

Theory of Machines and Mechanisms [TMM]

S.Y. Diploma : Sem IV
[ME/PT/PG/AE/MH]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	25@
Class Test (Two Test)	–	25 (each)

@ Internal Assessment

SYLLABUS

1. Fundamentals and types of Mechanisms

Kinematics of Machines : Definition of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic Pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure.

Inversions of Kinematic Chain

- Inversion of four bar chain, coupled wheels of Locomotive & Pentograph.
- Inversion of Single Slider Crank chain : Rotary I.C. Engines mechanism, Whitworth quick return mechanism, Crank and Slotted lever quick return mechanism.
- Inversion of Double Slider Crank Chain : Scotch Yoke Mechanism & Oldham's Coupling.

Common Mechanisms

- Bicycle free wheel Sprocket mechanism.
- Geneva Mechanism.
- Ackerman's Steering gear mechanism.
- Foot operated air pump mechanism.

2. Velocity and Acceleration in Mechanism

Concept of relative velocity and relative acceleration of a point on link, angular velocity and angular acceleration, inter- relation between linear and angular velocity and acceleration.

Analytical method [no derivation] and Klein's construction to determine velocity and acceleration of different links in single slider crank mechanism.

Drawing of velocity and acceleration diagram of a given configuration, diagrams of simple mechanisms. Determination of velocity and acceleration of a point on link by relative velocity method [Excluding coriollis components of acceleration].

3. Cams and Followers

- Concept, definition and application of Cams and Followers.
- Classification of Cams and Followers.
- Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation.
- Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method).

4. Power Transmission

- **Belt Drives** : flat belt, V- belt & its applications, material for flat and V-belt, angle of lap, belt length. Slip and creep. Determination of velocity ratio, ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission(Simple numericals).
- **Chain Drives** : Advantages & Disadvantages, Selection of Chain & Sprocket wheels, methods of lubrication.
- **Gear Drives** : Spur gear terminology, types of gears and gear trains, their selection for different application, train value & Velocity ratio for compound, reverted and simple epicyclic gear train, methods of lubrication, Law of gearing.
- **Rope Drives** : Types, applications, advantages & limitations of Steel ropes.

5. Flywheel and Governors

- **Flywheel** : Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-S IC Engine (no Numericals). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance.
- **Governors** : Types, concept, function and application & Terminology of Governors.
- Comparison between Flywheel and Governor.

6. Brakes, Dynamometers, Clutches & Bearings

Brakes and Dyanometers

- Function of brakes and dynamometer, types of brakes and Dynamometers, comparison between brakes and dynamometer.
- Construction and working of (i) shoe brake, (ii) Band Brake, (iii) Internal expanding shoe brake and (iv) Disc Brake.
- Concept of Self Locking & Self energizing brakes.
- Numerical problems to find braking force and braking torque for shoe & band brake.
- Construction and working of (i) Rope Brake Dynamometer, (ii) Hydraulic Dynamometer, (iii) Eddy current Dynamometer.

Clutches and Bearing

- **Clutches** – Uniform pressure and Uniform Wear theories.
- Function of Clutch and its application, Construction and working of (i) Single plate clutch, (ii) Multiplate clutch, (iii) Centrifugal Clutch, (iv) Cone clutch and (v) Diaphragm clutch. (Simple numericals on single and Multiplate clutch).
- **Bearings** : (i) Simple Pivot, (ii) Collar Bearing, (iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numericals.

7. Balancing & Vibrations

- Concept of balancing. Balancing of single rotating mass. Graphical method for balancing of several masses revolving in same plane.
- Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies.

References :

1. Theory of machines (*Kurmi Gupta*), Eurasia Publishing House Pvt. Ltd. (2006 edition)
2. Theory of machine (*S. S. Rattan*), McGraw Hill Companies (2nd Edition)
3. Theory of machines (*P. L. Ballaney*), Khanna Publication
4. Theory of machines (*Timo Shenko*), Wiley Eastern
5. Theory of machines (*Jagdishlal*), Bombay Metro – Politan book Ltd.
6. Theory of machines (*Ghosh – Mallik*), Affiliated East west press
7. Theory of machines (*Beven T.*), CBS Publication
8. Theory of machines (*J. E. Shigley*), McGraw Hill



Fundamentals of Electronics [FEL]

S.Y. Diploma : Sem IV
[ME/PT/PG/MH]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	50@
Oral Exam	–	–
Term Work	–	–
Class Test (Two Test)	–	25 (each)

@ Internal Assessment

SYLLABUS

1. Electronic Devices

Comparison of conductor and insulators Intrinsic and Extrinsic semiconductors. Introduction to electronic devices, their symbols, principle of working and testing procedure - Diode, Zener diode, Power diode, Varactor diode, Bipolar Junction Transistor (BJT), Field Effect Transistor(FET) - JFET & MOSFET, Uni-j unction Transistor(UJT), power devices — DIAC, TRIAC, SCR, Photo devices-, LDR, Photo diode, Photo transistor, LED & LED display (7 segment), Liquid crystal display(LCD), opto — coupler, therm isterNTC, PTC.

2. Power Supply

Circuit diagram and operation- Half wave, full wave & bridge rectifier. Comparison of efficiency and ripple f of rectifiers Filters - L, C, L-C, n filter
Zener diode as voltage regulator in line and load regulation.
Regulator ICs 78XX series 723
Block diagram of power supply
Concept of unregulated power supply, regulated power supply- line regulation & load regulation.
Principle of operation, block diagram and application of shunt regulated power supply, series regulated power supply, switch mode power supply (SMPS), 3 pin 1C regulated, IC 723 adjustable power supply.
Block diagram of UPS, Concept of online and off line UPS.
Concept of constant current limiting and fold back current limiting, concept of constant voltage source, constant current source.

3. Transistor

Transistor as a switch and amplifier, single stage transistor amplifier CB, CE and CC configuration and their applications, RC coupled and direct coupled amplifier, their frequency response and application.
Power amplifier – class A, class B, class C, class AB, their comparison on operating point, conduction cycle, efficiency, application.(No circuits expected).
Oscillator – Requirement of oscillator circuit, Barkhausen's criteria of oscillator, circuit diagram and its application-. Phase shift oscillator, Hartley oscillator, Colpitts oscillator, Crystal oscillator.

4. OP Amp

Block diagram, configurations and use of op amp as - Inverting, Non-inverting, Summing, Voltage to current converter, current to voltage converter, differentiator, Comparator, Wien bridge oscillator, Schmitt's trigger, Instrument amplifier

5. Digital Electronics

Number system : Decimal, Binary, Hexadecimal, BCD, Decimal to binary conversion, Decimal - Hexadecimal conversion.

Study of logic gates, Symbol, truth table and IC numbers - NOT, AND, OR, NAND, NOR, XOR, XNOR and NAND as universal gate.

Flip Flops : Block diagram of flip flop, RS flip flop, D flip flop Toggle , JK flip flop, Master Slave JK flip flop, Clocked flip flop – level triggered and edge triggered , Application of flip flop – Frequency divider, Ring counter, Shift register. Seven segment driving circuit, Encoder, Decoder, Multiplexer, De multiplier. (1_:2,1:4_only)

6. IC 555

Block diagram, Multi vibrator circuit diagram and working

for Mono stable, Bi stable and Astable Multivibrator, Analog to Digital Converters, Digital to Analog converter A..DCTypes:staircase ramp method,sucessive approximation iethod slope m slope method. DAC Types:Binary weighted resistor method,R-2R ladder network method.

Block diagram and. working of— Welding control circuits — sequential timer Temperature control circuits using SCR,FWR Speed control circuits Level control circuit using variable capacitor and potentiometer.

References Books :

1. Principles of Electronics (*V. K. Mehta*), S. Chand & Company Ltd. New Delhi
2. Electronic Principles (*Paul Malvino*), Tata McGraw Hill Publishers
3. Electronic Devices & Components' (*A. Mottershead*), Prentice Hall of India
4. Modern Digital Electronics (*R. P. Jain*), Tata McGraw Hill Publishers
5. Basic Electronics (*Grob Bernard*), Tata McGraw Hill Publishers
6. Basic Electronics – a Text Lab Manual (*Paul B. ZBar, Albert P. Malvino, Michael A. Miller*), Tata McGraw Hill Publishers
7. Industrial Electronics – a Text Lab Manual (*Paul B. ZBar*), Tata McGraw Hill Publishers



Production Processes [PPO]

S.Y. Diploma : Sem IV
[ME/PT/PG/MH]

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SYLLABUS

1. Turning

Lathe : Angle calculations for taper turning. Cutting tool nomenclature and tool signature. Cutting parameters and machining calculation

CNC Lathe : Introduction, classification, advantages, positioning system, Constructional features. Part programming: programming format, word, statement, block, Preparatory and miscellaneous code, Fixed cycles in programming – canned cycle, do – loop, subroutine.

2. Drilling

Twist drill nomenclature.

Cutting parameters , machining time calculation, Deep hole drilling.

3. Milling and gear cutting

Milling : Cutting parameters, machining time calculation, Milling operations - plain milling, side and face milling, form milling, gang milling, end milling, face milling, T- slot milling, slitting.

Gear cutting : Gear cutting on milling machine -Dividing head and Indexing methods.

Gear hobbing, Principle of operation, Advantages And limitations.

Hobbing techniques - climb and conventional, Gear shaping - Principle of operation, advantages, disadvantages, Gear finishing processes - Gear shaving , Gear grinding, Gear burnishing, gear lapping

4. Grinding

Classification of machines,

Grinding wheel composition, types and shapes, Designation. Types of Grinding operations.

5. Super Finishing Processes

Honing, Lapping, Burnishing, Buffing and polishing.

6. Plastic Moulding

Types of plastic, Compression molding, Transfer moulding, Injection moulding, blow molding, vacuum forming, extrusion, calendaring, rotational moulding.

References Books :

1. Elements of workshop Technology – Volume I & II (*S. K. Hajra Chaudary, Bose, Roy*), Media Promoters and Publishers Limited
2. Production Technology Volume – I & II (*O. P. Khanna & Lal*), Dhanpat Rai Publications
3. Workshop Technology – Volume – I, II, III (*W. A. J. Chapman, S. J. Martin*), Viva Books (p) Ltd.
4. A text book of Foundry Tech. (*O. P. Khanna*), Dhanpat Rai Publications.
5. Production Technology (*R. B. Gupta*), Satya Prakashan New Delhi
6. Workshop Technology Volume – I & II (*H. S. Bawa*), Tata McGraw–Hill
7. Introduction to Manufacturing Processes (*John A. Schey*), McGraw–Hill
8. Manufacturing Technology (*M. Adithan A. B. Gupta*), New age International
9. CNC machines (*Pabla B. S. M. Adithan*), New age international limited.
10. Fundamental of metal cutting and machine tools (*B. L. Juneja*), New age international limited
11. Technology of Machine Tools (*Steve Krar, Albert Check*), McGraw–Hill International
12. CAD/CAM Principles and Applications (*P. N. Rao*), Tata McGraw–Hill
13. Manufacturing Technology Metal Cutting & Machine tools (*P. N. Rao*), Tata McGraw Hill



Thermal Engineering [TEG]

S.Y. Diploma : Sem IV
[ME/MH]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
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@ Internal Assessment, # External Assessment

SYLLABUS

1. Sources of energy

- (i) Brief description of energy sources :
Classification of energy sources.
Renewable, Non-Renewable.
- (ii) Fossil fuels, including CNG, LPG.
- (iii) Solar :
 - (a) Flat plate and concentrating collectors & its application.
 - (b) Solar Water Heater.
 - (c) Photovoltaic Cell, Solar Distillation.
- (iv) Wind, Tidal, Geothermal.
- (v) Biogas, Biomass, Bio-diesel.
- (vi) Hydraulic, Nuclear.
- (vii) Fuel cell - list of fuel cells.

2. Fundamentals of Thermodynamics

Concepts of pure substance, types of systems, properties of systems, Extensive and Intensive properties with units and conversion like P, V, ρ and temperature. Point function and path function.

Work and Energy : Thermodynamic definition of work, heat, difference between heat and work, P.E., K.E, Internal Energy, Flow work, concepts of enthalpy, entropy.

Laws of Thermodynamic : Zeroth Law, Temperature measurement, principle of energy conservation, irreversibility, Second Law of Thermodynamics, Kelvin Plank, Clausius statements and their equivalence, Concept of perpetual motion machine 1 and 2.

Application of Thermodynamic laws : Steady Flow Energy equation and its application to open system like boiler, engine, nozzle, turbine, compressor & condenser.

Application of Second law to Heat Engine, Heat Pump and Refrigerator.

3. Ideal Gases

Concept of Ideal gas, Charle's law, Boyle's law, Avogadro's law, equation of state, Characteristic gas constant and universal gas constant.

Ideal gas processes : Isobaric, Isochoric, Isothermal, Adiabatic, Polytropic, Isentropic with representation of the processes on P-V and T-S diagram (only simple numericals).

4. Steam and Steam Boiler

Generation of steam at constant pressure with representation on various charts such as T-H, T-S, H-S, P-H. Properties of steam and use of steam table, Quality of steam and its determination with Separating, throttling and combined Separating and throttling calorimeter (no numerical).

Vapour process : Constant pressure, constant volume, constant enthalpy, constant entropy (numericals using steam table and Mollier chart), Rankine Cycle.

Steam Boilers : Classification of boilers, Construction and working of Cochran, Babcock and Wilcox, La-mont and Loeffler boiler. Boiler draught natural and Mechanical.
Boiler mounting and accessories [to be covered in practical].

5. Steam Turbines and Condensers

Steam nozzle : Continuity equation, types of nozzles, concept of Mach number, critical pressure, application of steam nozzles.

Steam turbine : Classification of turbines, Construction and working of Impulse and Reaction turbine. Compounding of turbines, Regenerative feed heating, bleeding of steam, nozzle control governing (no velocity diagrams and numerical).

Steam condenser : Dalton's law of partial pressure, function and classification of condensers, construction and working of surface condensers.

Sources of air leakage, concept of condenser efficiency, vacuum efficiency (no numerical).

Cooling Towers : Force draught, natural draught and induced draught.

6. Heat Transfer

Modes of heat transfer : Conduction, convection and radiation.

Conduction by heat transfer : Fourier's law, thermal conductivity, conduction through cylinder, thermal resistance, composite walls, combined conduction and convection (Simple numerical)

Heat transfer by Radiation : Thermal Radiation, Absorptivity, Transmissivity, Reflectivity, Emmissivity, black and gray bodies, Stefan-Boltzman law.

Heat Exchangers : Shell and tube, plate type, multiphase heat exchangers. Materials Used and applications of heat exchangers.

References Books :

1. A Course in Thermal Engineering (*Domkundwar V. M.*), Dhanpat Rai & Co.
2. A Course in Thermal Engineering (*P. L. Ballaney*), Khanna Publishers
3. A text book of Thermal Engineering (*R. S. Khurmi*), S. Chand & Co. Ltd.
4. A Course in Thermal Engineering (*R. K. Rajput*), Laxmi Publication, Delhi.
5. Heat Engine Vol. – I & II (*Patel and Karmchandani*), Acharya Publication
6. Engineering Thermodynamics (*P. K. Nag*), Tata McGraw Hill
7. Thermal Engineering (*B. K. Sarkar*), Tata McGraw Hill



Fluid Mechanics & Machinery [FMM]

S.Y. Diploma : Sem IV
[ME/PT/PG/MH]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
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@ Internal Assessment, # External Assessment

SYLLABUS

1. Properties of fluid

- Density, Specific gravity, Specific Weight, Specific Volume.
- Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity.
- Vapour Pressure, Compressibility.

2. Fluid Pressure & Pressure Measurement

- Fluid pressure, Pressure head, Pressure intensity.
- Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure.
- Simple and differential manometers, Bourden pressure gauge.
- Total pressure, center of pressure of plane, regular surfaces immersed in liquid. Horizontally, vertically and inclined.

Note : Numericals on Manometers, Total Pressure & Centre of pressure.

3. Fluid Flow

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

Note : Numericals on Venturimeter, orifice meter, pitot tube.

4. Flow Through Pipes

- Laws of fluid friction (laminar and turbulent).
- Darcy's equation and Chezy's equation for frictional losses.
- Minor losses in pipes.
- Hydraulic gradient and total gradient line.
- Hydraulic power transmission through pipe.

Note : Numericals to estimate major and minor losses.

5. Impact of jet

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

Note : Simple Numericals on work done and efficiency.

6. Hydraulic Turbines

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

7. A. Centrifugal Pumps

- Construction, principle of working and applications.
- Types of casings and impellers.
- Concept of multistage.
- Priming and its methods, Cavitation.
- Manometric head, Work done, Manometric efficiency, Overall efficiency, NPSH.
- Performance Characteristics of Centrifugal pumps.
- Trouble Shooting.
- Construction, working and applications of submersible, jet pump.

Note : Numericals on calculations of overall efficiency and power required to drive pumps.

B. Reciprocating Pump

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

Note : No Derivations and Numericals on reciprocating pumps.

References Books :

1. Hydraulic, fluid mechanics & fluid machines (*Ramamrutham S*), Dhanpat Rai and Sons New Delhi
2. Hydraulics and fluid mechanics including Hydraulic machines (*Modi P. N. and Seth S. M.*), Standard Book House, New Delhi
3. Fluid Mechanics (*Streeter Victor, Bedford K. W., Wylie E. B.*), McGraw Hill Int.
4. One Thousand Solved Problems in Fluid Mechanics (*K. Subramanya*), Tata MaGraw Hill
5. Pump manufactures' catalogs such as Kirloskar Brothers, KSB, Kishor pumps etc.

