BTME-312 COMPOSITE MATERIALS

L	T	P	Cr
2	1	0	3

COURSE OBJECTIVE:

- To understand the mechanical behaviour of composite materials.
- To get an overview of the methods of manufacturing composite materials.

UNITS	CONTENTS	Contact Hrs.
I	Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke's law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix and transformed stiffness.	10
II	Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes	4
III	Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli , evaluation of lamina properties, determination of lamina stresses	6
IV	Maximum stress and strain criteria, von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates.	6
V	Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies.	4

TEXT BOOKS:

1.	Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill, 1994.
2.	Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill, 1998.

Course Planner (Lecture Plan):

S. No.	Day	Subject	L	T	P
1.	D Day	Definition and applications of composite materials.	1	0	0
2.	D+1	Fibers- glass, carbon, ceramic and aramid fibers, Matrices-polymer.	1	0	0
3.	D+2	**Tutorial**	0	1	0
4.	D+3	Graphite, ceramic and metal matrices, characteristics of fibers and matrices.	1	0	0
5.	D+4	Lamina- assumptions, macroscopic viewpoint.	1	0	0
6.	D+5	**Tutorial**	0	1	0
7.	D+6	Generalized Hooke's law, reduction of homogeneous orthotropic lamina.	1	0	0
8.	D+7	Isotropic limit case, orthotropic stiffness matrix, commercial material properties.	1	0	0
9.	D+8	**Tutorial**	0	1	0
10.	D+9	Rule of mixtures, transformation matrix and transformed stiffness.	1	0	0
11.	D+10	Manufacturing of composite materials, Bag moulding.	1	0	0
12.	D+11	**Tutorial**	0	1	0
13.	D+12	Compression moulding, pultrusion, filament welding.	1	0	0
14.	D+13	Other manufacturing processes.	1	0	0
15.	D+14	**Tutorial**	0	1	0
16.	D+15	Basic assumptions of laminated anisotropic plates, Symmetric laminates	1	0	0
17.	D+16	Angle ply laminates, Cross ply laminates, laminate structural moduli.	1	0	0
18.	D+17	**Tutorial**	0	1	0
19.	D+18	Evaluation of lamina properties.	1	0	0
20.	D+19	Determination of lamina stresses.	1	0	0
21.	D+20	**Tutorial**	0	1	0
22.	D+21	Maximum stress and strain criteria, Von Mises Yield criterion for isotropic materials	1	0	0
23.	D+22	Generalized Hill's criterion for anisotropic materials.	1	0	0
24.	D+23	**Tutorial**	0	1	0
25.	D+24	Tsai Hill's criterion for composites, prediction of laminate failure.	1	0	0
26.	D+25	Thermal analysis of composite laminates.	1	0	0
27.	D+26	**Tutorial**	0	1	0
28.	D+27	Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis.	1	0	0
29.	D+28	Buckling analysis, free vibrations, natural frequencies.	1	0	0
30.	D+29	**Tutorial**	0	1	0

BTOE-414 (2) NON DESTRUCTIVE TESTING

L	T	P	Cr
2	1	0	3

COURSE OBJECTIVE:

- To provide a basic understanding on different NDT techniques and apply them for inspecting materials in accordance with industry specifications and standards.

UNITS	CONTENTS	Contact Hrs.
I	Magnetic Particle Testing, Magnets and magnetic materials, Magnetization and its methods, Magnetic fields, Detection media, Application of magnetic particles testing, Testing equipments machines and accessories, Inspection and interpretation, Application in industry. Liquid Penetrant Testing, Principle of liquid penetrant testing, Methods, Their advantages and disadvantages, Equipment used Penetrant materials, Testing procedures, Inspection and interpretation, Applications in industry.	8
II	Electromagnetic Methods, Eddy current theory, Magnetic flux leakage theory, Eddy current sensing probes, Flux leakage sensing probes, Principle of electromagnetic testing, Mathematical analysis, Flaw detection in conductors, Various types of eddy current techniques used and advantages of various electromagnetic methods for crack detection etc.	8
III	Ultrasonic Methods, Physical principle of sound, Ultrasonic waves propagation and their characteristics, Generation of ultrasonic waves, Ultrasonic transducers, Ultrasonic testing equipment, Ultrasonic flaw detector, Fundamental of ultrasonic testing, Contract and immersion testing, Merits and demerits, Defect location in angle beam testing, Immersion testing techniques, Ultrasonic signal display, Detection of defects and their characterization, DGS methods, Time of flight diffraction method (TOFD).	8
IV	Principle of radiography, Types of radiography, Equipments for neutron radiography, X-ray radiography, Equipments for X-ray radiography, Advantages and applications of fluoroscopy and photo fluoroscopy. Hardness Testing, Brinell hardness testing, Rockwell hardness tests, Micro hardness testing, Vickers hardness testing, Theory behind hardness testing methods.	6

TEXT BOOKS : :

1.	Handbook on Non-destructive Testing of Concrete	Malhotra, Publisher: CRC Press, 2002
2.	Introduction to Nondestructive Testing: A Training Guide	Mix, Paul E, John Wiley and Sons Ltd, 1999
3.	Electrical and Magnetic Methods of Nondestructive Testing	Blitz and Jack, Institute of Physics Publishing, 2001
4.	Non Destructive Testing and Evaluation for Manufacturing and Construction	Henrique L M, Hemisphere Publishers, New York, 2001

Course Planner (Lecture Plan):

S. No.	Day	Subject	L	T	P
1.	D Day	Magnetic Particle Testing, Magnets and magnetic materials, Magnetization and its methods, Magnetic fields.	1	0	0
2.	D+1	Detection media, Application of magnetic particles testing, Testing equipments machines and accessories.	1	0	0
3.	D+2	**Tutorial**	0	1	0
4.	D+3	Inspection and interpretation, Application in industry. Liquid Penetrant Testing, Principle of liquid penetrant testing.	1	0	0
5.	D+4	Their advantages and disadvantages, Equipment used Penetrant materials.	1	0	0
6.	D+5	**Tutorial**	0	1	0
7.	D+6	Testing procedures, Inspection and interpretation.	1	0	0
8.	D+7	Applications in industry	1	0	0
9.	D+8	**Tutorial**	0	1	0
10.	D+9	Electromagnetic Methods, Eddy current theory.	1	0	0
11.	D+10	Magnetic flux leakage theory, Eddy current sensing probes.	1	0	0
12.	D+11	**Tutorial**	0	1	0
13.	D+12	Principle of electromagnetic testing, Mathematical analysis.	1	0	0
14.	D+13	Flaw detection in conductors.	1	0	0
15.	D+14	**Tutorial**	0	1	0
16.	D+15	Various types of eddy current techniques used and advantages of various electromagnetic methods for crack detection etc.	1	0	0
17.	D+16	Ultrasonic Methods, Physical principle of sound, Ultrasonic wave's propagation and their characteristics.	1	0	0
18.	D+17	**Tutorial**	0	1	0
19.	D+18	Generation of ultrasonic waves, Ultrasonic transducers, Ultrasonic testing equipment.	1	0	0
20.	D+19	Ultrasonic flaw detector, Fundamental of ultrasonic testing, Contract and immersion testing.	1	0	0
21.	D+20	**Tutorial**	0	1	0
22.	D+21	Merits and demerits, Defect location in angle beam testing, Immersion testing techniques.	1	0	0
23.	D+22	Ultrasonic signal display, Detection of defects and their characterization, DGS methods, Time of flight diffraction method (TOFD).	1	0	0
24.	D+23	**Tutorial**	0	1	0
25.	D+24	Principle of radiography, Types of radiography, Equipments for neutron radiography, X-ray radiography.	1	0	0
26.	D+25	Equipments for X-ray radiography, Advantages and applications of fluoroscopy and photo fluoroscopy.	1	0	0
27.	D+26	**Tutorial**	0	1	0
28.	D+27	Hardness Testing, Brinell hardness testing, Rockwell hardness tests, Micro hardness testing.	1	0	0
29.	D+28	Vickers hardness testing, Theory behind hardness testing methods	1	0	0
30.	D+29	**Tutorial**	0	1	0

MTMA-211(2) COMPOSITE MATERIALS

L	T	P	C
2	1	0	3

COURSE OBJECTIVE
Upon successful completion of this course, the student will be able to: • To identify and explain the types of composite materials and their characteristic features • To understand the differences in the strengthening mechanism of composite and its corresponding effect on performance and application. • To understand and explain the methods employed in composite fabrication.

UNITS	CONTENTS	Contact Hrs.
I	**Introduction to Composite Materials:** Definition, classification and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites. Applications: Automobile, Aircrafts. Missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.	6
II	**Metal Matrix Composites:** Reinforcement materials, types, characteristics and selection of base metals. Need for production MMC's and its application. **Fabrication Process For MMC's:** Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques.	6
III	**Polymer matrix composites (PMC):** Reinforcement materials, types, characteristics and selection base matrix, process design of PMC's and applications. Processing of Thermoplastic composites: Types of processing methods, solution, film, lamination, sandwich etc., Advantages and limitations of each method.	6
IV	**Processing of Thermoses composites:** Hand layup method, compression and transfer moulding, pressure and vacuum bag process, filament winding, protrusion, reinforced RIM, RRIM, Injection moulding of thermoses, SMC and DMC, Advantages and limitations of each method. **Mechanical testing of composites:** Tensile testing, Compressive testing, impact, bending strength. Basic concepts of fracture mechanism, Inter laminar shear testing, Fracture testing.	6
V	**Thermal Methods:** Introduction, principle, theory, applications, advantages and limitations of Differential scanning calorimeter (DSC), thermo gravimetric analysis (TGA), Dynamic mechanical analysis (DMA), and thermo mechanical analyzer (TMA). **Morphological studies:** Introduction, principle, theory, applications, advantages and limitations of - Optical microscopy, Scanning Electron Microscopy (SEM), TEM and AFM. **Introduction:** Hybrid polymer composite, Green composites and Nano composites - fabrication, Characterization and applications.	6

REFERENCE BOOKS :	
1.	Composite Science and Engineering, K. K. Chawla Springer Verlag 1998.
2.	Mechanics of composite materials, Autar K. Kaw CRC Press New York.
3.	Fiber Reinforced Composites, P. K. Mallick, Marcel Dekker, Inc.
4.	Mechanics of Composite Materials, Robert M. Jones, McGraw Hill Kogakusha Ltd.1998.

Course Planner (Lecture Plan):

S. No.	Day	Subject	L	T	P
1.	D Day	**Introduction to Composite Materials:** Definition, classification and characteristics of composite Materials.	1	0	0
2.	D+1	Fibrous composites, laminated composites, particulate composites.	1	0	0
3.	D+2	**Tutorial**	0	1	0
4.	D+3	Applications: Automobile, Aircrafts. Missiles. Space hardware, Electrical and electronics, Marine.	1	0	0
5.	D+4	Recreational and sports equipment, future potential of composites.	1	0	0
6.	D+5	**Tutorial**	0	1	0
7.	D+6	**Metal Matrix Composites:** Reinforcement materials, types, characteristics and selection of base metals.	1	0	0
8.	D+7	Need for production MMC's and its application.	1	0	0
9.	D+8	**Tutorial**	0	1	0
10.	D+9	**Fabrication Process For MMC's:** Powder metallurgy technique.	1	0	0
11.	D+10	Liquid metallurgy technique and secondary processing, special fabrication techniques.	1	0	0
12.	D+11	**Tutorial**	0	1	0
13.	D+12	**Polymer matrix composites (PMC):** Reinforcement materials.	1	0	0
14.	D+13	Types, characteristics and selection base matrix, process design of PMC's and applications.	1	0	0
15.	D+14	**Tutorial**	0	1	0
16.	D+15	Processing of Thermoplastic composites: Types of processing methods, solution, film, lamination, sandwich etc.	1	0	0
17.	D+16	Advantages and limitations of each method.	1	0	0
18.	D+17	**Tutorial**	0	1	0
19.	D+18	**Processing of Thermoses composites:** Hand layup method, compression and transfer moulding, pressure and vacuum bag process.	1	0	0
20.	D+19	Filament winding, protrusion, reinforced RIM, RRIM, Injection moulding of thermoses.	1	0	0
21.	D+20	**Tutorial**	0	1	0
22.	D+21	SMC and DMC, Advantages and limitations of each method. **Mechanical testing of composites:** Tensile testing, Compressive testing, impact, bending strength.	1	0	0
23.	D+22	Basic concepts of fracture mechanism, Inter laminar shear testing, Fracture testing.	1	0	0
24.	D+23	**Tutorial**	0	1	0
25.	D+24	**Thermal Methods:** Introduction, principle, theory, applications, advantages and limitations of Differential scanning calorimeter (DSC).	1	0	0
26.	D+25	Thermo gravimetric analysis (TGA), Dynamic mechanical analysis (DMA), and thermo mechanical analyzer (TMA).	1	0	0
27.	D+26	**Tutorial**	0	1	0
28.	D+27	**Morphological studies:** Introduction, principle, theory, applications, advantages and limitations of - Optical microscopy, Scanning Electron Microscopy (SEM), TEM and AFM.	1	0	0
29.	D+28	**Introduction:** Hybrid polymer composite, Green composites and Nano composites - fabrication, Characterization and applications	1	0	0
30.	D+29	**Tutorial**	0	1	0

BTME-315 INTERNAL COMBUSTION ENGINES

L	T	P	CR
2	1	0	3

COURSE OBJECTIVE:

- To familiarize with the terminology associated with IC engines.
- To understand the basics of IC engines.
- To understand combustion, and various parameters and variables affecting it in various types of IC engines.

To learn about various systems used in IC engines and the type of IC engine required for various applications.

UNITS	CONTENTS	Contact hrs
I	Review of ideal cycles; Details of fuel-air cycles.	6
II	Combustion in SI and CI engines, Combustion stages, Combustion chambers and Abnormal combustion.	8
III	Fuel supply systems in SI and CI engines, carburetors, Port fuel injection, Direct injection and Common rail injection. Ignition system	8
IV	Lubrication system and Cooling system. Testing of IC engines. Engine emissions and control. Advanced IC Engine concepts.	8

REFERENCE BOOKS :

1.	Obert E. F, "Internal Combustion Engines and Air Pollution", Harper and Row Publication Inc. NY, 1973.
2.	Heisler H, "Advanced Engine Technology", Edward Arnold, 1995.
3.	Heywood J. B, "Internal Combustion Engine Fundamentals", McGraw Hill Book Co. NY, 1989.
4.	Heldt P. M, "High Speed Combustion Engines", Oxford & IBH publishing Co. India, 1985.

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day+2	**UNIT- I** Review of ideal cycles	2	1	0	3
2	D+5	Details of fuel-air cycles.	2	1	0	6
3	D+8	**UNIT- II** Combustion in SI and CI engines,	2	1	0	9
4	D+10	Combustion stages	2	0	0	11
5	D+13	Combustion chambers and Abnormal combustion.	2	1	0	14
6	D+15	**UNIT- III** Fuel supply systems in SI and CI engines	2	0	0	16
7	D+18	carburetors, Port fuel injection	2	1	0	19
8	D+21	Direct injection and Common rail injection. Ignition system	2	1	0	22
9	D+39	**UNIT- IV** Lubrication system and Cooling system	2	0	0	24
10	D+26	Testing of IC engines. Engine emissions and control.	2	1	0	27
11	D+29	Advanced IC Engine concepts.	2	1	0	30

MTOE-212(1) OPERATION RESEARCH

L	T	P	CR
2	1	0	3

COURSE OBJECTIVE:

- To understand the need for optimization and different techniques involved and also constraints.
- To know Linear/Non linear Programming.
- To understand the importance of optimization to solve Engineering problems.
- To know genetic algorithm for Engineering Optimization.

UNITS	CONTENTS	Contact hrs
I	**Introduction:** Definition and scope of OR; Techniques and tools; Model formulation; general methods for solution; Classification of optimization problems; Optimization techniques.	6
II	**Linear Optimization Models:** Complex and revised simplex algorithms; Duality theorems, sensitivity analysis; Assignment, transportation and transshipment models; Traveling salesman problem as an Assignment problem; Integer and parametric programming; Goal programming. **Game Problems:** Mini-max criterion and optimal strategy; Two person zero sum game; Games by simplex dominance rules.	6
III	**Waiting Line Problems:** Classification of queuing situations; Kendall's notation, Poisson arrival with exponential or Erlang service time distribution; Finite and infinite queues; Optimal service rates; Application of queuing theory to industrial problems.	6
IV	**Dynamic Programming:** Characteristic of dynamic programming problems (DPPs); Bellman's principle of optimality; Problems with finite number of stages; Use of simplex algorithm for solving DPPs.	6
V	**Non-linear Programming:** One dimensional minimization methods; Unconstrained optimization techniques; Optimization techniques characteristics of a constrained problem; Indirect methods; Search and gradient methods.	6

REFERENCE BOOKS :

1.	Operations Research, H.A. Taha, Prentice Hall.
2.	Engg. Optimization, S.S. Rao, New Age Publication.

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day+2	**UNIT- I** **Introduction:** Definition and scope of OR; Techniques and tools; Model formulation; general methods for solution	2	1	0	3
2	D+5	Classification of optimization problems; Optimization techniques.	2	1	0	6
3	D+7	**UNIT- II** **Linear Optimization Models:** Complex and revised simplex algorithms; Duality theorems, sensitivity analysis;	2	0	0	8
4	D+9	Assignment, transportation and transshipment models; Traveling salesman problem as an Assignment problem; Integer and parametric programming; Goal programming.	1	1	0	10
5	D+11	**Game Problems:** Mini-max criterion and optimal strategy; Two person zero sum game; Games by simplex dominance rules	2	0	0	12
6	D+13	**UNIT- III** **Waiting Line Problems:** Classification of queuing situations; Kendall's notation, Poisson arrival with exponential or Erlang service time distribution.	2	0	0	14
7	D+15	Finite and infinite queues; Optimal service rates;	1	1	0	16
8	D+17	Application of queuing theory to industrial problems.	2	0	0	18
9	D+19	**UNIT- IV** **Dynamic Programming:** Characteristic of dynamic programming problems (DPPs);	2	0	0	20
10	D+21	Bellman's principle of optimality; Problems with finite number of stages;	2	0	0	22
11	D+23	Use of simplex algorithm for solving DPPs.	1	1	0	24
12	D+25	**UNIT- V** **Non-linear Programming:** One dimensional minimization methods; Unconstrained optimization techniques.	2	0	0	26
13	D+27	Optimization techniques characteristics of a constrained problem; Indirect methods; Search and gradient methods.	1	1	0	28
14	D+29	Indirect methods; Search and gradient methods.	2	0	0	30

INSTRUMENTATION & CONTROL (BTME-313)

L	T	P	CR
2	1	2	4

COURSE OBJECTIVE:

- To provide a basic knowledge about measurement systems and their components
- To learn about various sensors used for measurement of mechanical quantities
- To learn about system stability and control

To integrate the measurement systems with the process for process monitoring and control

UNITS	CONTENTS	Contact hrs
I	Measurement systems and performance – accuracy, range, resolution, error sources; Instrumentation system elements – sensors for common engineering measurements.	10
II	Signal processing and conditioning; correction elements- actuators: pneumatic, hydraulic, electric.	10
III	Control systems – basic elements, open/closed loop, design of block diagram; control method – P, PI, PID, when to choose what, tuning of controllers.	10
IV	System models, transfer function and system response, frequency response; Nyquist diagrams and their use. (Practical group based project utilizing above concepts)	10

REFERENCE BOOKS :

1. Instrumentation and control systems by W. Bolton, 2nd edition, Newnes
2. Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV , Mechanical Measurements (6th Edition) Pearson Education India, 2007
3. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,1999

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day+3	**UNIT- I** Measurement systems and performance – accuracy, range, resolution, error sources	3	1	0	4
2	D+9	Instrumentation system elements – sensors for common engineering measurements.	4	1	2	6
3	D+14	**UNIT- II** Signal processing and conditioning	3	1	2	15
4	D+19	Correction elements- actuators: pneumatic, hydraulic, electric.	3	1	2	20
5	D+23	**UNIT- III** Control systems – basic elements, open/closed loop	2	1	2	24
6	D+25	design of block diagram	1	1	0	26
7	D+29	Control method – P, PI, PID, when to choose what, tuning of controllers.	2	1	2	30
8	D+34	**UNIT- IV** System models, transfer function and system response,	3	1	2	35
9	D+39	frequency response; Nyquist diagrams and their use.	3	1	2	40

PRACTICALS	
1.	Light sensor & Humidity sensor.
2.	Microprocessor controlled pick & place robot.
3.	Position Indication (LVDT,Pot).
4.	Proximity sensors (inductive).
5.	Water flow and level detection circuitry
6.	Open loop and close loop control system.
7.	Experiment to draw the frequency response characteristic of a given lag- lead compensating network.
8.	Frequency response of a second order system and evaluation of frequency domain specifications.
9.	The effect of P, PI, PD and PID controller on the step response of a feedback control system using control engineering trainer. Verify the same using simulation.

INSTRUMENTATION & CONTROL (BTME-313)

L	T	P	CR
2	1	2	4

COURSE OBJECTIVE:

- To provide a basic knowledge about measurement systems and their components
- To learn about various sensors used for measurement of mechanical quantities
- To learn about system stability and control

To integrate the measurement systems with the process for process monitoring and control

UNITS	CONTENTS	Contact hrs
I	Measurement systems and performance – accuracy, range, resolution, error sources; Instrumentation system elements – sensors for common engineering measurements.	10
II	Signal processing and conditioning; correction elements- actuators: pneumatic, hydraulic, electric.	10
III	Control systems – basic elements, open/closed loop, design of block diagram; control method – P, PI, PID, when to choose what, tuning of controllers.	10
IV	System models, transfer function and system response, frequency response; Nyquist diagrams and their use. (Practical group based project utilizing above concepts)	10

REFERENCE BOOKS :

1.	Instrumentation and control systems by W. Bolton, 2nd edition, Newnes
2.	Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV , Mechanical Measurements (6th Edition) Pearson Education India, 2007
3.	Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,1999

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day+3	**UNIT- I** Measurement systems and performance – accuracy, range, resolution, error sources	3	1	0	4
2	D+9	Instrumentation system elements – sensors for common engineering measurements.	4	1	2	6
3	D+14	**UNIT- II** Signal processing and conditioning	3	1	2	15
4	D+19	Correction elements- actuators: pneumatic, hydraulic, electric.	3	1	2	20
5	D+23	**UNIT- III** Control systems – basic elements, open/closed loop	2	1	2	24
6	D+25	design of block diagram	1	1	0	26
7	D+29	control method – P, PI, PID, when to choose what, tuning of controllers.	2	1	2	30
8	D+34	**UNIT- IV** System models, transfer function and system response,	3	1	2	35
9	D+39	Frequency response; Nyquist diagrams and their use.	3	1	2	40

PRACTICALS	
1.	Light sensor & Humidity sensor.
2.	Microprocessor controlled pick & place robot.
3.	Position Indication (LVDT,Pot).
4.	Proximity sensors(inductive).
5.	Water flow and level detection circuitry
6.	Open loop and close loop control system.
7.	Experiment to draw the frequency response characteristic of a given lag- lead compensating network.
8.	Frequency response of a second order system and evaluation of frequency domain specifications.
9.	The effect of P, PI, PD and PID controller on the step response of a feedback control system using control engineering trainer. Verify the same using simulation.

BTME- 411 POWER PLANT ENGINEERING

L	T	P	CR
3	1	0	4

RATIONALE
To make the students aware about the working of various types of power plants based on conventional as well as non conventional sources of energy. The students also learn about fluctuating loads on power plants, Its economic analysis and the tariff methods for electric energy.

UNITS	CONTENTS	Contact hrs
I	Conventional and non-conventional sources of energy, Importance of electrical energy, Geothermal power plants, Tidal power plants, Windmills, Solar power plants, Direct energy conversion systems, Energy from waste, Energy sources in India, Present power status and scenario in India. Hydrology, Rainfall, Runoff, Hydrographs, Flow duration curves, Site selection for hydro power plants, Classification of hydro power plants, Storage type hydro power plant and its operation, Estimation of power availability, Selection of water turbines, Combination of hydro power plants with steam plants, Advantages and disadvantages of hydro power plants.	10
II	Introduction to thermal power plants, Analysis of steam power cycles for power plant application, High pressure boilers- La-Mont boiler, Benson boiler, Loeffler boiler, Velox boiler, Super pressure steam power plants, Economizers, Air-preheaters, Super heaters and reheaters, Feed water heaters, General layout of a thermal power plant, Site selection for thermal power plant, Coal as fuel, Classification of coals, Analysis of coal; Coal handling, Dead and live storage, Combustion of coal, Overfeed stokers, Underfeed stokers, Pulverized fuels and burners, Ash handling and disposal, Dust collectors, Heat balance sheet for thermal power plants.	10
III	Introduction to diesel power plants, Field of use, Outline of diesel electric power plant, Different systems of diesel power plant, Supercharging of diesel engines, Performance of diesel power plant, Advantages and disadvantages of diesel plants over thermal power plants. Introduction and elements of gas turbine power plant, Thermal refinements, Performance of plants, Gas turbine characteristics, Comparison with other plants, Combined steam and gas turbine power plants. Introduction and need of nuclear power plants, Basic theory and terminology, Nuclear fission and fusion processes, Fission chain reaction, Moderation, Fertile materials, Nuclear fuels, General components of nuclear reactor, Different types of reactors, Breeder reactors, Disposal of nuclear waste, Nuclear power plants in India.	10
IV	Fluctuating Loads on Power Plants, Load curves, Different terms and definitions, Effects of variable loads on power plant design and operation. Cost of electrical energy, Selection of type of generation, Selection of generating equipment, Performance and operating characteristics of power	10

	plants, Load division among generators, Tariffs methods for electrical energy.

REFERENCE BOOKS :		
1.	Power Plant Engineering	Domkundwar, Dhanpat Rai Publishers
2.	Power Plant Engineering	Sharma P C, S K Kataria & Sons Publishers
3.	Power Plant Engineering	Wakil, McGraw Hill
4.	Power Plant Technology	Morse, by El-Wakil, East West Press Pvt. Ltd., New Delhi
5.	A Text Book of Power Plant Engineering	Rajput, Lakshmi Publications
6.	Power Plant Engineering	Verma Mahesh, Metropolitan Publishers

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day+1	**UNIT- I** Conventional and non-conventional sources of energy, Importance of electrical energy, Geothermal power plants, Tidal power plants, Windmills,	2	0	0	2
2	D+3	Solar power plants, Direct energy conversion systems, Energy from waste, Energy sources in India, Present power status and scenario in India.	2	0	0	4
3	D+6	Hydrology, Rainfall, Runoff, Hydrographs, Flow duration curves, Site selection for hydro power plants, Classification of hydro power plants, Storage type hydro power plant and its operation, Estimation of power availability	2	1	0	7
4	D+9	Selection of water turbines, Combination of hydro power plants with steam plants, Advantages and disadvantages of hydro power plants.	2	1	0	10
5	D+12	**UNIT- II** Introduction to thermal power plants, Analysis of steam power cycles for power plant application, High pressure boilers- La-Mont boiler, Benson boiler, Loeffler boiler, Velox boiler, Super pressure steam power plants,	2	1	0	13
6	D+15	Economizers, Air-preheaters, Super heaters and reheaters, Feed water heaters, General layout of a thermal power plant, Site selection for thermal power plant, Coal as fuel, Classification of coals, Analysis of coal;	2	1	0	16
7	D+19	Coal handling, Dead and live storage, Combustion of coal, Overfeed stokers, Underfeed stokers, Pulverized fuels and burners, Ash handling and disposal, Dust collectors, Heat balance sheet for thermal power plants.	3	1	0	20
8	D+22	**UNIT- III** Introduction to diesel power plants, Field of use, Outline of diesel electric power plant, Different systems of diesel power plant, Supercharging of diesel engines, Performance of diesel power plant, Advantages and disadvantages of diesel plants over thermal power plants.	2	1	0	23
9	D+25	Introduction and elements of gas turbine power plant, Thermal refinements, Performance of plants, Gas turbine characteristics, Comparison with other plants,	2	1	0	26

		Combined steam and gas turbine power plants.				
10	D+29	Introduction and need of nuclear power plants, Basic theory and terminology, Nuclear fission and fusion processes, Fission chain reaction, Moderation, Fertile materials, Nuclear fuels, General components of nuclear reactor, Different types of reactors, Breeder reactors, Disposal of nuclear waste, Nuclear power plants in India.	3	1	0	30
11	D+32	**UNIT- IV** Fluctuating Loads on Power Plants, Load curves, Different terms and definitions, Effects of variable loads on power plant design and operation.	2	1	0	33
12	D+35	Cost of electrical energy, Selection of type of generation, Selection of generating equipment,	2	1	0	36
13	D+39	Performance and operating characteristics of power plants, Load division among generators, Tariffs methods for electrical energy.	3	1	0	40

DIPME-215 THEORY OF MACHINES

L	T	P	CR
2	1	0	3

RATIONALE
An engineer should be well acquainted with the motion of mechanism of different machine element. With this view the study of Theory of machine is very much important. The contents of this subject include simple mechanism, kinematics of machine, dynamics of reciprocating parts, friction involved in the machine elements, power transmission, governors, balancing and vibrations in machine.

UNITS	CONTENTS	Contact hrs
I	**Simple Mechanism:** Introduction to link, kinematic pair, kinematic chain, structure, mechanism, machine, Slider crank mechanism and its inversion, Double slider crank chain, Example of mechanism with higher pairs, **Velocity and Acceleration in Mechanism:** Velocity diagrams of four bar and single slider crank mechanisms by relative, velocity method and instantaneous centre method, Acceleration diagram of four bar chain and reciprocating engine mechanism, carioles components, **Dynamics of Reciprocating Parts:** Analytical method for velocity and acceleration of piston, Piston effort, crank pin effort, turning moment diagrams, Fluctuation of energy and speed, Energy of a flywheel, Calculating the weight of flywheel.	8
II	**Friction:** Friction of collars and pivots, Friction clutches-plate clutch and centrifugal clutch, Friction in journal bearings, Rolling friction, **Transmission of Power:** Flat and V-belt drives, Velocity ratio of belt drives, slips in belt, and creep in belt. Length of open and cross belt drives, Power transmitted by a belt, Ratio of driving tension, centrifugal tension, Condition for the maximum, power transmission, initial tension in the belt. Chain drives - types of chain drives, roller chain and inverted tooth chain. Gear drives - Types of gear wheels, proportions of gear tooth, Gear trains - Simple gear train, compound gear train, reverted gear train and simple, epicyclical gear train.	8
III	**Balancing:** Static and dynamic balancing, need of balancing, Balancing of single rotating mass by a single mass in the same plane, by two masses, rotating in different planes. Partial primary balancing of a single cylinder reciprocating engine, **Vibration:** Causes of vibrations in machine, their effects and method of reducing them, Free or natural vibration, Forced vibration, Damped vibration.	6
IV	**Governors (No derivation & numerical) :**Introduction and classification, Methods of governing (Quality, Quantity and hit and miss governing),Dead wt governors (watt , porter and proell),Spring control governors (hartnell and Wilson hartnell),Concept of sensitivity, stability, isochronisms, hunting, effort and power. **Brakes and Dynamometer:** Introduction, function, capacity of brakes	8

	:Block and shoe brake, Band brake,Internal expanding brake,Functions of dynamometer, Pony brake, Rope brake and Froude's hydraulic,dynamometer,**Gyroscope –** Introduction and principle, Gyroscopic couple

REFERENCE BOOKS :		
1.	Theory of Machines	Jagdishlal
2.	Theory of Machines	R.S.Khurmi
3.	Theory of Machines	Abdullah Sharif
4.	Theory of Machines	Malhotra, Gupta
5.	Theory of Machines	S.S. Ratan

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day+1	**UNIT- I** **Simple Mechanism:** Introduction to link, kinematic pair, kinematic chain, structure, mechanism, machine Slider crank mechanism and its inversion, Double slider crank chain, Example of mechanism with higher pairs,	2	0	0	2
2	D+3	**Velocity and Acceleration in Mechanism:** Velocity diagrams of four bar and single slider crank mechanisms by relative, velocity method and instantaneous centre method	2	0	0	4
3	D+5	Acceleration diagram of four bar chain and reciprocating engine mechanism, carioles components,	1	1	0	6
4	D+7	**Dynamics of Reciprocating Parts:** Analytical method for velocity and acceleration of piston, Piston effort, crank pin effort, turning moment diagrams, Fluctuation of energy and speed, Energy of a flywheel, Calculating the weight of flywheel.	1	1	0	8
5	D+9	**UNIT- II** **Friction:** Friction of collars and pivots, Friction clutches-plate clutch and centrifugal clutch, Friction in journal bearings, Rolling friction,	2	0	0	10
6	D+11	**Transmission of Power:** Flat and V-belt drives, Velocity ratio of belt drives, slips in belt, and creep in belt. Length of open and cross belt drives, Power transmitted by a belt, Ratio of driving tension, centrifugal tension, Condition for the maximum, power transmission initial tension in the belt.	1	1	0	12
7	D+13	Chain drives - types of chain drives, roller chain and inverted tooth chain. Gear drives - Types of gear wheels, proportions of gear tooth,	1	1	0	14

8	D+15	Gear trains - Simple gear train, compound gear train, reverted gear train and simple, epicyclical gear train.	2	0	0	16
9	D+17	**UNIT- III** **Balancing:** Static and dynamic balancing, need of balancing, Balancing of single rotating mass by a single mass in the same plane, by two masses, rotating in different planes.	2	0	0	18
10	D+19	Partial primary balancing of a single cylinder reciprocating engine,	2	0	0	20
11	D+21	**Vibration:** Causes of vibrations in machine, their effects and method of reducing them, Free or natural vibration, Forced vibration, Damped vibration.	2	0	0	22
12	D+24	**UNIT- IV** **Governors (No derivation & numerical) :**Introduction and classification, Methods of governing (Quality, Quantity and hit and miss governing),Dead wt governors (watt , porter and proell),Spring control governors (hartnell and Wilson hartnell),Concept of sensitivity, stability, isochronisms, hunting, effort and power.	2	1	0	25
13	D+27	**Brakes and Dynamometer:** Introduction, function, capacity of brakes :Block and shoe brake, Band brake, Internal expanding brake, Functions of dynamometer, Pony brake, Rope brake and Froude's hydraulic, dynamometer,	2	1	0	28
14	D+29	**Gyroscope –** Introduction and principle, Gyroscopic couple.	2	0	0	30

BTME-211 THERMODYNAMICS

L	T	P	CR
3	1	0	4

COURSE OBJECTIVE:

- To learn about work and heat interactions, and balance of energy between system and its surroundings
- To learn about application of I law to various energy conversion devices
- To evaluate the changes in properties of substances in various processes

To understand the difference between high grade and low grade energies and II law limitations on energy conversion.

UNITS	CONTENTS	Contact hrs
I	**Fundamentals-** System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work. **Temperature:** Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.	**10**
II	**Pure substance:** Definition, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart	**8**
III	**First Law for Flow Processes**: Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume. **Second law:** Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.	**10**
IV	Clausius inequality: Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and	**8**

	nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis.	
V	Thermodynamic cycles: Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.	**4**

REFERENCE BOOKS :	
1.	Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6thEdition, Fundamentals of Thermodynamics, John Wiley and Sons.
2.	Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3.	Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.
4.	Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day+1	**UNIT- I** **Fundamentals-** System & Control volume; Property, State & Process; Exact & Inexact differentials;	2	0	0	2
2	D+3	Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.	2	0	0	4
3	D+6	**Temperature:** Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems.	2	1	0	7
4	D+19	First Law for Cyclic & Non-cyclic processes; Concept of total energy E; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.	2	1	0	10
5	D+13	**UNIT- II** **Pure substance:** Definition, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water;	3	1	0	14
6	D+15	Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart	3	1	0	18

7	D+20	**UNIT- III** **First Law for Flow Processes**: Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling;	2	1	0	21
8	D+23	Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume.	2	1	0	24
9	D+25	**Second law:** Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements;	2	0	0	26
10	D+27	Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.	2	0	0	28
11	D+30	**UNIT- IV** Clausius inequality: Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables	2	1	0	31
12	D+33	Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles	2	1	0	34
13	D+35	Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis.	2	0	0	36
14	D+37	**UNIT- V** Thermodynamic cycles: Basic Rankine cycle; Basic Brayton cycle;	2	0	0	38
15S	D+39	Basic vapor compression cycle and comparison with Carnot cycle.	2	0	0	40

DIPME-323 BASICS OF DESTRUCTIVE AND NON DESTRUCTIVE TESTIN

L	T	P	Cr
3	1	0	4

RATIONALE

To provide a basic understanding on different destructive and non destructive testing techniques and apply them for inspecting materials in accordance with industry specifications and standards.

UNITS	CONTENT	Contact Hrs.
I	**Introduction:** Introduction of DT, Some common DT methods and its application, Scope and advantages of NDT, Some common NDT methods used since ages, Comparison of NDT with Destructive Testing, Terminology, Flaws and Defects, Visual inspection, Equipment used for visual inspection. Ringing test, chalk test (oil whitening test). Uses of visual inspection tests in detecting surface defects and their interpretation, advantages & limitations of visual inspection.	10
II	**Magnetic Particle Testing:** Magnets and magnetic materials, Magnetization and its methods, Magnetic fields, Detection media, Application of magnetic particles testing, Testing equipments machines and accessories, Application in industry. **Liquid Penetrant Testing:** Principle of liquid penetrant testing, Methods, Their advantages and disadvantages, Equipment used, Penetrant materials, Testing procedures, Inspection and interpretation, Applications in industry.	10
III	**Electromagnetic Methods:** Eddy current theory, Magnetic flux leakage theory, Principle of electromagnetic testing, Various types of eddy current techniques used and advantages of various electromagnetic methods for crack detection etc	10
IV	**Ultrasonic Testing Methods:** Introduction, Principle of operation, Piezoelectricity. Ultrasonic probes, CRO techniques, advantages, Limitation & typical applications. Applications in inspection of castings, forgings, Extruded steel parts, bars, pipes, rails and dimensions measurements.	10

REFERENCE BOOKS :

1.	Handbook on Non-destructive Testing of Concrete	Malhotra, Publisher: CRC Press, 2002
2.	Non-destructive Testing	Abhishek Agarwal, Gaurav Pundir & Shyam Singh
3.	Electrical and Magnetic Methods of Nondestructive Testing	Blitz and Jack, Institute of Physics Publishing, 2001

4.	Non Destructive Testing and Evaluation for Manufacturing and Construction	Henrique L M, Hemisphere Publishers, New York, 2001

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**Introduction:** Introduction of DT, Some common DT methods and its application, Scope and advantages of NDT.	1	0	0	1
2	D+1	Some common NDT methods used since ages, Comparison of NDT with Destructive Testing.	2	0	0	2
3	D+3	Comparison of NDT with Destructive Testing, Terminology.	1	1	0	2
4	D+5	Flaws and Defects, Visual inspection, Ringing test, chalk test (oil whitening test).	1	0	2	2
5	D+7	Uses of visual inspection tests in detecting surface defects.	2	0	0	2
6	D+9	Their interpretation, advantages & limitations of visual inspection.	1	0	2	2
7	D+11	**Magnetic Particle Testing:** Magnets and magnetic materials, Magnetization and its methods.	2	0	0	2
8	D+13	Magnetic fields, Detection media, Application of magnetic particles testing.	1	1	0	2
9	D+15	Testing equipments machines and accessories, Application in industry.	2	0	0	3
10	D+18	. **Liquid Penetrant Testing:** Principle of liquid penetrant testing, Methods, Their advantages and disadvantages, Equipment used.	2	0	0	2
11	D+20	Their advantages and disadvantages, Equipment used Penetrant materials, Testing procedures, Inspection and interpretation, Applications in industry.	1	1	0	2
12	D+22	Penetrant materials, Testing procedures, Inspection and interpretation, Applications in industry.	1	0	2	2
13	D+24	. **Electromagnetic Methods:** Eddy current theory, Magnetic flux leakage theory.	2	0	0	2
14	D+27	Principle of electromagnetic testing, Various types of eddy current techniques and used.	2	0	0	3
15	D+29	advantages of various electromagnetic methods for crack detection etc.	1	0	2	2
16	D+31	**Ultrasonic Testing Methods:** Introduction,	1	1	0	2

		Principle of operation.				
17	D+33	Piezoelectricity. Ultrasonic probes.	2	0	0	2
18	D+35	CRO techniques, advantages, Limitation & typical applications.	1	0	0	2
19	D+37	Applications in inspection of castings, forgings	2	0	0	2
20	D+39	. Extruded steel parts, bars, pipes, rails and dimensions measurements.	1	0	0	1

ENGINEERING DRAWING SUBJECT CODE: DME-124

L	T	P	Cr
2	0	4	4

RATIONALE:-
Subject covers the study of various components used in various machines. This also deals with various types of cutting fluids and their property. Technicians have to carry out the job of measurement and inspection in the factories for controlling the quality of products. Therefore they must have the knowledge of science of measurements or metrology. They must be familiar with the concept and technique of inspection and quality control methods. The subject has been designed to impart all the related and concerned knowledge to the student to fulfill the need.

UNIT	CONTENT	Contact Hrs.
I	**ENGINEERING DRAWING** **UNIT-1** 1. Drawing, instruments and their uses. 1.1 Introduction to various drawing, instruments. 1.2 Correct use and care of Instruments. 1.3 Sizes of drawing sheets and their layouts. 2. (A) Lettering Techniques 1 Sheet Printing of vertical and inclined, normal single stroke capital letters. Printing of vertical and inclined normal single stroke numbers. Stencils and their use. (b) Introduction to Scales 1 Sheet Necessity and use, R Types of scales used in general engineering drawing. Plane, diagonal and chord scales.	**10**
II	**UNIT-2** 3. Conventional Presentation: 2 Sheet Thread (Internal and External), Welded joint, Types of lines, Conventional representation of materials, Conventional representation of machine parts. 4. (A) Principles of Projection 1 Sheet Orthographic, Pictorial and perspective. Concept of horizontal and vertical planes. Difference between I and III angle projections. Dimensioning techniques. (b) Projections of points, lines and planes. 1 Sheet 5 (a) Orthographic Projections of Simple 3 Sheet Edge and axis making given angles with the reference planes. Face making given angles with reference planes. Face and its edge making	**10**

	given angles with reference planes. (b) Orthographic views of simple composite solids from their isometric views. (c) Exercises on missing surfaces and views	
III	6. Section of Solids 1 Sheet Concept of sectioning Cases involving cutting plane parallel to one of the reference planes and perpendicular to the others. Cases involving cutting plane perpendicular to one of the reference planes and inclined to the others plane, true shape of the section 7. Isometric Projection. 2 Sheet Isometric scale Isometric projection of solids. 8. Free hand sketching 1 Sheet Use of squared paper Orthographic views of simple solids Isometric views of simple job like carpentry joints 9. Development of Surfaces 1 Sheet Parallel line and radial line methods of developments. Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid). 10. Assembly and Disassembly Drawings 2 Sheet Plummer block Footstep bearings Couplings etc. Riveted & amp; Welded Joints Screw and form of screw thread 11. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS: 2 Sheet Nut and Bolt, Locking device, Wall bracket	**10**
IV	**UNIT-4** **12. PRACTICE ON AUTO CAD:** To draw geometrical figures using line, circle, arc, polygon, ellipse, rectangle - erase and other editing commands and snap commands (two dimensional drawing only.	**10**

	RAFFERANCE BOOKS:-	
1.	ENGINEERING DRAWING	Sujeet Kumar (J.P.N.P Meerut)
2.	ENGINEERING DRAWING	B.K.Goel (J.P.N.P Meerut)

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**UNIT-1** 1. Drawing, instruments and their uses. 1.1 Introduction to various drawing, instruments. 1.2 Correct use and care of Instruments.	1	0	0	1
2	D+1	1.3 Sizes of drawing sheets and their layouts. 2. (A) Lettering Techniques 1 Sheet Printing of vertical and inclined, normal single stroke capital letters.	2	0	0	2
3	D+3	Printing of vertical and inclined normal single stroke numbers. Stencils and their use.	1	1	0	2

4	D+5	b) Introduction to Scales 1 Sheet Necessity and use, Types of scales used in general Engineering drawing. Plane, diagonal and chord scales.	1	0	2	2
5	D+7	**UNIT-2** 3. Conventional Presentation: 2 Sheet Thread (Internal and External), Welded joint, Types of lines, Conventional representation of materials, Conventional representation of machine parts.	2	0	0	2
6	D+9	4. (A) Principles of Projection 1 Sheet Orthographic, Pictorial and perspective. Concept of horizontal and vertical planes. Difference between I and III angle projections.	1	0	2	2
7	D+11	**Dimensioning techniques.** (b) Projections of points, lines and planes. 1 Sheet 5 (a) Orthographic Projections of Simple 3 Sheet Edge and axis making given angles with the reference planes.	2	0	0	2
8	D+13	Face making given angles with reference planes. Face and its edge making given angles with reference planes.	1	1	0	2
9	D+15	b) Orthographic views of simple composite solids from their isometric views. (c) Exercises on missing surfaces and views	2	0	0	3
10	D+18	6. Section of Solids 1 Sheet Concept of sectioning Cases involving cutting plane parallel to one of the reference planes and perpendicular to the others. Cases involving cutting plane	2	0	0	2
11	D+20	perpendicular to one of the reference planes and inclined to the others plane, true shape of the section	1	1	0	2
12	D+22	7. Isometric Projection. 2 Sheet Isometric scale Isometric projection of solids. 8. Free hand sketching 1 Sheet Use of squared paper Orthographic views of simple solids Isometric views of simple job like carpentry joints	1	0	2	2
13	D+24	9. Development of Surfaces 1 Sheet Parallel line and radial line methods of developments. Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid).	2	0	0	2
14	D+27	10. Assembly and Disassembly Drawings 2 Sheet Plummer block Footstep bearings Couplings etc.	2	0	0	3
15	D+29	Riveted Joints Welded Joints Screw and form of screw thread.	1	0	2	2
16	D+31	11. ORTHOGRAPHIC PROJECTION OF	1	1	0	2

		MACHINE PARTS: 2 Sheet Nut and Bolt.				
17	D+33	Locking device, Wall bracket.	2	0	0	2
18	D+35	To draw geometrical figures using line, circle, arc, polygon.	1	0	0	2
19	D+37	ellipse, rectangle - erase and rotation ,hatching commands.	2	0	0	2
20	D+39	Snap commands (two dimensional drawing only.	2	0	2	3

DIPME-223B PRODUCTION TECHNOLOGY-I

L	T	P	Cr
2	1	2	4

RATIONALE
This course focuses on the production technology.

UNITS	CONTENT	Contact Hrs.
I	**Introduction:** Concept of manufacturing processes, classification and application. **METAL FORMING PROCESSES:** **(a) FORGING:** Hammer forging, drop-forging, dies for drop-forging, drop hammers, press forging, forging machines or up setters, forging tools, forging defects and remedies. Concept of losses in forging operation, estimation of stock required for hand forging considering scale and shear losses	8
II	**(b) ROLLING:** Elementary theory of rolling, hot and cold rolling, types of rolling mills, rolling defects and remedies. **(c) PRESS FORMING:** Types of presses, working, and selection of press die, die-material. Press operation-Shearing, piercing trimming, shaving, notching gearing or rubber forming, embossing, stamping, punching. **(d)** Drawing, extrusion, pipe and tube drawing. **(e)** Energy forming technique - Explosive forming, electromagnetic forming	8
III	**CONVENTIONAL METAL CUTTING PROCESSES:** **(a)** Gear manufacturing process- Gear hobbling, gear shaping gear shaving, gear generating, gear burnishing, farming's' generator, straight bevel gear manufacturing, spiral bevel gear manufacturing. **(b)** External threading process-Roll threads, thread milling, thread grinding, thread rolling, and thread chasing, Die heads. **(c)** Machining of cylindrical holes - Multiple spindle drill press, gang drill press, drilling deep holes and small diameter holes, boring, coordinate method of locating holes, Jig boring machine.	8

IV	**METAL FINISHING PROCESS:** Grinding Process, Diamond machining, Honing, Lapping, Super finishing, Polishing and buffing. **SURFACE TREATMENT & FINISHING:** Meaning of the terms surface treatment and its purpose. Elements of surface treatment cleaning protecting, Coloring, Altering surface properties. Surface Treatment Processes- Wire brushing. Belt sanding. Alkaline cleaning, Vapor degreasing. Pickling. Ultrasonic cleaning. Solvent cleaning. Painting application by dipping. Hand spraying. Automatic spraying. Electrostatic spray finishing. Electro coating. Hot dip coating. Phosphate coating-Packetizing and Bonder sing. Buffing. Blackening, Anodizing. Electro Nickel Plating. Nickel carbide plating. Sputtering	**8**
V	**Plant Maintenance** **(A)** Maintenance: maintenance definition, scope of maintenance, maintenance strategies, economics and performance measures, objective of maintenance, concepts of general approach to eliminate Losses, classification of maintenance-corrective, scheduled, preventive, predictive and productive maintenance. Common techniques to monitor the conditions of systems-vibration based, radiographic, thermos graphic, Ferro graphic, computer based diagnosis etc., forms of wear, weapon guide surfaces, breakdown and remedies of machine tools, repair cycle, installation and maintenance of machine tools, PERT in maintenance. **(B)** Organization-Objective of maintenance organization, function and duties of maintenance department, inspections and scheduling, routine-servicing and scheduled repair, maintenance planning, concepts of maintenance management.	**8**

PRACTICALS

1	Centre lathe.
2.	Allgerared head Lathe
3.	C.N.C. Trainer Lathe Center height 100 mm, swing over carriage 60mm, and distance between centers 200 mm, Max. Machining diameter-50 mm, Max. Longitudinal travem-300 mm, Spindle speed 40-2000 RPM, Automatic lubrication paints provided
4.	Planning Machine
5.	Shaping Machine
6.	Slotting Machine
7.	Universal Milling Machine 3 Axis, Travel X-300mm, Y-250 mm, Z-125 capable of milling acrylic ,Al., Wood, etc. Compatible with FM5/DNC
8.	Universal Tool Cutter and Grinder
9.	Two Wheel bench Grinder (Wheel size 150x16x12 mm), Wheel standard Accessories Single phase motor .25 HP high speed
10.	Bench Drilling Machine 13 mm capacity, 5 HP, AC 230 Volt Single Phase, 1400 rpm motor with starter switch 30 mm capacity drill chuck V belt 100 mm machine vice.
11.	Power Hacksaw motorized with coolant pump, vice, length Gauge, machine drive belt guard, 1 H.P. A.C. 440/3/50/1440 rpm, and Electric motor with starter. Capacity to cut 175 mm. round And 150x150 mm. square rod, Blade size 350x25 mm.
12.	Cylindrical grinding machine (Plain)
13.	Surface grinder table size 12"x8". (Planer type)

REFERENCE BOOKS :		
1.	Production Engineering & Science	Pandey & Singh
2.	Elements of Workshop Technology Vol – I	Choudhury Hajra S.K.
3.	Book of Production Engineering	PC Sharma; S Chand and Company
4.	Foundry Technology	KP Sinha and DB Goel

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**Introduction:** Concept of manufacturing processes, classification and application.	1	0	0	1
2	D+1	**METAL FORMING PROCESSES:** **(a) FORGING:** Hammer forging, drop-forging, dies for drop-forging, drop hammers, press forging, forging machines or up setters, forging tools, forging defects and remedies.	2	0	0	2
3	D+3	Concept of losses in forging operation, estimation of stock required for hand forging considering scale and shear losses.	1	1	0	2
4	D+5	**b) ROLLING:** Elementary theory of rolling, hot and cold rolling, types of rolling mills, rolling defects and remedies.	1	0	2	2
5	D+7	**(c) PRESS FORMING:** Types of presses, working, and selection of press die, die-material. Press operation-Shearing, piercing trimming.	2	0	0	2
6	D+9	Shaving, notching gearing or rubber forming, embossing, stamping, punching. **(d)** Drawing, extrusion, pipe and tube drawing	1	0	2	2
7	D+11	**(e)** Energy forming technique - Explosive forming, electromagnetic forming. **CONVENTIONAL METAL CUTTING PROCESSES:** (a) Gear manufacturing process- Gear hobbling, gear shaping gear shaving, gear generating, gear burnishing,	2	0	0	2
8	D+13	Farming's' generator, straight bevel gear manufacturing, spiral bevel gear manufacturing.	1	1	0	2
9	D+15	(b) External threading process-Roll threads, thread milling, thread grinding, thread rolling, and thread chasing, Die heads.	2	0	0	3
10	D+18	(c) Machining of cylindrical holes - Multiple spindle drill press, gang drill press, drilling deep holes and small diameter holes, boring, coordinate method of locating holes, Jig boring machine.	2	0	0	2
11	D+20	**METAL FINISHING PROCESS:**	1	1	0	2

		Grinding Process, Diamond machining, Honing, Lapping, Super finishing, Polishing and buffing.				
12	D+22	**SURFACE TREATMENT & FINISHING:** Meaning of the terms surface treatment and its purpose. Elements of surface treatment cleaning protecting, Coloring, Altering surface properties. Surface Treatment Processes- Wire brushing.	1	0	2	2
13	D+24	Belt sanding. Alkaline cleaning, Vapor degreasing. Pickling. Ultrasonic cleaning. Solvent cleaning. Painting application by dipping. Hand spraying. Automatic spraying. Electrostatic spray finishing. Electro coating.	2	0	0	2
14	D+27	Hot dip coating. Phosphate coating-Packetizing and Bonder sing. Buffing. Blackening, Anodizing. Electro Nickel Plating. Nickel carbide plating. Sputtering.	2	0	0	3
15	D+29	**Plant Maintenance** (A) Maintenance: maintenance definition, scope of maintenance, maintenance strategies, economics and performance measures, objective of maintenance, concepts of general approach to eliminate Losses.	1	0	2	2
16	D+31	Classification of maintenance-corrective, scheduled, preventive, predictive and productive maintenance.	1	1	0	2
17	D+33	Common techniques to monitor the conditions of systems-vibration based, radiographic, thermos graphic, Ferro graphic, computer based diagnosis etc.	2	0	0	2
18	D+35	Forms of wear, weapon guide surfaces, breakdown and remedies of machine tools, repair cycle, installation and maintenance of machine tools, PERT in maintenance.	1	0	0	2
19	D+37	(B) Organization-Objective of maintenance organization, function and duties of maintenance department.	2	0	0	2
20	D+39	Inspections and scheduling, routine-servicing and scheduled repair, maintenance planning, concepts of maintenance management.	1	0	0	1

DIPME-225 MECHANICAL ESTIMATING AND COSTING

L	T	P	Cr
3	1	-	4

RATIONALE:-
The Knowledge about estimation and costing is required for engineers This subject is designed to develop understanding of various components of costs and making cost estimation.

UNIT	CONTENT	Contact Hrs.
I	**Introduction :**Estimating, Definition, Importance of estimating, Aims and functions, Estimating procedure, Costing, Definition, Aims of costing, Procedure of costing, Difference between estimating and costing, **Elements of Costs :**Material cost,Labourcost,Expenses,Directexpenses,Indirectexpenses,Component of cost Overhead cost, Allocation of on cost.	10
II	**Break Even Analysis and Equipment Replacement Analysis :**Break even analysis (cost, volume, profit analysts), determination of Breakeven point, breakeven point theory, Equipment Replacement Analysts, Regions, Policy, Guide line Various methods, Hire Purchasing **Estimation of Material Cost :** Estimation of volumes, weights and cost of materials for Pulley, Spindle, Lathe centre, Fly wheel Crank shaft **Labour Costing :**Type of Wage and Incentive ,Wage Differentials Methods of wage Payments, Job Evaluation.	10
III	**Estimation in Machining :**Cutting speed, feed and depth of cut, Setup time, operation time, machining, time tear down time, handling time, Allowances Estimation of machining time for various lathe operations :Turning, Facing, Threading, Drilling, Chamfering, Estimation of machining time for Milling operation, Estimation of machining time for Shaping operation, Estimation of machining time for Grinding operation, Metal removal rates, **Estimation in Welding Shop :**Estimation of electric arc welding cost, Estimation of gas welding Estimation of gas cutting, Factors affecting welding cost	10
IV	**Estimation in Forging Shop:** Hand forging ,Machine forging, Estimation of losses in forging operation , net weight, Time, Estimation of cost of forging operation **Estimation in Pattern Making and Foundry Shop :**Pattern allowances Estimation of pattern cost, Estimation of foundry shop, **Estimation in Sheet Metal Shop :**Sheet metal operations, Sheet metal joints, Estimation of time and cost in sheet metal operations, Blank layout, Capacity for power press.	10

REFERENCE BOOKS :		
1.	Estimating & Costing	Banga& Sharma
2.	Mechanical Estimating & Costing	O.P. Khanna
3.	Mechanical Estimating & Costing	T.T.T.I.Madras

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**Introduction: Estimating**, Definition, Importance of estimating, Aims and functions, Estimating procedure.	1	0	0	1
2	D+1	Costing, Definition, Aims of costing, Procedure of costing, Difference between estimating and costing.	2	0	0	2
3	D+3	**Elements of Costs:** Material cost, Labour cost, Expenses, Direct expenses, Indirect expenses.	1	1	0	2
4	D+5	Component of cost Overhead cost, Allocation of on cost. Break Even Analysis. Equipment Replacement Analysis :Break even analysis (cost, volume, profit analysts)	1	0	0	2
5	D+7	Determination of Breakeven point, breakeven point theory, Equipment Replacement Analysts, Regions, Policy, Guide line. Various methods.	2	0	0	2
6	D+9	**Hire Purchasing Estimation of Material Cost:** Estimation of volumes, weights and cost of materials for Pulley, Spindle, Lathe centre, Fly wheel Crank shaft.	1	0	0	2
7	D+11	Various methods, Hire Purchasing Estimation of Material Cost: Estimation of volumes, weights and cost of materials for Pulley, Spindle, Lathe centre, Fly wheel Crank shaft.	2	0	0	2
8	D+13	**Labour Costing:** Type of Wage and Incentive, Wage Differentials Methods of wage Payments, Job Evaluation.	1	1	0	2
9	D+15	**Estimation in Machining:** Cutting speed, feed and depth of cut, Setup time, and operation time, machining.	2	0	0	3
10	D+18	Time tear down time, handling time, Allowances Estimation of machining time for various lathe operations: Turning, Facing, Threading, Drilling, Chamfering.	2	0	0	2
11	D+20	Estimation of machining time for Milling operation, Estimation of machining time for Shaping operation.	1	1	0	2
12	D+22	Estimation of machining time for Grinding operation, Metal removal rates.	1	0	0	2
13	D+24	**Estimation in Welding Shop:** Estimation of electric arc welding cost, Estimation of gas welding.	2	0	0	2
14	D+27	Estimation of gas cutting, Factors affecting welding cost.	2	0	0	3

15	D+29	**Estimation in Forging Shop:** Hand forging, Machine forging.	1	0	0	2
16	D+31	Estimation of losses in forging operation, net weight, Time, Estimation of cost of forging operation.	1	1	0	2
17	D+33	**Estimation in Pattern Making and Foundry Shop:** Pattern allowances Estimation of pattern cost.	2	0	0	2
18	D+35	Estimation of foundry shop, **Estimation in Sheet Metal Shop:** Sheet metal operations.	1	0	0	2
19	D+37	Sheet metal joints, Estimation of time and cost in sheet metal operations.	2	0	0	2
20	D+39	Blank layout, Capacity for power press.	1	0	0	1

DIPMEA-311 AUTOMOBILE MAINTENANCE SERVICING AND REPAIR

L	T	P	Cr
3	1	0	4

COURSE OBJECTIVE:
Understanding of principle, operation of automobile engineering.

UNITS	CONTENTS	Contact Hrs.
I	**ENGINE MAINTENANCE &REPAIRING:** Maintenance, Maintenance schedule, Routine Maintenance schedule for petrol engine and diesel engine, lubricating chart, cleaning and adjustment, preventive maintenance, trouble shooting for faults in engines. Overhauling of engines, Adjusting the engine timing, Maintenance and adjustment of carburetor and fuel injection pump. Checking the valve clearance and adjustment, valve grinding and lapping, engine tuning, detection and rectification of faults use compression gauge and vacuum gauge, general methods of redelivery inspection of vehicle.	10
II	**REPAIRING PROCESSES:** Cylinder rebooting and relieving, Removal of liners and fitting, inspection; Repair and fitting of valve and valve guides, checking the connecting rod for bending and connecting rod alignment, inspection of crank shaft frivolity and regrinding, Phasing and calibration of fuel injection pump, nozzle testing, cleaning and grinding.	8
III	**REPAIR AND MAINTENANCE OF RADITOR AND LUBRICATING SYSTEM:** Radiator repair and maintenance, Maintenance of lubricating system, Flushing the lubricating system, Change of used lubricating oils, clearing and fitting of oil filter lubrication of water pump, grades of oils, multi grade oil, additives	6

	for improving the quality of oil.	
IV	**CHASIS REPAIR AND MAINTENANCE:** Grease and greasing points requiring greasing, specifications of greases to be used for different parts, repair of tires and tubes, greasing of wheel bearing, rotating schedule for front and rear tires, bleeding of brakes, pedal play adjustment in clutch and brakes, adjustment, change of brake lining, testing of brakes, Dissemble greasing and recombining of leaf spring.	6
V	**ELECTRICAL SYSTEM REPAIR AND MAINTENANCE:** Starter trouble, shooting and suggesting remedies, removal of starter from engine, repairing the starter, bushes and bushes replacement, checking of armature for short circuit, cleaning of commentators, checking, repairing of starter drive reassembly and testing of starter, dynamo, lubricating the dynamo, changing the bushes, checking and turning the electrical horn. **ACCESSORIES OF ELECTRICAL SYSTEM AND THEIR SERVICE:** Wind screen, wiper, electrical horn and relay, cigarette lighter, growler, spark plug cleaner and tester, electrical test bench. **TOOLS AND EQUIPMENTS:** Cylinder rebooting machine, surface grinder, arbor press, valve seat cutter and grinder, valve reface crank shaft grinder, engine tune up instruments, feeler gauge, Timing light (Neon light), Tachometer, Spark Plug cleaner micrometer, venire calipers, cylinder gauge, dial gauge, hydraulic hoist specification and working, car washer specification and working, air compressor specification and utility, screw jack, bearing puller, fuel pump testing and calibration machine, nozzle testing machine, grease guns. **AUTOMOBILE POLLUTION &CONTROL**: Source and control of automobile air pollution, causes of automobile pollution and their remedies monitoring and analysis of auto exhaust emission, legislative action, and judicial response. Introduction to energy conservation. **REPAIR AND MAINTENANCE OF VEHICLE AIR CONDITIONING SYSTEM:** Testing and Charging of Air Conditioner, care & maintenance allowance, primary & secondary circuit, heat exchanger, cooling & dehumidifying coil. Care & servicing-Air control unit, temperature control unit, magnet clutch, condenser, fan assembly, Evaporator, relays, expansion valve, filters and three way solenoid valve. Checking of harness of air-conditioning.	10

REFERENCE BOOKS :		
1	Automobile Engineering.	Kripal Singh
2	Automobile Engineering.	Hietner.
3	Automobile Engineering.	Narang.

Course Planner:

S .No.	Day	Subject	L	T	P	Total
1	D Day	**Unit-I ENGINE MAINTENANCE &REPAIRING:** Maintenance, Maintenance schedule,	2	0	0	2
2	D+2	Routine Maintenance schedule for petrol engine and diesel engine, lubricating chart,	2	0	0	2
3	D+4	Overhauling of engines, Adjusting the engine timing, Maintenance and adjustment of carburetor and fuel injection pump.	2	0	0	2
4	D+6	Checking the valve clearance and adjustment, detection Preventive maintenance, trouble shooting for faults in engines. Overhauling of engines,	2	0	0	2
5	D+8	Adjusting the engine timing, Maintenance and adjustment of carburetor and fuel injection pump.	2	1	0	2
6	D+10	**Unit-II REPAIRING PROCESSES:** Cylinder rebooting and relieving, Removal of liners and fitting	1	0	0	1
7	D+11	Inspection; Repair and fitting of valve and valve guides,	1	0	2	2
8	D+13	Checking the connecting rod for bending and	1	0	0	1
9	D+14	Connecting rod alignment, inspection of crank shaft frivolity and	1	0	0	1
10	D+15	Regrinding, Phasing and calibration of fuel injection pump, nozzle testing, cleaning and grinding.	1	1	0	2
11	D+17	**Unit-III REPAIR AND MAINTENANCE OF RADITOR AND LUBRICATING SYSTEM:** Radiator repair and maintenance, Maintenance of lubricating system, oil.	1	1	0	2
12	D+19	Flushing the lubricating system, Change of used lubricating oils,	1	0	2	2
13	D+20	Clearing and fitting of oil filter lubrication of water pump,	1	0	0	1
14	D+21	Grades of oils, multi grade oil, additives for improving the quality of oil	1	0	0	1
15	D+22	**Unit-IV CHASIS REPAIR AND MAINTENANCE:** Grease and greasing points requiring greasing, specifications of greases to be used for different parts,	1	1	0	2

16	D+24	Repair of tires and tubes, greasing of wheel bearing,	1	0	0	1
17	D+25	Rotating schedule for front and rear tires, bleeding of brakes,	1	0	2	2
18	D+27	Pedal play adjustment in clutch and brakes,	1	0	0	1
19	D+28	Adjustment, change of brake lining, testing of brakes	1	0	0	1
20	D+29	**Unit-V ELECTRICAL SYSTEM REPAIR AND MAINTENANCE:** Starter trouble, shooting	1	0	2	2
21	D+31	Suggesting remedies, cleaning of commentators, starter, dynamo, lubricating the dynamo, changing the bushes,	1	0	0	1
22	D+32	**ACCESSORIES OF ELECTRICAL SYSTEM AND THEIR SERVICE:** Wind screen, wiper, electrical horn and relay, cigarette lighter, growler, spark plug cleaner and tester, electrical test bench.	1	0	0	1
23	D+33	**TOOLS AND EQUIPMENTS:** Cylinder rebooting machine, surface grinder, arbor press, valve seat cutter and grinder, valve reface crank	1	0	0	1
24	D+34	Tachometer, Spark Plug cleaner micrometer, venire calipers, cylinder gauge, dial gauge,	1	0	0	1
25	D+35	**AUTOMOBILE POLLUTION &CONTROL**: Source and control of automobile air pollution, causes of automobile pollution and their remedies monitoring	1	0	0	1
26	D+36	Introduction to energy conservation.	1	0	0	1
27	D+37	**REPAIR AND MAINTENANCE OF VEHICLE AIR CONDITIONING SYSTEM:** Testing and Charging of Air Conditioner, care & maintenance allowance, primary & secondary circuit,	2	1	0	2
28	D+39	Heat exchanger, cooling & dehumidifying coil, Evaporator,	1	0	0	1

BTME- 213 COMPUTER AIDED DRAWING LAB

L	T	P	Cr
0	0	2	1

COURSE OBJECTIVE:

- To provide an overview of how computers can be utilized in mechanical drawing.
- Upon completion of this course, the students can use computer and CAD software for modelling mechanical drawing.

UNITS	CONTENTS	Contact Hrs.
I	**Introduction (1 drawing sheets):** Introduction, classification of machine drawings, principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, lines and rules of dimensioning. **Orthographic Projections (3 drawing sheets):** Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing line problems, principle of visualization of objects, sectional views, full and half sectional views, auxiliary views.	8
II	**Computer aided drafting (1 drawing):** Introduction to computer aided drafting; advantages and applications of CAD, concepts of computer aided 2D drafting using any drafting software like AutoCAD, Solid Edge, Draft Sight etc., basic draw and modify commands, making 2D drawings of simple machine parts.	6
III	**Riveted joints (1 drawing sheet):** Introduction, rivets and riveting, types of rivets, types of riveted joints, drawing of boiler joints etc. **Free hand sketching (1 drawing sheet):** Introduction, Need for free hand sketching, Free hand sketching of foundation bolts, studs, pulleys, couplings etc.	6

IV	**Fasteners (2 drawing sheets):** Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints.	5

COMPUTER AIDED DRAWING LAB - LAB – BTME-213

S. No	PRACTICALS		P(2hrs))
1	D	To study and draw various types of lines.	1
2	D+1	To study and draw first and third angle projection.	1
3	D+2	To study and draw section, full, and half view given object.	1
4	D+3	To study various types of auxiliary views.	1
5	D+4	To study and draw various types riveted joint.	1
6	D+5	To study and draw of free hand sketching.	1
7	D+6	To study and draw permanent temporary fasteners.	1
8	D+7	To study and draw permanent fasteners.	1

TEXT BOOKS:

1.	Engineering Drawing, Pathak, Wiley.
2.	AutoCAD 2014 for Engineers & Designers, Bhatt, WILEY.
3.	Textbook of Machine Drawing, K C John, PHI.
4.	Engineering Drawing by Bhat, & Panchal, Charotar Publishing House.

BTME-412 AUTOMOBILE ENGINEERING

L	T	P	CR
3	**1**	**2**	5

RATIONALE
Understanding of principle, operation of automobile engineering.

Unit	**Syllabus**	**No. of Hours**
Unit-I	**Power Unit and Gear Box:** Principles of Design of main components. Valve mechanism. Power and Torque characteristics. Rolling, air and gradient resistance. Tractive effort. Gear Box. Gear ratio determination. Design of Gear box.	**08**
Unit-II	**Transmission System:** Requirements. Clutches. Torque converters. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, wheel camber & Toe-in, Toe-out etc. Steering geometry. Ackerman mechanism, Under steer and Over steer.	**08**
Unit-III	**Braking System:** General requirements, Road, tyre adhesion, weight transfer, Braking ratio. Mechanical brakes, Hydraulic brakes. Vacuum and air brakes. Thermal aspects. **Chassis and Suspension System:** Loads on the frame. Strength and stiffness. Various suspension systems.	**08**
Unit-IV	**Electrical System :** Types of starting motors, generator & regulators,	**08**

	lighting system, Ignition system, Horn, Battery etc. **Fuel Supply System:** Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel Pump, Carburetor etc. MPFI.	
Unit-V	**Automobile Air Conditioning:** Requirements, Cooling & heating systems. **Cooling & Lubrication System:** Different type of cooling system and lubrication system. **Maintenance system:** Preventive maintenance, break down maintenance and over hauling.	**08**

REFERENCE BOOKS :		
1	Automobile Engineering.	Kripal Singh
2	Automobile Engineering.	Hietner.
3	Automobile Engineering.	Narang.

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**Unit-I**: **Power Unit and Gear Box:** Principles of Design of main components.	1	0	0	1
2	D+1	Valve mechanism. Power and Torque characteristics.	2	0	0	2
3	D+3	Rolling, air and gradient resistance.	1	1	0	2
4	D+5	Tractive effort. Gear Box.	1	0	0	1
5	D+6	Gear ratio determination. Design of Gear box.	1	0	2	2
6	D+8	**Unit-II: Transmission System:** Requirements. Clutches. Toque converters. Over Drive and free wheel, Universal joint.	2	0	0	2
7	D+10	Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle.	2	0	2	3
8	D+13	Castor Angle, wheel camber & Toe-in, Toe-out etc. Steering geometry.	1	1	0	2
9	D+15	Ackerman mechanism, Under steer and Over steer.	1	0	0	1
10	D+16	**Unit-III**: **Braking System:** General requirements, Road, tyre adhesion, weight transfer Braking ratio.	2	0	0	2
11	D+18	Mechanical brakes, Hydraulic brakes. Vacuum and air brakes. Thermal aspects.	2	0	0	2
12	D+20	**Chassis and Suspension System:** Loads on the frame. Strength and stiffness.	1	1	0	2
13	D+22	Various suspension systems.	1	0	2	2
14	D+24	**Unit-IV: Electrical System :**ypes of starting motors, generator & regulators, lighting system,	2	0	0	2
15	D+26	Ignition system, Horn, Battery etc.	2	0	0	2
16	D+28	**Fuel Supply System:**	1	0	2	2

		Diesel & Petrol vehicle system such as Fuel Injection Pump,				
17	D+30	Injector & Fuel Pump, Carburetor etc. MPFI.	2	1	0	3
18	D+33	**Unit-V: Automobile Air Conditioning:** Requirements, Cooling & heating systems.	2	0	2	3
19	D+36	**Cooling & Lubrication System:** Different type of cooling system and lubrication system.	2	1	0	3
20	D+39	**Maintenance system:** Preventive maintenance, break down maintenance and over hauling.	1	0	0	1

AUTOMOBILE ENGINEERING LAB BTME-P-412

Total Nine Experiments are carried out.

Course Planner Lab:

S. No.	Day	Subject Automobile engineering	P(2hrs)
1	D Day	Determination of Indicated H.P. of I.C. Engine by Morse Test.	1
2	D+1	Study & experiment on Valve mechanism.	1
3	D+2	Study & experiment on Gear Box.	1
4	D+3	Study & experiment on Differential Gear Mechanism of Rear Axle.	1
5	D+4	Study & experiment on Steering Mechanism.	1
6	D+5	Study & experiment on Automobile Braking System.	1
7	D+6	Study & experiment on Chassis and Suspension System.	1
8	D+7	Study & experiment on Ignition system of I.C. Engine.	1
9	D+8	Study & experiment on Fuel Supply System of S.I. Engines- Carburetor, Fuel Injection Pump and MPFI.	1

ES-212 ENGINEERING MECHANICS

L	T	P	Cr
2	1	2	4

COURSE OBJECTIVE:
The objective of this Course is to provide an introductory treatment of Engineering Mechanics to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters. A working knowledge of statics with emphasis on force equilibrium and free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions.

UNITS	CONTENTS	Contact Hrs.
I	**Two-dimensional force systems:** Basic concepts, Laws of motion, Principle of transmissibility of forces, transfer of a force to parallel position, resultant of a force system, simplest resultant of two dimensional concurrent and non-concurrent force systems, and distribution of force systems, free body diagrams, equilibrium and equations of equilibrium. Friction: Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction.	10
II	**Beam:** Introduction, shear force and bending moment, different equations of equilibrium, shear force and bending moment diagram for statically determined beams. **Trusses:** Introduction, simple truss and solution of simple truss, methods of F-joint and methods of sections.	8
III	**Centroid and moment of inertia:** Centroid of plane, curve, area, volume and composite bodies, moment of inertia of plane area, parallel axis theorem, perpendicular axis theorem, principle moment of inertia, mass moment of inertia of circular ring, disc, cylinder, sphere, and cone about their axis of symmetry.	6
IV	**Kinematics of rigid body:** Introduction, plane motion of rigid body, velocity and acceleration under translational and rotational motion, relative velocity. **Kinetics of rigid body:** Introduction, force, mass and acceleration, work and energy,	6

	impulse and momentum, D'Alembert's principle and dynamic equilibrium.	
V	**Simple stress and strain:** Introduction, normal and shear stresses, stress-strain diagrams for ductile and brittle material, elastic constants, one-dimensional loading of members of varying cross sections, strain energy. **Pure bending of beams:** Introduction, simple bending theory, stress in beams of different cross sections. **Torsion:** Introduction, torsion of shafts of circular cross sections, torque and twist, shear stress due to torque.	10

TEXT BOOKS:

- Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
- F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
- R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
- Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
- Tayal A.K. (2010), Engineering Mechanics, Umesh Publications
- Bansal R.K. (2010), A Text Book of Engineering Mechanics, Laxmi Publications

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**Unit-I Two-dimensional force systems:** Basic concepts, Laws of motion	2	0	0	2
2	D+2	Principle of transmissibility of forces, transfer of a force to parallel position	2	0	0	2
3	D+4	Resultant of a force system, simplest resultant of two dimensional concurrent and non-concurrent force systems	2	0	0	2
4	D+6	Distribution of force systems, free body diagrams, equilibrium and equations of equilibrium.	2	0	0	2
5	D+8	Friction: Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction	2	1	0	2
6	D+10	**Unit-II Beam:** Introduction, shear force and bending moment,	1	0	0	1
7	D+11	Different equations of equilibrium, shear force and bending	1	0	2	2
8	D+13	Shear force and bending moment diagram for statically determined beams.	1	0	0	1
9	D+14	**Trusses:** Introduction, simple truss and solution of simple truss,	1	0	0	1
10	D+15	Methods of F-joint and methods of sections.	1	1	0	2
11	D+17	**Unit-III Centroid and moment of inertia:** Centroid of plane,	1	1	0	2
12	D+19	curve, area, volume and composite bodies	1	0	2	2
13	D+20	Moment of inertia of plane area, parallel axis theorem,	1	0	0	1
14	D+21	Perpendicular axis theorem, principle moment of inertia,	1	0	0	1
15	D+22	Mass moment of inertia of circular ring, disc, cylinder, sphere.	1	1	0	2
16	D+24	**Unit-IV Kinematics of rigid body:** Introduction, plane motion of rigid body,	1	0	0	1
17	D+25	Velocity and acceleration under translational and rotational motion,	1	0	2	2
18	D+27	**Kinetics of rigid body:** Introduction, force, mass and acceleration,	1	0	0	1
19	D+28	work and energy, impulse and momentum	1	0	0	1

20	D+29	D'Alembert's principle and dynamic equilibrium.	1	0	2	2
21	D+31	**Unit-V Simple stress and strain:** Introduction, normal and shear stresses,	1	0	0	1
22	D+32	Stress-strain diagrams for ductile and brittle material,	1	0	0	1
23	D+33	Elastic constants, strain energy	1	0	2	2
24	D+35	**Pure bending of beams:** Introduction, simple bending theory,	1	0	0	1
25	D+36	Stress in beams of different cross sections.	1	0	0	1
26	D+37	**Torsion:** Introduction, torsion of shafts of circular cross sections,	2	1	0	2
27	D+39	torque and twist, shear stress due to torque	1	0	0	1

ENGINEERING MECHANICS- LAB – ES-212

S. No	PRACTICALS		P(2hrs))
1	**D**	To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for a steel specimen.	**1**
2	**D+1**	To determine the compression test and determine the ultimate compressive strength for a specimen	**1**
3	**D+2**	To conduct the Impact-tests (Izod / Charpy) on Impact-testing machine to find the toughness.	**1**
4	**D+3**	To determine the hardness of the given specimen using Vickers/ Brinell	**1**
5	**D+4**	To study Friction experiment(s) on inclined plane and/or on screw-jack.	**1**
6	**D+5**	To study Worm & worm-wheel experiment for load lifting.	**1**
7	**D+6**	To determine the hardness of the given specimen using Rockwell hardness testing machine.	**1**
8	**D+7**	To study various types Trusses.	**1**

DIPME-313 THERMAL ENGINEERING AND I. C. ENGINE

L	T	P	Cr
2	1	2	4

RATIONALE
For technical education in Mechanical & Auto mobile engineering field the subject of Thermal engineering and IC Engine is very important for understanding the basic principles and concept of thermodynamics and knowledge of thermal engineering is essential in order to understand the working of the Steam Generator, Steam Turbine, Petrol engines and Diesel engines.

UNIT	CONTENTS	Contact Hrs.
I	**Basic Concept and Gas Laws:** Thermodynamics, property-Intensive and Extensive, system - open, closed and isolated, Energy - Internal energy, potential energy, kinetic energy, heat, work, specific, heat, enthalpy, Boyle's law, Charles's law, Joule's law, Characteristics gas equation, gas constant, mol, universal gas constant and molar, specific heats Simple numerical problems. **Laws of Thermodynamics:** Zeroth law of thermodynamics, First law of thermodynamics. Second law of thermodynamics Concept of entropy, Constant volume, constant pressure, isothermal, adiabatic polytrophic processes, throttling and free expansion, work done during these processes. Simple numerical problems.	10
II	**Formation of Steam and its Properties :** Generation of steam at constant pressure, various stage of steam- wet steam, dry steam saturated steam, dryness fraction, super heated steam, degree of super heat. Critical point, triple point, thermodynamic properties of steam - specific volume, specific enthalpy, specific internal energy, specific entropy. Steam property diagram: enthalpy- entropy, diagram, Heating and expansion of steam during thermodynamic processes, Change of internal energy and entropy of steam during processes Simple numerical problems Use of steam tables and Mollier charts. **Steam Generators:** Definition of boiler according to I.B.R., classification of boilers, Comparison of water tube and fire tube boilers. Special characteristics of high-pressure boilers Introduction to Indian Boiler Act.	10
III	**Steam nozzles:** Flow of steam through convergent- divergent nozzle, Velocity of steam leaving nozzles, Mass of steam discharged through nozzles. Critical pressure ratio. Area of cross section of throat and exit for maximum discharge. Length of nozzle, Super saturated flow, Numerical problems. **Steam Turbines:** Classification and industrial application of steam turbines. Principle and operation of impulse and reaction turbine, Compounding of turbines, Description of simple De-Laval turbine, velocity diagram, work done and efficiency. Description of Parson's reaction turbine, velocity diagram, work done and efficiency, Bleeding of steam, Lubrication system for steam turbines, Blade materials and defects in blades, Simple numerical problems.	10

IV	**Principles of Internal Combustion Engines :** Introduction and Classification of I.C Engines, Working principle of four stroke and two stroke cycle and their comparison, Working and special features of petrol and diesel engines and their comparison and applications I.C. engine terms - Bore, stroke, dead centers, crank throw, compression ratio, clearance volume, piston displacement and piston speed, Valve timing diagrams (Theoretical & Actual), firing order, Super charging of I.C. engines. **Petrol Engines:** Concept of Carburetion, Air fuel ratio, Simple carburetors and its limitations, Multi point fuel injection system, Mechanical and electrical feed pump. **Diesel Engines:** Description and working of Fuel feed pump Injection of fuel, Introduction to swirl and open combustion chambers. **Cooling, Lubrication and Governing:** Necessity of engine cooling, Properties of coolants, Methods of cooling and their merits and demerits, Function of Lubrication, lubrication systems of I.C. Engines, Properties of lubricants, Governing methods of I.C. Engines.	**10**

Reference Books		
1.	Thermal Engineering (Hindi)	Arpit Singh
2.	Thermal Engineering (Hindi)	Verma & Gulecha
3.	Thermal Engineering	R.K.Purohit.
4.	Thermal Engineering	R.S. Khurmi
5.	Elements of Heat Engines -Vol.1	Patel & Karam Chandani
6.	Internal Combustion Engine	Mathur & Sharma
7.	Internal Combustion Engine	V. Ganesan

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**Basic Concept and Gas Laws:** Thermodynamics, property-Intensive and Extensive, system - open, closed and isolated.	1	0	0	1
2	D+1	Energy - Internal energy, potential energy, kinetic energy, heat, work, specific, heat, enthalpy.	1	0	0	2
3	D+2	Tutorial	0	1	0	3
4	D+3	Boyle's law, Charles's law, Joule's law, Characteristics gas equation, gas constant, mol, universal gas constant and molar, specific heats Simple numerical problems.	1	0	0	4
5	D+4	**Laws of Thermodynamics:** Zeroth law of thermodynamics, First law of thermodynamics. Second law of thermodynamics Concept of entropy.	1	0	0	5
6	D+5	Tutorial	0	1	0	6
7	D+6	Constant volume, constant pressure, isothermal, adiabatic polytrophic processes, throttling and free expansion, work done during these processes. Simple numerical problems.	1	0	0	7
8	D+7	**Formation of Steam and its Properties :** Generation of steam at constant pressure, various stage of steam- wet steam, dry steam saturated steam, dryness fraction, super heated steam, degree of super heat.	1	0	0	8
9	D+8	Tutorial	0	1	0	9
10	D+9	Critical point, triple point, thermodynamic properties of steam - specific volume, specific enthalpy, specific internal energy, specific entropy.	1	0	0	10
11	D+10	Steam property diagram: enthalpy- entropy, diagram, Heating and expansion of steam during	1	0	0	11

		thermodynamic processes, Change of internal energy and entropy of steam during processes Simple numerical problems Use of steam tables and Mollier charts.				
12	D+11	Tutorial	0	1	0	12
13	D+12	**Steam Generators:** Definition of boiler according to I.B.R., classification of boilers.	1	0	0	13
14	D+13	Comparison of water tube and fire tube boilers. Special characteristics of high-pressure boilers Introduction to Indian Boiler Act.	1	0	0	14
15	D+14	Tutorial	0	1	0	15
16	D+15	**Steam nozzles:** Flow of steam through convergent- divergent nozzle, Velocity of steam leaving nozzles, Mass of steam discharged through nozzles.	1	0	0	16
17	D+16	Critical pressure ratio. Area of cross section of throat and exit for maximum discharge. Length of nozzle, Super saturated flow.	1	0	0	17
18	D+17	Tutorial	0	1	0	18
19	D+18	**Steam Turbines:** Classification and industrial application of steam turbines. Principle and operation of impulse and reaction turbine, Compounding of turbines.	1	0	0	19
20	D+19	Description of simple De-Laval turbine, velocity diagram, work done and efficiency. Description of Parson's reaction turbine, velocity diagram, work done and efficiency.	1	0	0	20
21	D+20	Tutorial	0	1	0	21
22	D+21	Bleeding of steam, Lubrication system for steam turbines, Blade materials and defects in blades.	1	0	0	22
23	D+22	**Principles of Internal Combustion Engines :** Introduction and Classification of I.C Engines, Working principle of four stroke and two stroke cycle and their comparison, Working and special features of petrol and diesel engines and their comparison and applications I.C.	1	0	0	23
24	D+23	Tutorial	0	1	0	24
25	D+24	Engine terms - Bore, stroke, dead centers, crank throw, compression ratio, clearance volume, piston displacement and piston speed, Valve timing diagrams (Theoretical & Actual), firing order, Super charging of I.C. engines.	1	0	0	25
26	D+25	**Petrol Engines:** Concept of Carburetion, Air fuel ratio, Simple carburetors and its limitations, Multi point fuel injection system, Mechanical and electrical feed pump.	1	0	0	26
27	D+26	Tutorial	0	1	0	27
28	D+27	**Diesel Engines:** Description and working of Fuel feed pump Injection of fuel, Introduction to swirl and open combustion chambers.	1	0	0	28
29	D+28	**Cooling, Lubrication and Governing:** Necessity of engine cooling, Properties of coolants, Methods of cooling and their merits and demerits, Function of Lubrication, lubrication systems of I.C. Engines, Properties of lubricants, Governing methods of I.C. Engines.	1	0	0	29
30	D+29	Tutorial	0	1	0	30

S. No.	Day	PRACTICALS
1.	D Day	Study of Cochran's boiler & Lancashire boiler
2.	D+1	Study of Blackcock & Wilcox boiler
3.	D+2	Study of Boiler mountings
4.	D+3	Study of Boiler accessories
5.	D+4	Study of impulse turbine
6.	D+5	Study of reaction turbine
7.	D+6	Study of two-stroke Petrol engine.
8.	D+7	Study of four stroke Petrol engine.
9.	D+8	Study of two-stroke & four stroke Diesel engine.
10.	D+9	Study of carburetors

BTME-311 HEAT TRANSFER

L	T	P	Cr
2	1	2	4

COURSE OBJECTIVE:

- The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
- Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.
- The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.

UNITS	CONTENTS	Contact Hrs.
I	Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heissler charts.	10
II	Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.	10
III	Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.	10

IV	Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and εNTU methods. Boiling and Condensation heat transfer, Pool boiling curve. Introduction mass transfer, Similarity between heat and mass transfer.	10

TEXT BOOKS:

1.	A. Bejan, Heat Transfer John Wiley, 1993.
2.	J.P.Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.
3.	F.P.Incropera, and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, Sixth Edition, 2007
4.	MassoudKaviany, Principles of Heat Transfer, John Wiley, 2002
5.	Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill, 2002

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian and cylindrical geometry.	1	0	0	1
2	D+1	Steady one dimensional solution for conduction heat transfer in spherical geometry, concept of conduction and film resistances.	1	0	0	2
3	D+2	Tutorial	0	1	0	3
4	D+3	Critical insulation thickness, lumped system approximation and Biot number,	1	0	0	4
5	D+4	Heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer.	1	0	0	5
6	D+5	Tutorial	0	1	0	6
7	D+6	Approximate solution to unsteady conduction heat transfer by the use of Heissler charts.	1	0	0	7
8	D+7	Heat convection, basic equations, and boundary layers.	1	0	0	8
9	D+8	Tutorial	0	1	0	9
10	D+9	Forced convection, external and internal flows-Natural convective heat transfer.	1	0	0	10
11	D+10	Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection.	1	0	0	11
12	D+11	Tutorial	0	1	0	12
13	D+12	Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow.	1	0	0	13
14	D+13	Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.	1	0	0	14
15	D+14	Tutorial	0	1	0	15
16	D+15	Interaction of radiation with materials.	1	0	0	16
17	D+16	Definitions of radiative properties, Stefan Boltzmann's law.	1	0	0	17
18	D+17	Tutorial	0	1	0	18

19	D+18	Black and gray body radiation.	1	0	0	19
20	D+19	Calculation of radiation heat transfer between surfaces using radiative properties.	1	0	0	20
21	D+20	Tutorial	0	1	0	21
22	D+21	View factors and the radiosity method.	1	0	0	22
23	D+22	Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and εNTU methods.	1	0	0	23
24	D+23	Tutorial	0	1	0	24
25	D+24	Analysis and design of heat exchangers using LMTD methods.	1	0	0	25
26	D+25	Analysis and design of heat exchangers using εNTU methods.	1	0	0	26
27	D+26	Tutorial	0	1	0	27
28	D+27	Boiling and Condensation heat transfer, Pool boiling curve.	1	0	0	28
29	D+28	Introduction mass transfer, Similarity between heat and mass transfer.	1	0	0	29
30	D+29	Tutorial	0	1	0	30

S. No.	Day	PRACTICALS
1.	D Day	Determination of thermal conductivity of a metal rod.
2.	D+1	Determination of thermal conductivity of a solid by guarded hot plate method
3.	D+2	Determination of thermal resistance of a composite wall.
4.	D+3	Temperature distribution of a pin fins in free-convection.
5.	D+4	Temperature distribution of a pin fin in forced-convection.
6.	D+5	Forced convection heat transfer from a cylindrical surface.
7.	D+6	Determination of Effectiveness of a Heat Exchanger.
8.	D+7	Determination of Stefan-Boltzman constant.
9.	D+8	Determination of the water side overall heat transfer coefficient on a cross-flow heat exchanger.
10.	D+9	Measure the emissivity of the gray body (plate) at different temperatures and plot the variation of emissivity with surface temperature.

DIPME-211 STRENGTH OF MATERIALS

L	T	P	Cr
2	1	2	4

RATIONALE
In Engineering every structure or machine element is designed for a particular application. Then it is tested. A Diploma holder should be capable of designing the various elements for particular requirements. For this he must be able to calculate the stresses in an elements and their nature.

UNITS	CONTENTS	Contact Hrs.
I	**Simple Stress and Strain :** Various mechanical properties, Elasticity, Plasticity, Ductility, Brittleness, Toughness, Hardness, Concept of stress and strain, Type of force - Direct, shear, Stress - Tensile, compressive, shear, Hook's law, Statement of Hook's law, Young's modulus of elasticity, Tensile test diagram, Gauge length, Limit of proportionality, Elastic limit, Yield point, Yield strength, Ultimate stress, Rupture strength, Nominal stress, Proof stress, Working stress and factor of safety, Stress and strain calculations, Principle of superposition, Bar of homogeneous section, Bar of uniform cross-section, Bar of steeped cross-section, Bar of composite section, Temperature stresses, Homogeneous section, Composite section, Shear stresses, Modulus of rigidity, Complementary shear stress, Concept of single shear and double shear, Shear strain, Poisson's ratio and volumetric strain, Lateral strain, Longitudinal strain, Volumetric strain, Bulk modulus, Relationship between elastic constants (Derivation),E=3K(1-2/m),E=2N(1+1/m), E=9KN/(3K+N), **Compound Stress:** Introduction, Stress components on an inclined plane, Induced by direct stresses, Induced by simple shear, Induced by direct and simple shear stresses, Mohr's circle: For like direct stresses, For unlike direct stresses, For two perpendiculars direct stresses with state of simple shear, Principal stresses and planes, Major principal stress, Minor principal stress, Mohr's circle method for principal stresses, **Strain Energy:** Introduction, Strain energy from stress - strain diagram, Proof resilience, Types of loading - gradual, sudden, impact, Stress in gradual loading, Stress in sudden loading, Stress in impact loading.	12
II	**Bending Moments and Shear Force:** Basic concept, Types of support, Movable hinge support, (roller),Immovable hinge support, Fixed support, Types of beam, Cantilever beam, Simply supported beam, Fixed beam, Continuous beam, Overhanging beam, Types of load, Point load, Distributed load - uniformly and non uniformly, Shear force and bending moment, Concept and calculation of shear force and bending moment, Sign convention for shear force and bending, moment, Bending	

	moment and shear force diagrams (for point loads, U.D.L. and their combinations), Cantilever beam, Simply supported beam, Simply supported beam with overhang **Moment of Inertia:** Concept of moment of Inertia, Radius of gyration, Parallel axis theorem, Perpendicular axis theorem, Moment of Inertia of various section, Rectangle, Triangle, Circle, Moment of inertia of unsymmetrical section like: T-section, channel section, L-section etc. **Bending Stresses in Beams:** Concept of bending stress, Theory of simple bending, Assumptions in theory of simple bending, M=f=E, use of equation I y R (with proof),Design criterion and section modulus, Section modulus, Calculation of max bending stress in beams of rectangular, circular, I and T section.	**10**
III	**Shear Stress in Beams:** Concept, Use of equation q =F/Ib *(A-y), Shear stress distribution, diagram of various sections, Rectangle, I section, T section, Channel section, H section,+ section, Circular section, **Deflection:** Concept of deflection of a beam, Use of standard formula for, calculating deflection (for point loads, U.D.L. and their combination), Cantilever beam, Simply supported beam, **Columns and Struts:** Concept of column and struts, Modes of failure, Types of column; long and short, Buckling loads, Slenderness ratio, Euler's formula (without proof), Both ends hinged, One end fixed and other end free, Both ends fixed, One end fixed and other end, hinged, Limitations of Euler's Formula, Equivalent length, Rankine's formula.	**08**
IV	**Torsion of Shaft:** Concept of torsion, Angle of twist, Polar moment of Inertia, Assumptions in the theory of pure torsion, Derivation and use of, Q=T=N R J I ,Relation between power and torque, Combined stress due to bending and torsion in solid and hollow shaft, **Springs:** Introduction and classification of springs, Flat carriage springs, Application of flat carriage springs, Determination of number of leaves and their sections, deflection and radius of curvature, Quarter elliptical spring, Closely coiled helical springs: Application of closely coiled helical springs, Determination of deflection, angle of twist, number of coils and stiffness, under axial loading in closely coiled helical springs. **Thin Cylindrical Shells:** Use of cylinders, Stresses due to internal pressure, Circumferential stress or hoop stress, Longitudinal stress, Design of thin cylinders - calculation of the various dimensions of a thin cylinder, **Combined Direct and Bending Stress:** Effect of eccentricity, Stress due to eccentric load, Middle third rule, Quarter rule.	**10**

REFERENCE BOOKS :		
1.	Strength of Materials & Theory of Structures (vol. I)	B.C.Punmia
2.	Strength of Materials	Ramamurtham
3.	Strength of Materials	Junarkar
4.	Strength of Materials	R.S. Khurmi
5.	Strength of Materials (Hindi)	Gurcharansingh

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**Unit-I**: **Simple Stress and Strain :** Various mechanical properties, Elasticity, Plasticity, Ductility, Brittleness, Toughness, Hardness, Concept of stress and strain, Type of force - Direct, shear, Stress - Tensile, compressive, shear, Hook's law, Statement of Hook's law, Young's modulus of elasticity, Tensile test diagram, Gauge length, Limit of proportionality, Elastic limit, Yield point, Yield strength, Ultimate stress, Rupture strength.	1	0	0	1

2	D+1	Nominal stress, Proof stress, Working stress and factor of safety, Stress and strain calculations, Principle of superposition, Bar of homogeneous section, Bar of uniform cross-section, Bar of steeped cross-section, Bar of composite section.	1	0	0	2
3	D+2	Tutorial	0	1	0	3
4	D+3	Temperature stresses, Homogeneous section, Composite section, Shear stresses, Modulus of rigidity, Complementary shear stress, Concept of single shear and double shear.	1	0	0	4
5	D+4	Shear strain, Poisson's ratio and volumetric strain, Lateral strain, Longitudinal strain, Volumetric strain, Bulk modulus, Relationship between elastic constants (Derivation),E=3K(1-2/m),E=2N(1+1/m), E=9KN/(3K+N).	1	0	0	5
6	D+5	Tutorial	0	1	0	6
7	D+6	**Compound Stress:** Introduction, Stress components on an inclined plane, Induced by direct stresses, Induced by simple shear, Induced by direct and simple shear stresses, For two perpendiculars direct stresses with state of simple shear, Principal stresses and planes, Major principal stress, Minor principal stress, Mohr's circle method for principal stresses.	1	0	0	7
8	D+7	**Strain Energy:** Introduction, Strain energy from stress - strain diagram, Proof resilience, Types of loading - gradual, sudden, impact, Stress in gradual loading, Stress in sudden loading, Stress in impact loading.	1	0	0	8
9	D+8	Tutorial	0	1	0	9
10	D+9	**Unit-II Bending Moments and Shear Force:** Basic concept, Types of support, Movable hinge support, (roller),Immovable hinge support, Fixed support, Types of beam, Cantilever beam, Simply supported beam, Fixed beam, Continuous beam, Overhanging beam, Types of load, Point load, Distributed load - uniformly and non uniformly.	1	0	0	10
11	D+10	Shear force and bending moment, Concept and calculation of shear force and bending moment, Sign convention for shear force and bending, moment, Bending moment and shear force diagrams (for point loads, U.D.L. and their combinations), Cantilever beam, Simply supported beam, Simply supported beam with overhang.	1	0	0	11
12	D+11	Tutorial	0	1	0	12
13	D+12	**Moment of Inertia:** Concept of moment of Inertia, Radius of gyration, Parallel axis theorem, Perpendicular axis theorem, Moment of Inertia of various section, Rectangle, Triangle, Circle, Moment of inertia of unsymmetrical section like: T-section, channel section, L-section etc.	1	0	0	13
14	D+13	**Bending Stresses in Beams:** Concept of bending stress, Theory of simple bending, Assumptions in theory of simple bending, $\underline{M}=\underline{f}=\underline{E}$, use of equation I y R (with proof).	1	0	0	14
15	D+14	Tutorial	0	1	0	15
16	D+15	Design criterion and section modulus, Section modulus, Calculation of max bending stress in beams of rectangular, circular, I and T section.	1	0	0	16

17	D+16	**Unit-III: Shear Stress in Beams:** Concept, Use of equation q =F/Ib *(A¯y), Shear stress distribution, diagram of various sections, Rectangle, I section, T section, Channel section, H section,+ section, Circular section.	1	0	0	17
18	D+17	Tutorial	0	1	0	18
19	D+18	**Deflection:** Concept of deflection of a beam, Use of standard formula for, calculating deflection (for point loads, U.D.L. and their combination), Cantilever beam, Simply supported beam,	1	0	0	19
20	D+19	**Columns and Struts:** Concept of column and struts, Modes of failure, Types of column; long and short, Buckling loads, Slenderness ratio, Euler's formula (without proof).	1	0	0	20
21	D+20	Tutorial	0	1	0	21
22	D+21	Both ends hinged, One end fixed and other end free, Both ends fixed, One end fixed and other end, hinged, Limitations of Euler's Formula, Equivalent length, Rankine's formula.	1	0	0	22
23	D+22	**Unit-IV: Torsion of Shaft:** Concept of torsion, Angle of twist, Polar moment of Inertia, Assumptions in the theory of pure torsion, Derivation and use of, Q=T=N R J I , Relation between power and torque, Combined stress due to bending and torsion in solid and hollow shaft.	1	0	0	23
24	D+23	Tutorial	0	1	0	24
25	D+24	**Springs:** Introduction and classification of springs, Flat carriage springs, Application of flat carriage springs, Determination of number of leaves and their sections, deflection and radius of curvature.	1	0	0	25
26	D+25	Quarter elliptical spring, Closely coiled helical springs: Application of closely coiled helical springs, Determination of deflection, angle of twist, number of coils and stiffness, under axial loading in closely coiled helical springs.	1	0	0	26
27	D+26	Tutorial	0	1	0	27
28	D+27	**Thin Cylindrical Shells:** Use of cylinders, Stresses due to internal pressure, Circumferential stress or hoop stress, Longitudinal stress, Design of thin cylinders - calculation of the various dimensions of a thin cylinder.	1	0	0	28
29	D+28	**Combined Direct and Bending Stress:** Effect of eccentricity, Stress due to eccentric load, Middle third rule, Quarter rule.	1	0	0	29
30	D+29	Tutorial	0	1	0	30

S. No.	Day	PRACTICALS
1.	D Day	Study of extensometers
2.	D+1	Study and operation of UTM

3.	D+2	Tensile test on mild steel specimen and plotting stress strain curve.
4.	D+3	Bending test on timber beams.
5.	D+4	Compression test on common structural materials viz. timber, cast iron etc.
6.	D+5	Determination of toughness of cast iron and mild steel specimen by Charpy and Izod test.
7.	D+6	Hardness test by Brinell and Rockwell test.
8.	D+7	Determination of deflection for various types of loading
9.	D+8	Torsion test on brass and mild steel
10.	D+9	Determination of stiffness of close coiled spring

BTME-212 MATERIALS ENGINEERING

L	T	P	Cr
2	1	2	4

COURSE OBJECTIVE:

- To understand the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
- To provide a detailed interpretation of equilibrium phase diagrams
- Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

UNITS	CONTENTS	Contact Hrs.
I	**Crystal Structure:** Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress. **Mechanical Property measurement:** Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength.	8
II	**Static failure theories:** Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. **Fatigue failure:** High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to nondestructive testing (NDT).	6
III	**Alloys, substitutional and interstitial solid solutions-** Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron.	6
IV	**Heat treatment of Steel:** Annealing, tempering, normalizing and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development.	5

	Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.	
V	**Alloying of steel:** properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys.	5

TEXT BOOKS:	
1.	W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
2.	Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3.	V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 1999
4.	U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**Crystal Structure:** Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects.	1	0	0	1
2	D+1	Dislocation strengthening mechanisms and slip systems, critically resolved shear stress.	1	0	0	2
3	D+2	Tutorial	0	1	0	3
4	D+3	**Mechanical Property measurement:** Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, Generalized Hooke's law.	1	0	0	4
5	D+4	Yielding and yield strength, ductility, resilience, toughness and elastic recovery, Hardness: Rockwell, Brinell and Vickers and their relation to strength.	1	0	0	5
6	D+5	Tutorial	0	1	0	6
7	D+6	**Static failure theories:** Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb.	1	0	0	7
8	D+7	Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion.	1	0	0	8
9	D+8	Tutorial	0	1	0	9
10	D+9	**Fatigue failure:** High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits.	1	0	0	10
11	D+10	Effects of mean stress using the Modified Goodman diagram; Fracture with fatigue. Introduction to non-destructive testing (NDT).	1	0	0	11
12	D+11	Tutorial	0	1	0	12

13	D+12	**Alloys, substitutional and interstitial solid solutions-** Phase diagrams: Interpretation of binary phase diagrams.	1	0	0	13
14	D+13	Microstructure development; eutectic, peritectic, peritectoid and monotectic reactions.	1	0	0	14
15	D+14	Tutorial	0	1	0	15
16	D+15	Iron Iron-carbide phase diagram.	1	0	0	16
17	D+16	Microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron.	1	0	0	17
18	D+17	Tutorial	0	1	0	18
19	D+18	**Heat treatment of Steel:** Annealing, tempering, normalising and spheroidising.	1	0	0	19
20	D+19	Isothermal transformation diagrams for Fe-C alloys and microstructure development.	1	0	0	20
21	D+20	Tutorial	0	1	0	21
22	D+21	Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding.	1	0	0	22
23	D+22	Cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.	1	0	0	23
24	D+23	Tutorial	0	1	0	24
25	D+24	**Alloying of steel:** properties of stainless steel and tool steels, maraging steels.	1	0	0	25
26	D+25	cast irons; grey, white, malleable and spheroidal cast irons.	1	0	0	26
27	D+26	Tutorial	0	1	0	27
28	D+27	Copper and copper alloys; brass, bronze and cupro-nickel.	1	0	0	28
29	D+28	Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys.	1	0	0	29
30	D+29	Tutorial	0	1	0	30

S. No.	Day	PRACTICALS
1.	D Day	Strength test of a given mild steel specimen on UTM with full details and stress versus strain plot on the machine.
2.	D+1	Other tests such as shear, bend tests on UTM.
3.	D+2	Impact test on impact testing machine like Charpy, Izod or both.
4.	D+3	Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
5.	D+4	Spring index test on spring testing machine.
6.	D+5	Fatigue test on fatigue testing machine.
7.	D+6	Creep test on creep testing machine.
8.	D+7	Experiment on deflection of beam, comparison of actual measurement of

		deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9.	D+8	Torsion test of a rod using torsion testing machine.
10.	D+9	Study of NDT (non-destructive testing) methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.

DIPME-314 MACHINE TOOL TECHNOLOGY & MAINTENANCE

L	T	P	Cr
2	**1**	**0**	**3**

RATIONALE
For technical education in Mechanical & Auto mobile engineering field the subject of machine tool technology & maintenance is very important for understanding the basic principles and concept of various types of machining operations and machine tools is essential in order to understand the working of the Lathe, Drilling, Milling machines etc.

UNIT	CONTENTS	Contact Hrs.
I	**Basic Features And Kinematics:** Various types of machining operations and machine tools. Common features of all basic machine tools, work holding and tool holding devices, Drive systems, sources of power, Bed, body or frame. Mechanical drive system for providing reciprocating, oscillating and rotational movement. Systems of stepped and steeples, friction and positive drives. Principle of setting upper, lower and intermediate speeds. Mechanical methods of providing automaticity in machine tools.	**07**
II	**Centre Lathe:** The Centre lathe and its principle of working. Types of lathes, Lathe specification and size, Features of lathe bed. Head stock and tail stock. Feed mechanism and change-gears, carriage saddle, Cross slide, Compound rest, Tools post, Apron mechanism, lathe accessories, Chucks, Face plate, Angle plate, Driving plate, Lathe dogs, mandrills, Steady rest, Lathe attachments. Lathe operations-plane and step turning, Taper turning, Screw cutting, Drilling, Boring, reaming, Knurling, Parting off, under cutting, Relieving. Types of lathe tools and their uses. Brief description of semi-automatic and automatic lathes such as capstan and turret lathes, their advantages and disadvantages over Centre lathe, types of job done on them. General and periodic maintenance of a Centre lathe.	**08**
III	**Shaping, Planing & Slotting Machines:** Working principles of planer, shaper and slotter. Differences and similarities among them, quick return mechanism applied to the machines. Types of work done on them, types of tools used, their geometry. General and periodic maintenance of a shaper. **Drilling & Boring Machines:** Types of tools used in drilling and boring. Classification of drilling and boring machines, principle of working and constructional details of simple and radial drilling M/C and general and periodic maintenance. Operations like facing, counter boring, tapering.	**07**

IV	**Milling Machines:** Types of milling machines, constructional features of horizontal milling M/C. general maintenance of the machine, types of milling cutters, milling operations like plane milling, space milling, angular milling form milling, straddle milling, gang milling, Negative rack milling, cutting speed and speed for different tools in up and down milling. Simple compound and differential indexing, milling of spur gears and racks. General and periodic maintenance of milling machine. **Grinding Machines:** Common abrasive grinding wheel materials, Bonds, Grain or grits of abrasive, Grain structure and shapes of common wheels, various speeds and feeds, Use of coolants, Methods of grinding. Types of grinding machines, precision finishing operations like honing. **Jigs and Fixtures:** Object of Jigs and Fixture. Difference between jigs and fixtures. Principle of location. Principle of clamping. Locating and clamping devices. Types of jigs -Simple open and closed (or box) jigs. Drill jigs- Bushes (Fixed liner, Renewal slip). Template. Plate jigs. Channel jigs, Leaf jigs. Simple example of milling, turning, grinding, horizontal boring fixtures and broaching fixtures. Welding fixtures. Devices.	**08**

Reference Books		
1.	Machine Tool Technology & Maintenance	Ajay Kumar Bansal
2.	Machine Tool Technology & Maintenance	Sushil Kumar and Anil Kumar
3.	Machine Tool Technology	J. K. Kapoor
4.	Machine Tool Technology	S. K. Bhatnagar

Course Planner:

S. No.	Day	Subject	L	T	P	Total
1	D Day	**Basic Features And Kinematics:** Various types of machining operations and machine tools. Common features of all basic machine tools.	1	0	0	1
2	D+1	Work holding and tool holding devices, Drive systems, sources of power, Bed, body or frame.	1	0	0	2
3	D+2	Tutorial	0	1	0	3
4	D+3	Mechanical drive system for providing reciprocating, oscillating and rotational movement. Systems of stepped and steeples, friction and positive drives.	1	0	0	4
5	D+4	Principle of setting upper, lower and intermediate speeds. Mechanical methods of providing automaticity in machine tools.	1	0	0	5
6	D+5	Tutorial	0	1	0	6
7	D+6	**Centre Lathe:** The Centre lathe and its principle of working. Types of lathes.	1	0	0	7

8	D+7	Lathe specification and size, Features of lathe bed. Head stock and tail stock. Feed mechanism and change-gears, carriage saddle, Cross slide, Compound rest, Tools post.	1	0	0	8
9	D+8	Tutorial	0	1	0	9
10	D+9	Apron mechanism, lathe accessories, Chucks, Face plate, Angle plate, Driving plate, Lathe dogs, mandrills, Steady rest, Lathe attachments.	1	0	0	10
11	D+10	Lathe operations-plane and step turning, Taper turning, Screw cutting, Drilling, Boring, reaming, Knurling, Parting off, under cutting, Relieving.	1	0	0	11
12	D+11	Tutorial	0	1	0	12
13	D+12	Types of lathe tools and their uses. Brief description of semi-automatic and automatic lathes such as capstan and turret lathes, their advantages and disadvantages over Centre lathe, types of job done on them.	1	0	0	13
14	D+13	General and periodic maintenance of a Centre lathe.	1	0	0	14
15	D+14	Tutorial	0	1	0	15
16	D+15	**Shaping, Planing & Slotting Machines:** Working principles of planer, shaper and slotter. Differences and similarities among them, quick return mechanism applied to the machines.	1	0	0	16
17	D+16	Types of work done on them, types of tools used, their geometry. General and periodic maintenance of a shaper.	1	0	0	17
18	D+17	Tutorial	0	1	0	18
19	D+18	**Drilling & Boring Machines:** Types of tools used in drilling and boring. Classification of drilling and boring machines,	1	0	0	19
20	D+19	Principle of working and constructional details of simple and radial drilling M/C and general and periodic maintenance. Operations like facing, counter boring, tapering.	1	0	0	20
21	D+20	Tutorial	0	1	0	21
22	D+21	**Milling Machines:** Types of milling machines, constructional features of horizontal milling M/C. general maintenance of the machine, types of milling cutters, milling	1	0	0	22

		operations like plane milling, space milling, angular milling form milling, straddle milling, gang milling.				
23	D+22	Negative rack milling, cutting speed and speed for different tools in up and down milling. Simple compound and differential indexing, milling of spur gears and racks. General and periodic maintenance of milling machine.	1	0	0	23
24	D+23	Tutorial	0	1	0	24
25	D+24	**Grinding Machines:** Common abrasive grinding wheel materials, Bonds, Grain or grits of abrasive, Grain structure and shapes of common wheels, various speeds and feeds,	1	0	0	25
26	D+25	Use of coolants, Methods of grinding. Types of grinding machines, precision finishing operations like honing.	1	0	0	26
27	D+26	Tutorial	0	1	0	27
28	D+27	**Jigs and Fixtures:** Object of Jigs and Fixture. Difference between jigs and fixtures. Principle of location. Principle of clamping. Locating and clamping devices. Types of jigs -Simple open and closed (or box) jigs. Drill jigs-Bushes (Fixed liner, Renewal slip).	1	0	0	28
29	D+28	Template. Plate jigs. Channel jigs, Leaf jigs. Simple example of milling, turning, grinding, horizontal boring fixtures and broaching fixtures. Welding fixtures. Devices.	1	0	0	29
30	D+29	Tutorial	0	1	0	30

HS-211 INDUSTRIAL MANAGEMENT

L	T	P	Cr
2	1	0	3

COURSE OBJECTIVE:
• To understand the principles of management and their application to the functioning of an organization.

UNITS	CONTENTS	Contact Hrs.
I	**Introduction:** Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership	6
II	**Management Function:** Principles of Management- Management Tools – time and motion study, work simplification- process charts and flow diagrams, Production Planning, Specification of Production requirements	6
III	**Inventory control:** Inventory, cost, Deterministic models, Introduction to supply chain management	6
IV	**Quality control:** Meaning, process control, SQC control charts, single, double and sequential sampling, Introduction to TQM	6
V	**Environmental Issues:** Environmental Pollution – various management techniques to control Environmental pollution – Various control acts for Air, Water, Solid waste and Noise pollution	6

TEXT BOOKS :	
1.	Khanna O.P.: Industrial Engineering
2.	T.R. Banga: Industrial Engineering and Management
3.	Sharma B.R.: Environmental and Pollution Awareness

Industrial Management (HS-311) Lesson Plan

L	T	P	C
2	1	0	3

S. No	D-Day	Subject/Topic	L	T	P	Total
1	D	Introduction to subject	1	0	0	1
2	D+1	Concepts of Industrial management	1	0	0	1
3	D+2	Developments in Industrial management	1	0	0	1
4	D+3	application and scope of Industrial Management	0	1	0	1
5	D+4	Productivity: Definition	1	0	0	1
6	D+5	Measurement of Productivity	1	0	0	1
7	D+6	productivity index	1	0	0	1
8	D+7	types of production system	0	1	0	1
9	D+8	Industrial Ownership	1	0	0	1
10	D+9	**Management Function:** Principles of Management	1	0	0	1
11	D+10	Management Tools	1	0	0	1
12	D+11	time and motion study	0	1	0	1
13	D+12	work simplification	1	0	0	1
14	D+13	process charts and flow diagrams	1	0	0	1
15	D+14	Production Planning	1	0	0	1
16	D+15	Specification of Production requirements	0	1	0	1
17	D+16	**Inventory control**	1	0	0	1
18	D+17	Inventory and cost	1	0	0	1
19	D+18	Deterministic models	1	0	0	1
20	D+19	Introduction to supply chain management	0	1	0	1
21	D+20	Capital accounts-deficits	1	0	0	1
22	D+21	**Quality control**	1	0	0	1
23	D+22	Meaning and process control	1	0	0	1

24	D+23	SQC control charts	0	1	0	1
25	D+24	Single sampling,	1	0	0	1
26	D+25	double sampling	1	0	0	1
27	D+26	sequential sampling	1	0	0	1
28	D+27	Introduction to TQM	0	1	0	1
29	D+28	**Environmental Issues**	1	0	0	1
30	D+29	Environmental Pollution	1	0	0	1
31	D+30	various management techniques to control Environmental pollution	1	0	0	1
32	D+31	Various control acts for Air pollution	0	1	0	1
33	D+32	Various control acts for Water pollution	1	0	0	1
34	D+33	Various control acts for Solid waste pollution	1	0	0	1
35	D+34	Various control acts for Noise pollution	1	0	0	1
36	D+35	Test	0	1	0	1
37	D+36	Doubts, Problems & revision	1	0	0	1
38	D+37	Doubts, Problems & revision	1	0	0	1
39	D+38	Doubts, Problems & revision	1	0	0	1
40	D+39	Doubts, Problems & revision	0	1	0	1