanical advantage, velocity ratio and efficiency in the case of Winch Crab Single Graphical Representation.
l. To study the performance of differential axle and wheel and find its velocity ratio, efficiency and law of machine.

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 3102 THERMAL ENGINEERING LAB.

LIST OF EXPERIMENTS

1. Study of Lancashire boiler.
2. Study of Babcock and Wilcox boiler.
3. Study of Reverse flue gas oil fired packaged boiler.
4. Study of Rover gas turbine, its components and instrumentation provided over it.
5. Study of Steam turbine.
6. Study of Steam Power Plant.
7. Study of Single stage and multistage compressor.
8. Study of Refrigeration and Air conditioning.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DHU 3002 PROFESSIONAL PRACTICES-II

Module-I:

Industrial visit: Industrial visit be arrange and report of the same should be submitted by the individual student, to form a part of team work. TWO industrial visits be arranged.

Module-II:

Lectures by professional /Industrial expert be organised from any one of the following areas:

i. Use of plastics in automobiles
ii. Non-ferrous metals and alloys for engineering applications
iii. Industrial hygiene
iv. Composite materials
v. Heat treatment processes
vi. Ceramics
vii. Safety engineering and waste elimination

Module-III:

Individual assignments:

Any two from the following lists;

i. Process sequence of any two machine operations
ii. Write material specification of any two composite jobs
iii. Collections of different plastic material or cutting tools with properties, applications and specifications
iv. List the various properties and applications of following materials-
a) Ceramics, b) Thermoplastic plastics, c) thermo setting plastics and d) rubbers.

Module-IV:

Conduct any one of the following activities through active participation of the students and write report:

i. Survey for local social problems such as malnutrition, unemployment, cleanliness, illiteracy
ii. Conduct aptitude, general knowledge test, IQ test.

Module-V:

Seminar:

Seminar on any advanced technical topic to be presented by individual student in a batch of 5.

SYLLABUS

SEMESTER-IV

Diploma in Mechanical Engineering
(wef 2018 batch)

COURSE STRUCTURE
(W.E.F. 2018 Batch Students)
(Total Credits 24.0)

Subject Code	Subject	Theory	Tutorial	Lab.	Credit
DMM 4007	Strength of Materials	3	1	0	4
DMM 4009	Engineering Measurement	3	0	0	3
DCS 4011	Computer Programming	3	0	0	3
DMM 4011	Heat and Power Engineering	3	0	0	3
DMM 4013	Fluid Mechanics	3	0	0	3
DAC 4001	Environmental Science	2	0	0	2
DMM 4008	Strength of Materials Lab.	0	0	2	1
DMM 4010	Engineering Measurement Lab.	0	0	2	1
DCS 4012	Computer Programming Lab.	0	0	2	1
DMM 4104	Fluid Mechanics Lab.	0	0	2	1
DHU 4002	Professional Practices-III	0	0	2	1
	Periods per week	**17**	**1**	**10**	-
	Total credits	-	-	-	**23**
	Total periods per week	-	-	-	**30**

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 4007 STRENGTH OF MATERIALS

OBJECTIVE: The Student should be able to

1. Understand the fundamentals of solid mechanics.
2. Acquire elementary knowledge of stresses, strains & material properties.
3. Understand & analyse the basic principles involved in the behaviour of machine parts under load in the context of designing it.
4. Understand & analyse the mechanical properties of the various materials.

Module –I:

Basic Concepts: Definition, elastic & plastic properties of material, stress & strain diagram for ductile & brittle materials, introductory remarks on fatigue, creep & fracture .Simple stresses and strains: Stress & strain, Simple stress and strain in composite sections, Thermal stresses, relation between elastic constants.

Module –II:

Principal Planes and Stresses: Principal stresses and principal planes, Mohr's circle for biaxial stresses.

Module –III:

Bending Moment and shearing forces : Types of beams, types of support, shear force and bending moment diagram for simply supported, and cantilever subjected to point and uniformly distributed loads, relation between intensity of loading shear force and bending moment.

Module-IV:

Bending, slope and deflection of beams: Definitions, theory of simple bending, relation between slope and deflection calculations for cantilever & simply supported beams.

Module –V:

Torsion & Vibration: Concept of Pure Torsion, Torsion equation for solid and hollow circular shafts, power Transmitted and stiffness of shaft. Assumptions in theory of pure Torsion, Comparison between Solid and Hollow Shafts, Theory of Failure for Brittle and Ductile material. Types of vibrations, free vibrations.

Text Books :

1. Strength of materials – Ryder
2. Strength of materials – Sadhu Singh
3. Strength of materials – Rajput

Reference Books:

4. Strength of materials – Bansal

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 4009 ENGINEERING MEASUREMENT

OBJECTIVE

Student will be able to:

1. Understand the principle of operation of an instrument.
2. Appreciate the concept of calibration of an instrument.
3. Select Suitable measuring device for a particular application.
4. Distinguish between various types of errors.

Module-I: Significance of measurement classification of instruments, static terms and characteristics- range and span, accuracy and precision, reliability, calibration, hysteresis and dead zone, drift, sensitivity, threshold and Resolution, repeatability and reproducibility, linearity. Dynamic characteristics- speed of response, fidelity and dynamic errors, overshoot. Measurement of error- classification of errors, environmental errors, signal Transmission errors, observation errors, operational errors, Transducers: Classification of transducers- active and passive, resistive, inductive, capacitive, piezo, resistive, thermo resistive

Module-II Control systems:
Block diagram of automatic control system, closed loop system, open loop, system, feedback control system, feed forward control system, servomotor, mechanism, comparison of hydraulic, pneumatic, electronic control, Systems, proportional control action. Applications of measurements and control for setup for boilers, air conditioners, motor speed control.

Module-III Mechanical Measurement: Displacement measurement**:** Potentiometer, LVDT, Eddy current generation type, tachometer, incremental and absolute type, Speed measurement: Mechanical Tachometers, Revolution counter &timer Inductive Pick Up, Capacitive Pick Up, Stroboscope, Flow measurements: Variable head flow meters, variable area meter-Rota meter, turbine meter, anemometer- hot wire, electromagnetic flow meter, Strain Measurement: resistance strain gauge- bonded and unbounded, types (foil, semiconductor, wire wound gauges)

Module-IV Temperature measurements:
Non-electrical methods- bimetal and liquid in glass thermometer, pressure thermometer Electrical methods- RTD, platinum resistance thermometer, thermistor Thermoelectric methods- elements of thermocouple, law of intermediate temperature, law of intermediate metals, thermo mf measurement. Quartz thermometer, Pyrometers- radiation and optical

Module-V Miscellaneous Measurement:
Acoustics measurement- sound characteristics, intensity, frequency, pressure, power, sound level meter, piezoelectric crystal type, Humidity measurement –hair hygrometer, Humistor hygrometer, Liquid level, measurement – direct and indirect methods Force measurement -Tool Dynamometer (Mechanical Type),Shaft Power Measurement - Eddy Current Dynamometer, Transmission Dynamometer, surface Roughness measurement, CMM

Text Books

Name of Author	Titles of the Book Edition
A.K.Sawhney	Mechanical Measurements & Instrumentation

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DCS 4011 COMPUTER PROGRAMMING

OBJECTIVE:

1. To understand basic programming concepts and write simple programs.
2. To use operators and library functions for writing arithmetic expressions.
3. To apply programming logic and develop problem solving approach.
4. To use arrays for developing more efficient logic.
5. To apply function oriented approach in program design.

Module-I:

Programming techniques and overview of c language:

Algorithm and Programming Development, Steps in development of a program. Flow charts, Algorithm development, Program Debugging, Program Structure. Formatted input, formatted output., assignment statements, Constants, variables and data types.

Module-II:

Operators and Expressions:

Arithmetic, Relational, Increment, increment, Assignment, logical and Conditional Operators, Operator precedence and associativity, type casting, size of () operator, Math functions sqrt ()), pow(), sin(), cos() and tan() .

Module-III:

Decision making and branching:

if statement (if, if-else, else-if ladder, nested if-else), Switch case statement, break statement, goto.

Decision making and looping:

while, do, do-while statements for loop, continue statement

Module-IV:

Arrays and Strings:

Declaration and initialization of one dimensional, two dimensional and character arrays, accessing array elements. Declaration and initialization of string variables, string handling functions from standard library (strlen (), strcpy (), strcat (),strcmp ()).

Module-V:

Functions:

Need of functions, scope and lifetime of variables, defining functions, function call (call by value, call by reference), return values, storage classes. Category of function (No argument No return value, No argument with return value, argument with return value), recursion.

Pointers:

Understanding pointers, declaring and accessing pointers, Pointers arithmetic, pointers and arrays.

Text Books:-

1. E Balagurusamy, "Programming in ANSI C" Tata McGraw-Hill, New Delhi.

Reference Books:

1. Ashok N. Kamthane, "Programming in C" Pearson Education India, New Delhi.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 4011 HEAT AND POWER ENGINEERING

OBJECTIVE:

1. Acquire, Demonstrate and apply advanced knowledge in the field of Heat and power Engineering.
2. Indentify problems in the field of Heat power Engineering formulate them.
3. Apply various numerical technique, Methods, Tools to Model analyze and Solve Thermal Engineering problem.
4. Apply Engineering and scientific principles for Effective management of thermal system.
5. Solving real life problems and optimal solution of thermal Engineering Devices.

Module-I:

Air –Standard Cycles and their Analysis

Introduction, Carnot, Rankine, Reheat and Superheated, Regeneration, Ericsson cycle, Otto, Diesel and Dual cycle, Brayton Cycle, refrigeration cycle, Thermal Efficiency, compression ratio, Work output, mean Effective pressure P-V and T-S Diagram, comparison of the Otto, Diesel and Dual Cycles.

Module-II:

Fuels and Alternate fuels

Different types of fuels, Petroleum refining process, important qualities of engine fuels and Rating of Fuels (S.I and CI Engine fuels), Alternate aspects of Fuels (Alcohol, Methanol, Natural Gas, Biogas), Dual Fuel operation ,Electrical and solar vehicle Engine Emission and control and pollution norms and standard.

Module-III:

Steam Generator Devices

Classification of Boilers/Steam Generators, Boiler Accessories, Boiler Draught and performance of Boiler. Steam Power Plants: Major components of power plant, storage, preparation, handling and burning, Ash handling and dust collection, Feed water treatment plants, cooling towers. Nuclear Power Plants: Principle of power generation by nuclear fission and Fusion fuels for nuclear power plants, preparation and care, fertile materials and breeding.

Module-IV:

Hydro Power and Tariff

Hydraulic Power Plants: Different types of hydraulic power plants, rain fall and run-off measurements and plotting of various curves for estimating power available with or without storage. Energy Storage Methods: Compressed air, Energy Storage flywheel, electrochemical energy storage, thermal energy storage, Site selection and Economics of Power Plants: Criterion for site selection of different types of power plants, cost consideration of different types of power plants, Different tariff of power

Module-V:

Pneumatic power

Introduction and classification- Concept of Lift and Drag and Air Foil, Description of Reciprocating and Rotary Air-compressor, Fan, Blowers and Supercharger, working principles of Reciprocating single and two stage Compressor, Centrifugal compressor, Air Compressibility, Mach Number, sonic, subsonic, and supersonic condition, Valves and their characteristics. Fans, Blowers and Motors

Reference Books:

1. Power Hydraulics – Michael J. Pinches & John G. Aohby
2. Hydraulic & Pneumatic – Andrew Parr
3. Power Plant Engineering- By – Arora & Domkundwar

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 4013 FLUID MECHANICS

OBJECTIVE: -The student will be able to

1. Measure various properties such as pressure, velocity, flow rate using various instruments.
2. Calculate different parameters such as co-efficient of friction, power, efficiency etc. of various Systems.
3. Describe the construction and working of turbines and pumps.
4. Test the performance of turbines and pumps.
5. Plot characteristics curves of turbines and pumps.

Module-I:

Properties of fluid

Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility,, laws of viscosity, Hydrostatic and Pascal's law

Module-II:

Fluid Pressure & Pressure Measurement

Introduction ,Fluid pressure, Pressure head, Pressure intensity, Concept of absolute vacuum, gauge pressure, atmospheric Pressure, absolute pressure, Simple and differential manometers, Bourdon pressure, gauge. Concept of total pressure on immersed bodies, center of pressure, Buoyancy, center of Buoyancy, Metacenter and metacentric Height, conditions of Equilibrium of a Floating and submerged Bodies.

Module-III:

Fluid Flow and Measurement

Types of fluid flows, Continuity equation, Bernoulli's theorem, Venturimeter – Construction, principle of working, Coefficient of discharge, Derivation for discharge through venturimeter, Orifice meter – Construction, Principle of working, hydraulic coefficients, Derivation for discharge through Orifice meter Pitot tube – Construction, Principle of Working.

Module-IV:

Flow through Pipes

Laws of fluid friction (Laminar and turbulent), Darcy's equation and Chezy's equation for frictional losses.

Minor losses in pipes, Hydraulic gradient and total gradient line, Hydraulic power transmission through pipe. Series and parallel pipes connection, siphon and Water Hammer in pipes.

Module-V:

Dimensional and Model Analysis

Introduction, Dimensional homogeneity, methods of dimensional Analysis: Rayleigh Method, Buckingham's Π Theorem, model analysis, similitude- types of similarities, dimensional Numbers: Reynolds's Number, Froude's Number, Euler's Number, Weber's Number, and Mach's Number, Models testing of partial submerged Bodies, Classification of models

Text Books

Modi P. N. and Seth	Fluid mechanics and Machinery
Dr.R.K Bansal	Fluid Mechanics and hydraulic machine

Syllabus of Diploma in Engineering (Mechanical Engineering)

DAC 4001 ENVIRONMENTAL SCIENCE

OBJECTIVE

The main aim of Environmental Science is to make the students acquainted with various types of pollution hazards, which are becoming more critical every day and also acquire the knowledge to participate in solving environmental problems for green earth.

Students will be able to understand:

1. Importance of Environmental Science as well as biogeochemical cycles and food chain
2. Composition and function of various segments of environment
3. Water pollution, various pollutants, their toxic effects and water treatment process
4. Classification, toxic effects and sources of air pollutants and their control measures
5. Brief introduction to Noise Pollution, Soil Pollution and radiation pollution

Module-I:

Multidisciplinary nature of Environmental Science & Ecology:

Definition & importance of Environmental Science. Ecosystem, basic structure of an ecosystem (abiotic and biotic components), nutrient and biogeochemical cycles (carbon cycle, nitrogen cycle, and hydrological cycle), food chain, food web.

Module-II:

Segments of environment:

Atmosphere, hydrosphere, lithosphere, soil profile and composition of soil, biosphere.

Module-III:

Water Pollution & Waste water treatment:

Water resources, sources of water pollution, various pollutants, their toxic effect, potability of water, rain water harvesting, primary and secondary waste water treatment (Trickling filter & Activated sludge process.

Module-IV:

Air Pollution:

Classification of air pollutants, toxic effects, sources and their control measures like ESP, catalytic converter and bag house filter.

Module-V:

A brief introduction to Noise Pollution, Soil Pollution and radiation pollution.

Text books:

1. Environmental Chemistry – A. K. Dey
2. A basic course in Environmental studies - Deswal & Deswal

Reference books:

1. Environmental pollution – B. K. Sharma
2. Environmental pollution and control - C. S. Rao
3. Essentials of ecology & environmental Sciences - S.V.S. Rana

DMM 4008 STRENGTH OF MATERIALS LAB.

LIST OF EXPERIMRNTS

1. Study of Rockwell Hardness Machine.
2. Study of Brinell Hardness Machine.
3. Study of Tensile Strength of mild steel
4. Study of Young Modulus of bending.
5. Study of torsion test.
6. Study of Universal Testing Machine.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 4010 ENGINEERING MEASUREMENT LAB.

LIST OF EXPERIMENTS

1. To study the measurement of dimensions of given work-piece using Vernier Calliper
2. To study the measurement of dimensions of given work-piece using Outside Micrometer.
3. To study the measurement of dimensions of given work-piece using Vernier Height Gauge.
4. To study the measurement of dimensions of given work-piece using inside Micrometer.
5. To study Slip Gauges and Angle Gauges to construct different given dimensions and angles.
6. To determine the included angle of a given angle plate using sine bar and slip gauges.
7. To measure the different angle of a single point cutting tool("V" tool) by Profile Projector.
8. To study the working of auto-collimator.
9. To study the working of optical flat and monochromatic light source.
10. To study the working of workshop microscope.
11. To study the working of Floating Carriage Diameter Measuring Machine to measure the external threads of a given work piece.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DCS 4012 COMPUTER PROGRAMMING LAB.

LIST OF EXPERIMENTS

1. Write Programs in C to implement
2. Programming Exercise on Executing and Editing a C Program.
3. Programming Exercise on defining Variable and assigning values to variables.
4. Programming Exercise on arithmetic's and relational operators.
5. Programming Exercise on arithmetic expression and their evaluation.
6. Programming Exercise on formatting input/output using printf and scanf
7. Programming Exercise using if-statement.
8. Programming Exercise using if-else statement.
9. Programming Exercise on switch statement
10. Programming Exercise on do-while statement.
11. Programming Exercise on for statement.
12. Programming exercise on one-dimensional array and two-dimensional array.
13. (i) Programs for putting two strings together (ii) Programs for comparing two strings.
14. Simple programs using structures and Union.

DMM 4104 FLUID MECHANICS LAB.

LIST OF EXPERIMENTS

1. Study of Bernoulli's theorem.
2. Study of Impulse Turbine.
3. To determine the Co-efficient of discharge of Rotameter.
4. Study of Reciprocating Pump.
5. Study of Radial flow Reaction Turbine.
6. To find the characteristics of Centrifugal Pump at different speed.

DHU 4002 PROFESSIONAL PRACTICES-III

Module-I:

Industrial visit:

Industrial visit be arranged and report of the same be submitted by the individual student, to form a part of term work. One industrial visit may be arranged in the following areas to observe material handling system, Quality control chart/ production records/ layout system/ hydraulic and pneumatic system/working of boilers and steam engineering applications.

Module –II:

Lectures by professionals/ industrial expert be organised from any one of the following areas.

- Use of plastics in automobiles
- Non-ferrous metals and alloys for engineering applications
- Industrial hygiene
- Composite materials
- Heat treatment processes
- Ceramics
- Safety engineering and waste elimination

Module –III:

Group-Discussion:

The students shall discuss in group of six to eight students and write a brief report on the same as a part of term work.

Module –IV:

Student Activities:

The students in a group of 3 or 4 will perform any two of the following activities and write a report as a part of term work.

Activity:

i. Study any one type of CNC machine centre and prepare on tooling and tool holding devices.
ii. For a given job write a sequence of operations performed by automated manufacturing system. Draw a block diagram of control system to perform above operations.
iii. For a drilling or milling operations on a simple machine component, draw a jig or fixtures showing various features like locating clamping tool.
iv. For a given job involving 3 to 4 operations suggest to prepare a report.

Module –V:

Seminar:

Seminar on any advanced technical topic to be presented by individual student.

SYLLABUS

SEMESTER-V

Diploma in Mechanical Engineering

(wef 2018 batch)

Course Structure
Diploma in Mechanical Engineering

Fifth Semester

Subject Code	Subject	Theory	Tutorial	Lab.	Credit
DMM 5107	Heat Transfer	3	0	0	3
DMM 5103	CAD/CAM	3	0	0	3
DMM 5105	IC Engines and Gas Turbine	3	0	0	3
DMM 5011	Hydraulic Machine	3	0	0	3
DMM 5013	Theory of Machine	3	0	0	3
DAE 5019	Basics of Automobile Engineering	3	0	0	3
DMM 5108	Heat Transfer Lab.	0	0	2	1
DMM 5104	CAD Lab.	0	0	2	1
DMM 5106	IC Engines and Gas Turbine Lab.	0	0	2	1
DMM 5016	Hydraulic Machineries Lab.	0	0	2	1
DMM 5014	Theory of Machine Lab	0	0	2	1
DMM 5012	Project-I	0	0	4	2
	Periods per week	**18**	**0**	**14**	-
	Total credits	-	-	-	**25**
	Total periods per week	-	-	-	**32**

DMM 5107 HEAT TRANSFER

OBJECTIVE:

- Understand the concept and Mode of the Heat Transfer and their Mechanism.
- Understand the concepts1 Exchanges of Heat with in the body or outside.
- Generation and utilization of Heat within the system
- Design the Heat Equipment devices and their performance analysis and correlation Number.
- To understand basics concepts of convection and radiation and their combined process.

Module-I:

Introduction to Heat transfer: Introductory concepts, modes of heat transfer – conduction, convection and radiation, Basic equations and applications,

Module-II:

Conduction: one dimensional heat conduction without heat generation, composite walls, cylinders and spheres, electrical analogy of thermal systems and critical thickness of insulation.
Heat transfer through extended flat and circular surfaces (Fins) : General equation, , heat flow, fin efficiency, fin effectiveness.

Module-III:

Convection: Concept of Natural and forced convection, concept of viscous and thermal boundary layers, Natural convection: Grashoff number, constant heat flux, horizontal flat surfaces, simplified correlation for air, combined free and forced convection.
Forced Convection: Dimensional analysis, Nusselt number, force convection for internal laminar flow.

Module-IV:

Radiation: Definition and laws of thermal radiation, black body, real surfaces, gray surfaces, radiation properties, radiation shield, gas radiation basics only.

Module-V:

Heat Exchanger: Types of heat exchanger, LMTD method of analysis counter and parallel flow, storage type exchangers.

Text Book:

1. A course in Heat Transfer by Arora and Domkundwar

Reference Books:

1. Heat and Mass Transfer by F. Kids
2. Heat and Mass Transfer by J.P. Holman
3. Heat and Mass Transfer by C.P. Kothandraman
4. Heat and Mass Transfer by D.S.Kumar

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 5103 CAD/CAM

Module-I: **Basic Concepts of CAD and CAM**
Introduction of Computer Aided Design, The Design Process, Product Cycle, CAD/CAM Developments, Definition of CAD&CAM Tools, Hardware and Software requirement of CAD, Engineering Application of CAD.

Module-II: Computer Graphics:
Graphic System: CRT, Raster Scan system and Display process, Random Scan System and display, direct view storage tubes, Graphics Software configuration. Line draw algorithm – DDA & Bresenhems, Circle Midpoint circle Algorithm, Bezier & B-Spline curves. Bezier & B-Spline surfaces. The various surface representation scheme & techniques.

Module-III: Geometric Transformations and Modelling System
2D & 3D Transformations. Translation, Rotation, Scaling, Reflection, Homogeneous co-ordinates, windowing & clipping, Orthographic projection, Isometric projection.
Geometric modelling: Wire frame, surface & solid modelling. Techniques, Boundary Representation and constructive Solid Geometry method.

Module-IV: Introduction to CAM, ROBOTICS & FMS
Concept of numerical control machine, CNC machine and DNC machine Working principle of NC, Features of CNC machine, Construction and working principle of . Concept & Introduction of Robotics, Configuration of Robots, Industrial application of ROBOT. Introduction to FMS, components of FMS, Layout of FMS, Types of FMS.

Module-V: CAM & Part Programming
NC coordinate system, various programming technique, manual programming, conventional programming and APT, Word address format, NC coordinate system, types of motor control, preparatory function and G code, simple program for lathe and milling: linear & circular interpolation.

Text Book:

1. Groover. M.P., CAD/CAM

Reference Books:

1. CAD/CAM – by Ibrahim Zeid ,Tata McGraw Hill Publishing Comp. Ltd., New Delhi
2. CAD/CAM – by P. N. Rao
3. .CAD/CAM – by Chirs McMohan, Publication: Pearson Education Asia.
4. Computer Aided Design – by R.K. Srivastava, Umesh Publication.
5. Computer Graphics – by Hearn & Baker, Publication Prentice Hall

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 5105 IC ENGINES & GAS TURBINE

OBJECTIVE

- Understand the concept and working principles of various types of the engine
- Understand the various parameter and modern technological concepts of Petrol, Diesel and Dual fuel and alternative fuels which are commonly used.
- Knowledge of various parts of the Engine and their modernisation.
- To understand basics concepts of Gas Turbine, fuel analysis and performance parameters.

Module-I:

Introduction: Classification of I.C. Engine, difference between S.I. and C.I. engine, comparison between two strokes and four stroke engines, Air standard cycle: Otto cycle, Diesel cycle, Fuel air cycle and their analysis. Types of fuel and their properties, and their properties, chemical composition, additives.

Module-II:

Carburetion, injection, and supercharging: Introduction MPFI system. Injection system of C.I. Engine, Introduction of supercharging and turbo charging, and its purpose.

Module-III:

Engine cooling and Lubrication: Introduction, necessity of engine cooling, types of cooling system and their applications, different types of water cooling systems Introduction of radiator. Function and properties of lubricating oil. Role of additives, and different types of lubricating systems.

Module-IV:

Testing and performance: Introduction, Study the different types of performance parameters, measurements of air, Fuel consumption, Morse test, Measurement of brake power, and indicated power, performance of S.I. and C.I. engine.

Module-V:

Gas turbine and Jet propulsion: Introduction, Types of gas turbines, Theory of gas turbine, thermodynamic analysis of Brayton cycle, and with regeneration, reheat, inter-cooling, compressor, and turbine isentropic efficiency, jet propulsion cycle elementary idea of turbojet.

Text Book:

1. Obert. E.F. — Internal Combustion Engines.
2. Roger Cohen. — Gas turbine Theory

Reference Books:

1. Mathur. M.L and. Sharma R.P — A course in Internal Combustion Engines.
2. Mathur M.L. and Sharma R.P. — Gas Turbine Jet and Rocket Propulsion.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 5011 HYDRAULIC MACHINE

OBJECTIVE

1. The student will be familiarized with the different types of hydraulic turbine and pump working.
2. It will help to understand how a fluidic power is converted to other forms of the energy, for future prospective knowledge of these devices will help them in making of reliability and sustainable products**.**

Module-I:

Impact of jet

Impact of jet on fixed vertical, moving vertical flat plates, Impact of jet on curved vanes with special reference to turbines & pumps

Module-II:

Hydraulic Turbines

Classification of hydraulic turbines, Selection of turbine on the basis of head and discharge available Construction and working principle of Pelton wheel, Francis and Kaplan turbine. Draft tubes-types and construction, Concept of cavitations in turbines, Calculation of Work done, Power, efficiency of turbine.

Module-III:

Reciprocating Pump

Construction, working principle and applications of single and double acting reciprocating pumps. Concept of Slip, Negative slip, Cavitations and separation, Use of air Vessel, Indicator diagram with effect of acceleration head & frictional head.

Module-IV:

Centrifugal Pumps

Construction, principle of working and applications, Types of casings and impellers. Concept of multistage Priming and its methods, Cavitations, Manometric head, Work done, Monometric efficiency, overall, efficiency, NPSH, Performance Characteristics of Centrifugal pumps

Module-V:

Hydraulic Devices

Construction, working and applications of submersible, jet pump, Hydraulic Ram, Hydraulic press, Hydraulic Accumulator, Fluid coupling and Torque converter, Accumulators, Accessories – Pipes, Hoses, fittings, Oil filters, Seals and gaskets, Filters. Process and control valve.

Name of Authors	Titles of the Book Edition
Text Books	
Ramamrutham S.	Hydraulic, fluid mechanics & machines
Ramamurtham.S	Fluid and Hydraulics Devices

Reference Book:

Bansal. R.K	Hydraulic machines and Pump

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 5013 THEORY OF MACHINE

OBJECTIVE: The Student should be able to

1. To focus on understanding the concept of machines, mechanisms and their elements. Also study kinematics aspects of various links in mechanisms. To form foundation for kinematics synthesis, analysis and design of mechanism.
2. To know different machine elements and mechanisms.
3. Understand Kinematics and dynamics of different machines and mechanisms.
4. Select Suitable drives and mechanisms for a particular application,
5. Appreciate concept of balancing.
6. Develop ability to come up with innovative ideas.

Module-I:
Mechanisms: Kinematic concept of Link, Kinematic chain, Mechanism, degree of freedom, Inversions of four bar mechanism, single slider crank mechanism and double slider crank mechanisms.

Module-II:
Motion Analysis: Types of motion: Kinematic and Dynamic quantities; Vector diagrams, Velocity and acceleration diagram of plane mechanism.

Module-III:
Flywheel & Belt: Concept, function and application of flywheel with the help of Turning Moment diagram; Fluctuation of energy and speed. Types of belt, ration of tension in belt, Centrifugal tension in belt & Power transmission

Module-IV:
Gears: Fundamental laws of gearing: classification and basic terminology, involute tooth profile and its kinematic consideration, spur gears, other types of gears, standards in tooth forms. Gear trains: Simple and, compound gear trains.

Module-V:
CAM & Balancing: Balancing of Rotating masses by a single mass in same plane, Balancing of a single rotating mass by two masses rotating in different planes, Balancing of several masses rotating in same plane. Various types of cams, Displacement, velocity and acceleration of followers, Graphical determination of CAM profiles with simple followers.

Text Book:

1. Khurmi.R.S Theory of Machine

Reference Books:

1. Singh. Sadhu Theory of Machine

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DAE 5019 BASIC OF AUTOMOBILE ENGINEERING

OBJECTIVE: The Student should be able to

1. To focus on understanding the concept of Engines parameters and performance.
2. Understand constructional details of automotive engine
3. Concept of combustion phenomenon of SI and CI Engine
4. Appreciate concept of Ignition, Transmission and Distribution system.
5. Concepts and familiarisation of the Control, emission and Norms and regulation of Automobile Systems.

Module-I:

INTRODUCTION

Basic units, major components of engine, mechanism of operation, Four- stroke and Two-stroke petrol and diesel engine, their application.

Module-II:

CONSTRUCTIONAL DETAILS OF AUTOMOTIVE ENGINE

Introduction, multi-valve overhead cam system, crank case, cylinder liner, piston rings, connecting rod, crank shaft, main bearing cam shaft, valve seats, valve mechanism, valve timing gears, balancing, flywheel, vibration damper, timing order.

Module-III:

COMBUTION PHENOMENON

Characteristics of petrol and diesel engine fuel, additives, combustion in S.I. and C.I. engine, flam propagation, detonation, pre- ignition and diesel knock, HUCR, Octane and Cetane number.

Module-IV:

AUTOMOBILE, ELECTRICAL AND IGNITION SYSTEM

Charging system, various automobile lighting circuits, indicator lights & warning devices, Electrical accessories, Ignition system: - Requirements, types, components, automotive ignition timing, Distribution system, spark plug, electronic ignition system, distribution less system.

Module-V:

DIFFERENTIAL &TRANSMISSION SYSTEM

Differential, Necessity &function of final drive, Types of axle, drive line operation, axle less transmission, transfer case, two wheels & four wheel drives and all-wheel drive, wheel alignment- toe in and toe out, camber, caster, and kingpin inclination.

Text Books

Singh. Kirpal	Automobile Engineering
Khurmi, R.S	Automobile Engineering

References Books

De, Amitosh	Automobile Engineering

DMM 5108 HEAT TRANSFER LAB.

LIST OF EXPERIMRNTS

1. To determine the overall heat transfer coefficient of shell and Tube type heat Exchanger.
2. To determine the heat transfer coefficient of the inner surface of pipe for different heat or voltage.
3. To determine the Emissivity of Gray body.
4. To determine the Thermal conductivity of Insulating powder
5. To study the temperature distribution along the length of pin under natural convection Heat transfer.
6. To find the heat transfer coefficient of vertical cylinder under Natural convection.
7. To determine the thermal conductivity of Liquid.
8. To find the heat transfer coefficient of vertical cylinder ion natural convection and find the percentage deviation from the theoretical value.
9. To determine the Efficiency and Effectiveness of a pin-fin under a natural convection of Heat Transfer.
10. To determine the Efficiency and Effectiveness of a pin-fin under a forcedl convection of Heat Transfer.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 5104 CAD LAB.

1. Practice on the following commands
Units , limits , grid , line , poly-line , donut , polygon , chamfer , fillet , offset , text , de-text.

2. Practice on the following commands:
O snap , Extension , undo , redo , oops , color , line-type , layer , save , quit , end.
Hints: use layers, color, line-types)

3. Practice on the following commands:

Erase , Copy , move , array , break , trim , mirror , pedit , pan , divide , zoom

4. **Practice on the following commands:** Hatch, batch, Hatchedit, boundary and dimensioning.

5. Draw the details of the footstep bearing and also draw plan and elevation (full sectional).

6. Draw the details of connecting Rod, Crank pin, cylinder block and also draw plan and Elevation.

7. Draw all the Automobile components by using the CAD Tools.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 5106 I.C ENGINE AND GAS TURBINE LAB.

LIST OF EXPERIMRNTS

1. Performance study of Morse test on MPFI Petrol Engine.
2. Heat Blance test on a Diesel Engine.
3. Energy Auditing of a Maruti ZEN Petrol Engine.
4. Study of different types of carburetors.
5. Study of MPFI/SPFI system.
6. Study of blower and Compressor.
7. Study OF Wankel Rotary Engine.
8. Economic Load test on Diesel Engine.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 5016 HYDRAULIC MACHINERIES LAB.

LIST OF EXPERIMRNTS

1. Impact of jets on vane apparatus
2. Pelton wheel apparatus
3. Francis Turbine apparatus
4. Kaplan Turbine apparatus
5. Friction factor for given pipe line apparatus
6. Single stage centrifugal pump apparatus
7. Multi stage centrifugal pump apparatus
8. Reciprocating Pump apparatus
9. Loss of Head due to sudden contraction in pipeline apparatus.
10. To determine the heat transfer coefficient for drop-wise and film-wise condensation process.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 5014 THEORY OF MACHINE LAB.

LIST OF EXPERIMRNTS

1. To verify the relation of simple pendulum.
2. To verify the relation of compound pendulum and determine of the radius of Gyration.
3. To determine the radius of Gyration of given bar using bifilar suspension.
4. To study the torsional vibration single rotor system
5. To study the free vibration of two rotor system and to determine natural frequency(both theoretically and experimentally)
6. To study the gyroscopic effect of a rotating disc.
7. To study the static and dynamic balancing using rigid blocks.
8. To study the effect of whirling of shaft with:
    a. both end fixed.
    b. Both end supported
    c. Fixed supported.
9. Study of cam-follower pair and to plot X-0 curve for different cam-follower pairs.
10. Balancing of masses in Machines fault-simulator

SYLLABUS

SEMESTER-VI

Diploma in Mechanical Engineering

(wef 2018 batch)

COURSE STRUCTURE
(W.E.F. 2018 Batch Students)

(Total Credits 25.0)

Sixth Semester

Subject Code	Subject	Theory	Tutorial	Lab.	Credit
DMM 6101	Machine Design	3	1	0	4
DMM 6107	Refrigeration and Air-conditioning	3	1	0	4
DME 6107	Operation Research	3	1	0	4
DME 6011	Industrial Engineering	3	0	0	3
DME 6023	Quality Control	3	0	0	3
	Elective	3	0	0	3
DMM 6108	Refrigeration and Air-conditioning Lab.	0	0	2	1
DMM 6012	Project-II	0	0	6	3
ELECTIVE(Any one)					
DMM 6017	Energy Resources and Utilization	3	0	0	3
DMA 6001	Numerical Technique	3	0	0	3
DMM 6110	Non-Conventional Energy Resources	3	0	0	3
	Periods per week	**18**	**3**	**8**	-
	Total credits	-	-	-	**25**
	Total periods per week	-	-	-	**29**

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 6101 MACHINE DESIGN

OBJECTIVE: The Student should be able to

1. To focus on understanding the concept of machines, mechanisms and their elements.
2 Understanding the various aspects of the materials selection on their characteristic properties
3. To focus on concept and preliminary phases of the design of any machine elements.
4. Design of various machine parts, wear and tear analysis, failure analysis, strength properties analysis.
5. Consideration of various design aspects on the behaviour of the material properties.

Module-I:

Introduction to design

Principles of Machine Design, standardization, types of loading, concept of different type of stresses, Fatigue, S- N curve, Endurance limit. Factor of safety and factor governing selection of factor of safety. Concept of stress concentration. Use of machine design data hand book

Module-II:

Theory of elastic failure.

Principal normal stress theory, maximum shear stress theory, Maximum distortion energy theory.

Module-III:

Design of simple machine parts & Joints

Cotter and Knuckle joints, Design of lever, Riveted and Welded Joints

Module-IV:

Design of Shafts, keys, couplings, and Spur gear

Types of Shaft, shaft material, Standard sizes, design of solid shaft using strength criteria design of line shaft supported between bearings with one or two pulleys in between them. Lewis equation for design of spur gear teeth, power transmission capacity of spur gears.

Module-V:

Design of power screws and springs

Thread Profiles used for Power screws, Torque required to overcome thread friction, self- locking Design of Screw Jack, Stresses in springs, Design of Helical (Tension and compression springs) and leaf springs.

Text Books:

1.	VB Bhandari	Design of Machine Elements,
2.	Khurmi and Gupta	Design of Machine ,

Reference Books:

1.	Kataria S.K.	Machine Design
3.	Shegley J.F.	Mechanical Engineering Design

Hand Book:

1. Hand book of Properties of Engineering Materials and Design Data far Machine Elements, Abdulla Shariff, Dhanpat Rai & Sons, New Delhi

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 6107 REFRIGERATION AND AIR-CONDITIONING

OBJECTIVE: The Student should be able to

1. Understand vapour compression and vapour absorption system operation.
2. Analyse the refrigeration cycles and methods for improving performance.
3. Familiarize the components of refrigeration systems
4. Design air conditioning systems using cooling loads calculation.
5. Know the application of refrigeration and air-conditioning systems.

Module-I:

Definition of Refrigeration and Air-conditioning, Introduction and Basic concepts. Air-cycle Refrigeration, its application in air-craft refrigeration Evaporative cooling system, Boot strap cooling system, Regenerative cooling system, methods for improving COP-Multi stage and multiple Evaporator system- cascade system, COP comparison

Module-II:

Simple vapour compression Refrigeration systems, Compound vapour compression Refrigeration systems and its applications.

Module-III:

Vapour Absorption Refrigeration system and its applications. Thermo-electric Refrigeration systems, Steam jet Refrigeration system, comparison of absorption system with the vapour compression systems

Module-IV:

Function and classification of compressors, construction and working of reciprocating compressors, Work done and volumetric efficiency. Multi-stage compression and their advantages Centrifugal and Rotary Compressors.

Module-V:

Properties of Refrigerants and eco-friendly refrigerants. Low Temperature Refrigeration and its applications. Psychometric, Cooling load calculation and Air-conditioning, systems and accessories, Design of Air-conditioning systems, Cooling Towers & Cooling Ponds

Text Books:

1. A Text book of Refrigeration & Air-conditioning – R.S. Khurmi & J.K. Gupta.
2. Refrigeration & Air-conditioning – Arora & Domukndwar
3. Refrigeration & Air-conditioning – C.P. Arora.

Reference books:

1. Refrigeration & Air-conditioning – R.C. Jordan & G.B. Priester.
2. Refrigeration & Air-conditioning – Manohar Prasad

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DME 6107 OPERATIONAL RESEARCH

OBJECTIVE: - Students will be able to

1. Develop the essential background in Operations Research.
2. Learn to use the LPP in different fields of engineering problems.
3. Learn to use Assignment and Transportation algorithms necessary for practical problems.
4. Acquire basic skills in PERT/CPM and Queuing Theory.
5. Learn to use Sequencing Problem and Inventory Models for managing practical engineering jobs.

Module-I:

Operation Research:

An overview, Organ and Development of OR, Nature and Features of OR, Modelling in OR, General Solution Methods for OR models, Scientific method in OR, Methodology of OR, Application, Opportunities and Shortcomings of OR.

Module-II:

Linear Programming Problem

Introduction, Mathematical Formulation of the Problem, Graphical Solution Method, Some Exceptional Cases.

General LPP, Canonical and Standard forms of LPP.

Simplex Method: Introduction, Fundamental properties of solutions, the Computational Procedure, Use of Artificial variables.

Module-III:

Assignment Problem, Transportation Problem

The transportation problem, Formulation of Transportation Problem, Initial Feasible Solution Methods, Optimality Test, Degeneracy in TP.

Assignment Problem, Balanced Assignment Problems, Hungerian Method.

Module-IV:

PERT/CPM and Queuing Theory

Network representation, Critical path (CPM) computations and PERT networks.

Queuing Models: The M/M/1/FIFO queuing systems.

Module-V:

Sequencing Problem and Inventory Models

Sequencing Problem, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem. Deterministic Inventory Models: EOQ Model and EOQ Cost Model. Sensitivity Analysis

.

Text Book

Kanti Swarup, P.K. Gupta, Man Mohan, "Operations Research", Sultan Chand & Sons, 2001

Reference Books

1. Hillier & Lieberman, "Operations Research", TMH
2. Sharma, J.K., "Operations Research-Theory and Applications", 4th Ed. Macmillan India, 2009.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DME 6011 INDUSTRIAL ENGINEERING

OBJECTIVE: The student will be able to
1. Understand importance of productivity, factors affecting productivity and forecasting.
2. Find the break-even point for manufacturing a product.
3. Prepare or modify layout of production system.
4. Find the economic order quantity for given situation.
5. Using techniques of work measurement and method study should be able to improve the existing manufacturing method.

Module –I:
Production Functions and Forecasting
Concept, Types and Management of production systems, Predicting markets for products, components of demands, time series forecasting methods (moving average, exponentially weighted moving average, Delphi, market survey and historical and life cycle analysis.

Module-II:
Facility Layout and Engineering Economy
Process charts, line and product layout, functional process lay out, group layout, balancing technique, Concept of replacement and depreciation, Break even analysis, overhead, fixed and variable cost.

Module –III:
Inventory Control
System inventories, EOQ, buffer stock, reorder point, fixed reorder quantity system, periodic reorder system, ABC analysis, Material requirement planning.

Module –IV:
Concept of JIT, Lean Manufacturing & Group Technology
Production wastages and its control, Concept, classification and coding of parts, coding system, OPTIZ coding system and its application.

Module –V:
Work study
Conceptual frame work of Method Study, Micro-motion study and work measurement, Principle of Motion Economy, Work sampling.

Books Recommended:
1. Industrial Engg. & Management – O. P. Khanna
2. Production & Operation Management – S. N. Chary
3. Production & Operation Management – Ronald, S. Ebert
4. Production & Operation Management – S. K Sharma

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DME 6023 QUALITY CONTROL

OBJECTIVE: Students will be able to

1. Understand the terms like quality, quality control, inspection, value of quality, cost of quality.
2. Know about reliability and statistical quality control.
3. Construct and draw control charts.
4. Understand different sampling methods and draw OC curve.
5. Understand ISO certification procedure and quality system.

Module –I:

Concept of Quality

Definition of quality cost of quality, value of quality. Quality control, objectives of quality control, quality control and inspection.

Module –II:

Statistical concepts and Reliability

Definition of probability, laws of probability. Normal and Binomial probability distributions. Statistical Quality Control, Definition of reliability, basic concept. Failure patterns for complex product, designing for reliability, System reliability.

Module –III:

Control Charts for Variables and Attributes

Introduction, objectives, theories of control charts for averages, ranges, standard deviations. Process capability study, Fraction defectives and number of defects. Interpretation of control charts.

Module –IV:

Acceptance Sampling by attributes

Concepts of acceptance sampling, advantages and limitations, sampling methods, single, double and-multiple sampling plants .operating characteristic curves.

Module –V:

Total Quality Management and ISO 9000 Quality System

Concept of Total Quality management, Principle objectives of TQM, History of ISO: 9000, ISO: 9000 series in general, benefits by becoming an ISO: 9000 company, steps to registration, India and ISO: 9000.

Text Books:

1. Statistical Quality Control - M.Mahahjan
2. Quality Planning and Analysis - J.M .Juran & Frank M Gryna

Reference Books:

1. Statistical Quality Control by Eugune L.Grant & Richard S Leaven worth
2. Total Quality Management by John M Kelly
3. TQM by R.P. Mohanty & R.R. Lakhe.

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 6108 REFRIGERATION AND AIR-CONDITIONING LAB.

LIST OF EXPERIMRNTS

1. To study different types of tool used in Refrigeration and air Conditioning.
2. Study of House hold/Domestic Refrigerator.
3. Study of Leak Detection and charging Procedure for refrigerant.
4. Study of Refrigeration controls used in refrigeration and air conditioning.
5. To study Heat Pump and calculate it's COP.
6. To study ice Manufacturing plant and calculate its COP.
7. To demonstrate vapour compression cycle and to calculate theoretical and actual COP.
8. To study Air conditioning system and calculate COP Of air conditioning system with the help of P-H Chart.
9. To study and calculate and capacity and COP of vapour absorption Refrigeration (VAR) system.
10. **To study and calculate capacity and COP of vapour compression refrigeration (VCR) systems.**

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 6017 ENERGY RESOURCES AND UTILIZATION

OBJECTIVE

Students should be able to:

1. Develop awareness for effective utilization of alternative energy sources.
2. Identify different components of solar energy and wind energy devices.
3. Identify and analyze biomass plant
4. Identify and apply energy conservation techniques for commonly used power absorbing and Generating devices
5. Apply principles of energy conservation and energy management techniques

Module-I:

Solar and Wind Power

Introduction to energy sources, major sources of energy: renewable and non-renewable, principle of conversion of solar energy into heat and electricity, solar radiations at earth's surface geometry declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle applications of solar energy: - construction and working of typical flat plate collector and solar concentrating collectors and their applications, advantages and limitations, basic principle of wind energy conversion, available wind power formulation, power coefficient, maximum power, main considerations in selecting a site for wind mills, limitations of wind energy conversion, classification of wind mills, construction and working of horizontal and vertical axis wind mills.

Module-II:

Energy from Biomass

Common species recommended for biomass. Methods for obtaining energy from biomass, Thermal classification of biomass, Gasified, Fixed bed and fluidized, Application of gasifier, Biodiesel production and application. Agriculture waste as a biomass, Biomass digester, Comparison of Biomass with conventional fuels, Fuel cell list of fuel cells

Module-III:

Energy Conservation & Management

Global and Indian energy market, energy scenario in various sectors and Indian economy, need and importance of energy conservation and management, concept of payback period, return on investment (roi), life cycle cost, sankey diagrams, specific energy consumption.

Module-IV:

Energy Conservation Techniques

Distribution of energy consumption, Principles of energy conservation, Energy audit, Types of audit, Methods of energy conservation, Cogeneration and its application, Combined cycle system, Concept of energy management. Study of different energy management techniques like - Analysis of input, Reuse and recycling of waste

Module-V: Economic approach of Energy Conservation

Costing of utilities like steam, compressed air, electricity and water, Ways of improving boiler efficiency, Thermal insulation, Critical thickness of insulation, Waste heat recovery systems, their applications, criteria for installing. An introductory approach of energy conservation in compressed air.

Text & Reference BookS:

Khan B.H., Non- conventional energy
Rai G. D., Non- conventional energy
Ray D. A., Industrial energy conservation

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMA 6001 NUMERICAL TECHNIQUE

OBJECTIVE: Students will be able to

1. Understand the importance of Error Analysis in Numerical Analysis.
2. Realize the applications of numerical methods in solving Algebraic and Transcendental Equations.
3. Learn to use Interpolation Techniques and apply it to solve Numerical Differentiation and Integration problems.
4. Solve systems of linear equations numerically.
5. Use and learn basic numerical techniques necessary for solving ODEs

Module-I:

Error and Solution of Algebraic and Transcendental Equations

Errors and Their Computations, A General Error Formula, Errors in Series Approximations. The Bisection Method, Method of False Position, The Iteration Method, Newton-Raphson Method.

Module-II:

Finite Differences- Forward Differences, Backward Differences, Central Differences, Symbolic Relations and Separation of Symbols, Newton's Formula for Interpolation. Interpolation with Unevenly Spaced Points- Lagrange's Interpolation Formula, Divided Differences and Their Properties.

Module-III:

Numerical differentiation and Integration

Numerical Differentiation. Numerical Integration- Trapezoidal Rule, Simpson's 1/3- Rule, Simpson's 3/8- Rules, Romberg Integration, Weddle's rule.

Module-IV:

Numerical solution of linear system of equations

Direct method- Gauss elimination, Gauss-Jordan, LU decomposition methods. Iterative methods- Gauss-Jacobi & Gauss Seidel methods.

Module-V:

Numerical solution ordinary differential equations

Solution by Taylor's Series, Picard's Method, Euler's Method, Modified Euler's Method, Runge-Kutta Methods of 2^{nd} & 4^{th} order.

Text Book

1. Grewal and Grewal, "Numerical Methods", Khanna Publishers, 2005.

Reference Books

1. Sastry, S.S., "Introductory Methods of Numerical Analysis", PHI, 2005.
2. Vedamurthy, V.N. and Iyengar N. Ch. S.N., "Numerical Methods", Vikas Publishing House Pvt. Ltd., 2005.
3. Mollah, S.A., "Numerical Analysis and Computational Procedures". Books and Allied (P) Ltd, 2005.

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Mechanical Engineering)

DMM 6110 NON- CONVENTIONAL ENERGY RESOURCES

OBJECTIVE: Students will be able to

1. Understand the various Non –conventional Energy Resources and their utilization.
2. Basic and innovative Idea of the different aspects of the alternate sources of the Energy.
3. Generation of useful Energy from the waste and their optimal utilization.
4. To develop the energy generation and their proper recovery for a sustainable development.

Module-I:

Introduction:

Energy needs and energy supply, conventional & non-conventional energy sources. Present energy scenario.

Wind Energy: Availability, site selection, different types of wind turbines, design criteria and material selection.

Module-II:

Solar energy:

Solar geometry, Characteristics & estimation of solar radiation. Collector – flat plate & concentrating types. Collector efficiency calculation, Selective paints & surfaces for them.

Module-III:

Thermal Storages and Solar ponds

Principle & its uses. Solar Application: Heating of air & water for building and other uses. Solar pumps, solar power plant, solar cookers, solar refrigeration & air conditioning solar cookers, solar furnaces etc.

Module-IV:

Bio-conversion: Photosynthesis & generation of bio-gas, digester and their design, selection of material, feed of digester, pyrolytic gasification.

Module-V:

Geo-thermal Energy: Sites, potentiality and limitation, study of different conversion system and other uses of geo-thermal sources. Tidal Energy: Sites, potentiality and possibility of harnessing from site, limitation. Different method of using tidal power and application Ocean Thermal Energy: Principle of utilization and its limitation description of few systems. Other Non-Conventional Sources:

.

Text and Reference Books:

1. Non-conventional Energy Sources – G.D. Rai
2. Solar Energy –Garg and Prakash
3. Solar Energy Utilization – G.D. Rai
4. Solar Thermal energy – Peter J. Lunde