



MATS UNIVERSITY

ARANG, RAIPUR (C.G.)

Scheme of Teaching & Examination

IV - Semester

S.N.	code	Subject	Periods per week			Scheme of marks		Total Credit
			L	T	P	ESE	IM	
1.	DP410	Theory of Machines and Mechanisms	3	2	-	70	30	4
2.	DP411	Production Process	4	0	-	70	30	4
3.	DP412	Fluid Mechanics and Machinery	3	1	-	70	30	4
4.	DP413	Plant Maintenance and Safety	4	0	-	70	30	4
5.	DP414	Metrology and Instrumentation	3	0	-	70	30	3
6.	DP415	Theory of Machine lab	-	-	2	30	20	1
7.	DP416	Metrology and Instrumentation Lab	-	-	2	30	20	1
8.	DP417	Fluid Mechanics and Machinery lab	-	-	2	30	20	1
9.	DP418	Computer Aided Machine Drawing Lab	-	-	2	30	20	1
10.	DP419	Machine Shop – II			2	30	20	1
Total			17	3	10	540	260	24

L – Lecture, T – Tutorial, ESE – End Semester Examination
 P – Practical, IM – Internal Marks (Include Class Test & Teacher's Assessments)

MATS UNIVERSITY
SEMESTER – IV
SUBJECT- THEORY OF MACHINE
CODE- DP410

UNIT – I: POWER TRANSMISSION BY BELT AND PULLYS

Open & cross belt drive, velocity ratio, length of belt, tension on tight side & slack side, initial tension, relation between tight side & slack side tension, centrifugal tension, power transmission, problems on flat belt drive, idea of v-belt drive, rope drive, compound drive(no problem)

UNIT – II: POWER TRANSMISSION BY GEAR.

Types of gear- important terms and definition related to spur gear (pitch, pitch circle, addendum, dedendum, module etc.), velocity ratio, simple gear train, compound gear train, power transmitted by gears, problems on spur gear train, epicyclic gear train, problems

UNIT- III: BALANCING OF ROTATING PAR

Balancing of single rotating mass by another single mass rotating in the same plane, balancing of several rotating masses by a single mass rotating in the same plane (graphical method), balancing of several masses rotating in different planes, problems.

UNIT IV: FLYWHEELS & GOVERNERS

Crank effort diagram, function of flywheel, co-efficient of fluctuation of speed, determination of weight of flywheel for a given crank effort diagram, governors, functions, types, simple watt, porter & hartnel governor, simple problems in relation to simple watt & porter governor

UNIT V: LINK MOTION

Definition of kinematic link, kinematic pair, kinematic chain mechanism & machines, relative motion, instantaneous centre, 4 bar linkage, crank & connecting rod mechanism to determine velocity by relative velocity diagram & instantaneous centre method

Books and References:

1. Theory of Machines - Thomas Bevan
2. Theory of Machines and Mechanisms- Shigley
3. Theory of Machines and Mechanisms-Ghosh&Mallik
4. Theory of Machines and Mechanisms- Rao&Dukkipati
5. Theory of Machines - S.S. Rattan
6. Theory of Machines – R.K. Bansal
7. Mechanics of Machines – V. Ramamurti
8. Theory of Machines – Khurmi& Gupta
9. Theory of Machines – P.L. Ballaney
10. Theory of Machines – V. P. Singh

MATS UNIVERSITY
SEMESTER – IV
BRANCH – MECHANICAL
SUBJECT-PRODUCTION PROCESS
CODE – DP411

UNIT – I

Introduction to Manufacturing Processes:

Importance of manufacturing processes, classification, economic and technological definitions of manufacturing processes. **Foundry Pattern making** - Types, material, allowances, colour codes, core – types, materials and its properties. **Mould Making** - Types of sand moulding, design considerations, moulding machines & moulding procedure, moulding sand – types, properties, composition and applications. **Casting** - Procedure, Melting furnaces, casting defects. **Special Casting Processes** - Investment casting, centrifugal casting, shell moulding, CO2 moulding, slush casting, die casting.

UNIT – II

Welding

Principles of Welding, survey and allied processes. **Arc Welding** Power Source and Consumable, MMAW, TIG and MIG processes and their parameter selection, atomic hydrogen welding, welding of cast iron, welding electrode – types, composition, specification.

Resistance Welding Principle, equipment and processes. Thermit Welding, brazing & soldering, Internal and external welding defects, Inspection & testing of weld.

UNIT – III

Powder Metallurgy

Powder Manufacturing, compacting and sintering processes, Advantages, limitations and applications of powder metallurgy .

Manufacturing of Plastic Components

Advantages, application and principle of the following processes, extrusion, injection moulding compression moulding, transfer moulding, blow moulding .

UNIT – IV

Forging - Principle, types, tools and fixture of forging, forging dies, forging machines, forging design, drop forging die design ,upset forging die design, forging practice and process capability, forging defects, Inspection and testing of forged parts.

Extrusion

Principle, extrusion processes, process parameters, extrusion equipment, extrusion defects.

Rolling - Principle, classification of rolled products, types of rolling, rolling mill train components, roll pass design for continuous mill.

UNIT-V

Drawing

Wire drawing, tube drawing: Principle, setup, type, process capability.

Press Working - Types of presses, selection of press, components of a simple press, press working operations – shear, bending, drawing etc., types of dies, die sets, considerations in die design, scrap strip layout.

Unconventional Machining - Advantages, application and limitation, survey of Non-conventional machining processes, mechanics of metal removal, tooling, equipment, process parameters and surface finish obtained & specific application of following processes - EDM, ECM, USM, AJM, EBM and LBM.

TEXT BOOKS

1. Manufacturing Technology (Vol. – I & II) – P.N. Rao – Tata McGraw Hill Pub. Company, New Delhi
2. A Text Book of Production Technology(Manufacturing Processes) – P.C. Sharma – S. Chand and Company Ltd., New Delhi
3. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi
4. Production Technology – R.K. Jain – Khanna Publishers, New Delhi

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT-FLUID MECHANICS AND MACHINERY
CODE- DP412

UNIT I

Properties of fluid

Fluid, ideal and real fluid, properties of fluid : mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Newtonian and non-Newtonian fluids

Fluid Statics

Pressure, Pascal's law, Hydrostatic law, Pressure measurement, Hydrostatic force on submerged plane and curved surface, Buoyancy.

UNIT – II

Fluid Kinematics

Description of fluid motion, Lagrangian and Eulerian approach, Type of fluid flow, Type of flow lines-path line, streak line, stream line, stream tube. Continuity equation, acceleration of a fluid particle, motion of fluid particle along curved path, Normal and tangential acceleration, Rotational flow, Rotation and Vorticity, circulation, stream and potential function.

Fluid Dynamics

Bernoulli's equation and its practical application, Venturimeter, Orifice meter, Nozzle , Pitot tube. Impulse momentum equation, Momentum of Momentum equation. Vortex flow.

UNIT – III

Flow around submerge bodies

Force exerted by flowing fluid on a body: Drag and lift; stream lined and bluff body, Drag on sphere and cylinder,

circulation and lift on circular cylinder, lift of an air foil.

Impact of Free Jets

Impulse momentum principle, force exerted by the jet on stationary flat and curved plate, hinged plate, moving plate and moving curve vanes, jet propulsion of ship.

UNIT – IV

Impulse Turbine

Classification of turbine, impulse turbine, Pelton wheel, Construction working, work done, head efficiency and Cavitations in turbines Design aspects, governing of impulse turbine.

Reaction Turbine

Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over pelton wheel.

UNIT-V

Axial flow reaction turbine

Propeller and Kaplan turbine, bulb or tubular turbine, draft tube, specific speed, unit quantities, cavitation, degree of reaction, performance characteristics, surge tanks, governing of reaction turbine.

Centrifugal Pumps

Classification of Pumps, Centrifugal pump, Construction, working, workdone, heads, efficiencies, multistage centrifugal pump, pump in series and parallel, specific speed, characteristic, net positive suction head, cavitation.

TEXT BOOKS

1. Mechanics of Fluids by Massey BS; Van Nostrand Reinhold Co
2. Fluid Mechanics by Douglas JF, Gasiorek JM, Swaffield JP; Pitman
3. Fluid Mechanics by Streetes VL and Wylie EB; McGraw Hill Book Co
4. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som & G. Biswas – TMH
5. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd.

MATS UNIVERSITY
SEMESTER - IV
BRANCH - MECHANICAL
SUBJECT – PLANT MAINTENANCE AND SAFETY
CODE - DP413

UNIT I: Organization of Plant Engineering:

Principles of Plant management functions. Classification of maintenance work-Routine maintenance, emergency work, service work, preventive maintenance. Project work, Corrective work, Assessment of maintenance work. Performance and productivity measurement; problem solving techniques. Statistical processes. Parato chart. Manpower planning and training for maintenance and safety staff.

UNIT II: Plant Facilities and Layout Planning:

Basic Plant facilities, (a) Building: Types of Building structures, Ventilation and lighting, Roads and parking. (b) Electrical power generation, distributions, utilisation, stand by units. (c) Heating, ventilation and Air conditioning. (d) Water supply, Purification, use and disposal. (e) Sanitation. (f) Planning and estimation of auxiliary services, such as water, steam, compressed air. Layout of facilities-Types of layouts, selection of layout. Group technology aspect. P. Q. Analysis, PQRST analysis, material flow, REL charts, space requirements, space diagram. Use of computer for optimization of layouts.

UNIT III: Maintenance Management Practice:

Various types of maintenance, breakdown, preventive, periodic or predictive, condition based maintenance as predictive preventive maintenance. Online or off-line, concept of health as well as usage monitoring. Quantitative decision making for selection of maintenance system & management classification of material, MICLASS, CUSDD, Software for Classification and Coding. Maintenance problems occurring in product and process type industries and Power plants and their management.

Spare Parts Management- Simulation and Software needed for spare parts management and inventory planning.

UNIT IV; Preventive Maintenance and Life Cycle Costing:

Periodic Preventive Management - Scheduled maintenance and period for P.M. Life cycle cost taking into consideration maintenance, reliability, hazard function etc. Life cycle costing: Rigorous models, mathematical formulation etc.

UNIT V: Plant Safety issues and Energy conservation:

Plant safety-fire protection and prevention, safety against mechanical hazards, chemical hazards, accident prevention practices and codes. Pollution control-Waste disposal, existing limiting norms. Recycling of waste. Energy conservation, management and audit. Material handling equipments.

Text Books:

1. A. K. Gupta, "*Terotechnology & Reliability Engineering*", McMillan Co.
2. Sushikumar Srivastava, "*Industrial Maintenance Management*", S.Chand and Co.Ltd., New Delhi.
3. R.C. Rosaler-Handbook of Plant Engineering-McGraw Hill.ISBN 0070521646

Reference books:

1. B.Bhadury and S.K. Basu, "*Terotechnology: Reliability Engineering and Maintenance Management*", Asian Books, New Delhi 2002.
2. A. K. S. Jardine, "*Maintenance, Replacement & Reliability*" HMSO, London.
3. R.A. Collacatt, "*Mechanical fault Diagnosis and Condition Monitoring*", Chapman and Hall Ltd.ISBN 0412129302

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT-METROLOGY AND INSTRUMENTATION
CODE- DP414

UNIT – I Simple Inspection Meaning and application of inspection, daily life example of inspection, concept of inspection as applied to daily life and industries, Effect of absence of inspection in an industry, Classification of inspection function, meaning and advantages of each concept of inspection applied to metrology. Definition/ meaning of precision, its accuracy and error, Differentiation between precision measurement in industry, meaning of standard inspection and specification, relationship between cost and accuracy, Interchange ability and selective assembly. **General Measurement Concept** Limits, fits and tolerance definition, Selection of fit, calculation of fundamental deviation, limit of sizes, selection of limit of sizes, selection of limits, Tolerances and allowances.

UNIT – II Linear Measurements Standards of length, Classification and use of slip gauges, wringing process, Gauge block calibration precautions to be observed while using gauge blocks, classification of linear measuring instrument direct and indirect, Construction and working of Vernier caliper, micrometers- outside and inside and depth, vernier height gauge, dial vernier and dial height gauge identification of parts, finding least count, precautions of each type, types of errors, Dial gauge types construction, principle, accuracy and precaution to be observed in handling, field of application, 108 Comparators principle, type, working, use field of application of Mechanical, Electrical, Optical and Pneumatic comparators selection specific work , Measuring Machine-type, application limitations, working principle, Interferon meters type, working principle, and applications . **Angular Measurements** Classification- direct and indirect, Protractor- vernier and optical, universal- working use and limitation, precautions, Angle blocks-set size, accuracy, calibration, method of measuring unknown angle and checking know angle, Sine bar- common types, use in actual practice for finding out known and unknown angle, Spirit level- types, use field of application, sensitivity, Clinometers types, working principle, accuracy, Angle Dakar-type, Principle of working method, field of application.

UNIT – III Concept of squareness, flatness, Roundness, Straight edge method, light gap and feeler gauge method, Wedge method, Precision level method, Auto collimator method, squariness- - indicator method, Square tester, Auto collimator method, Determination of straightness, flatness, squariness of a given piece, Use of v- block and dial indicator for determining roundness.

Surface Roughness Definition of primary and secondary texture, Real surface, geometrical surface, effective surface, Real profile, geometrical profile, effective profile, Reference line, lay, traversing length, sampling length, mean time, Center line of profile, “M” and “S” system of surface assessment, Salient features, merits and demerits of each basic unit of indication surface roughness- CL No. R.M.S., Ten point height, Interpretation of units graphically and mathematically, Types of surface measuring instruments, Method of surface measurement stylus skid, stylus pressure, Mechanical amplification, Tomlinson Mechanical surface finish recorder working principle,

UNIT – IV Screw Thread Measurements Type of screw threads, Threads nomenclatures, Errors in screw thread pitch errors, Progressive and periodic instrument, Equipment required for measuring pitch, effective diameter and angle – procedure, advantages, limitation and

precautions of each method Limit gauges for screw thread measurement, procedure, Advantages and limitation of catch Gauge, Precautions observed while using a limit gauge.

Gear Measurements Types of gears, Gear nomenclature, Gear elements requiring measurement, Necessity of measuring gear elements accuracy, Types of gear tests, Different method of inspecting gear tooth from, Measurement of chordal thickness & constrict chord using vernier tooth caliper, Gear tooth profile check- involutes testing M/C- principle and uses, Electricity-Tests - Principle and use, Parkerson gear tester principle and use.

UNIT – V:Limit Gauges Definition of gauge and gauging, Necessity of gauging in industrial practice, Gauges types- according to use (shop, Inspection and reference gauge) type fixed limit, indicating and combination, Specific use (Screw pitch, gauge, template, feeler gauge- and their uses, application identification, selection and precautions, Working tolerance of gauges Maximum and minimum metal conditions of tolerances, Calculation maximum and minimum metal conditions from given tolerances, tolerance frames and their use, selection and specification as per IS, 2251, 3455, 3484, Wear allowances and its selection for design,

TEXT BOOKS

1. Mechanical Measurements and Control – D.S. Kumar – S.K. Kataria & Sons
2. Mechanical Measurements – G. Beckwith Thomas G. – Pearson Education

REFERENCES BOOKS

1. Measurement Systems, Application Design – E.O. Deoblein - McGraw Hill
2. Engineering Metrology – K.J. Hume - MacDonald and Compan

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT-THEORY OF MACHINE LAB
CODE- DP415

EXPERIMENTS TO BE PERFORMED

1. To find out the oscillations of simple pendulum with universal vibration apparatus.
2. To find out the oscillations of Compound pendulum with universal vibration apparatus.
3. To find out the radius of gyration of bi-filler suspension with universal vibration apparatus.
4. To find out undamped torsional vibrations of single rotor system with universal vibration apparatus..
5. To find out the frequency of damped torsional vibration of single rotor system with universal vibration vibration apparatus.
6. To measure the frequency of torsional vibrations of single rotor system with universal vibration apparatus.
7. To measure the frequency of torsional vibrations of double rotor system with universal vibration apparatus.
8. To find out free vibration of helical coiled spring with universal vibration apparatus.
9. To study forced damped vibration of a spring mass system and simple supported beam with universal vibration apparatus.
10. To find out the Gyroscopic couple and prove the Gyroscopic law with Gyroscope apparatus.
11. To find out the Power and effort of Proel, Porter & Hartnell Governor with Governor Apparatus.
12. To find out the critical speed for different diameters of shaft by whirling of shaft apparatus.
13. To verify the static and dynamic balancing for different planes and masses by balancing apparatus.
14. To study about the different types of gear and gear train

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Universal Vibration Apparatus
2. Whirling Of Shaft Apparatus.
3. Balancing Apparatus (Both Static & Dynamic)
4. Epicyclic Gear Train And Holding Torque Apparatus
5. Gyroscope apparatus
6. Governor apparatus with differential attachments

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT-METROLOGY AND INSTRUMENTATION LAB
CODE- DP416

LIST OF PRACTICALS:

1. Measurement of a gap by means of slip gauges.
2. Measurement of diameter and height of a circular spigot.
3. Comparing methods of internal Measurement.
4. Comparing methods of external Measurement
5. Comparing methods of angular Measurement
6. Checking a sine bar.
7. Comparing methods of external, taper Measurement
8. Comparing methods of internal, taper Measurement
9. Given a set of slip gauges, straightedge to be tested and surface plat, the student will test the straightness error in the given straightedge.
10. Given the surface plate, spirit level and straight edge the student will test the flatness of surface plate in the laboratory.
11. Check an engineer's square in the laboratory provided with parallel set, slip gauges and plate and determine the square-ness error.
12. Determination of effective diameter of a screw with the help of screw thread
13. Determination of core diameter of an internal screw gauge with the help of pair of precision wedge parallels and outside micrometer.
14. setting of a roller type of adjustable thread gauge and inspection of given screw of given nominal size.

LIST OF APPARATUS:

1. Vernier calliper.
2. Screw gauge.
3. Sine bar.

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT-FLUID MECHANICS AND MACHINERY LAB
CODE- DP417

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)

1. To determine the meta-centric height of a ship model.
2. To verify Bernoulli's Theorem.
3. To verify Impulse Momentum Principle.
4. To calibrate a Venturimeter and study the variation of coefficient of discharge.
5. To calibrate an orifice-meter.
6. Performance characteristics of Pelton wheel turbine.
7. Performance characteristics of Francis turbine.
8. Performance characteristics of Kaplan turbine.
9. Performance characteristics of variable speed centrifugal pump.
10. Performance characteristics of rated speed centrifugal pump.
11. Performance characteristics of multistage centrifugal pump.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Apparatus for determination of metacentric height
2. Bernoulli's apparatus
3. Impact of jet apparatus
4. Venturimeter
5. Orificemeter
6. Pelton Wheel Turbine
7. Francis Turbine Test Rig
8. Kaplan Turbine Test Rig
9. Variable Speed Centrifugal Pump Test Rig
10. Rated Speed Centrifugal Pump Test Rig
11. Multi Stage Centrifugal Pump Test Rig

MATS UNIVERSITY
SEMESTER –IV
BRANCH – MECHANICAL
SUBJECT-COMPUTER AIDED MACHINE DRAWING LAB
CODE- DP418

EXPERIMENTS TO BE PERFORMED

CAD

1. Introduction & different features of the CAD Software
 2. 2-D Drafting
 3. 3-D Modeling
 4. 3-D Advanced Modeling
 5. Assembly modeling
 6. Feature Modification and Manipulation
 7. Detailing
 8. Sheet Metal Operations
 9. Surface Modeling
 10. One Dimensional problems of Finite Element Method.
- (These exercises may be performed by any of the following Advanced CAD Software)*

CAM

1. To prepare part programming for plain turning operation.
2. To prepare part programming for turning operation in absolute mode.
3. To prepare part program in inch mode for plain turning operation.
4. To prepare part program for taper turning operation.
5. To prepare part program for turning operations using turning cycle.
6. To prepare part program for threading operation.
7. To prepare part program for slot milling operation.
8. To prepare part program for gear cutting operation.
9. To prepare part program for gear cutting using mill cycle.
10. To prepare part program for drilling operation.
11. To prepare part program for multiple drilling operation in Z-axis.
12. To prepare part program for multiple drilling in X-axis.
13. To prepare part program for multiple drilling in X and Z axis using drilling cycle.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Computer Numerically Control Lathe Trainer
2. P-IV (IBM) 2.6 GHz, 80 GB HDD, 256/512 SD RAM (As Compatible with CAD Software) 52 X CD RW, 1.44 MB
FDD, 17" Colour Monitor, Laser Scroll Mouse
3. Software – Pro-E, Solid-work, CATIA, ANSYS
4. CNC Controlled Milling Machine
5. CNC Controlled Drilling Machine