

GANPAT UNIVERSITY
B. TECH. SEM. VI – MECHANICAL ENGINEERING
ME - 601 CONTROL SYSTEM ENGINEERING

Teaching scheme (Hrs)			Examination scheme (Marks)							
			Theory				Practical			Grant Total
L	P	Total	Int. Asses	Sem. End		Total	Internal Asses	Sem. End	Total	
				Marks	Hrs					
04	00	04	30	70	3	100	00	00	00	100

ME 601 : CONTROL SYSTEM ENGINEERING

1. Basic Control System :

Open loop and closed loop control systems, Concept of feedback, Advantages and disadvantages of both types of systems, Classification of control systems. System differential equation of electrical, mechanical, thermal, hydraulic and electromechanical network, analogy.

2. MATHEMATICAL MODELING OF PHYSICAL SYSTEMS:

Definition, Laplace Transform, Laplace Transform of standard functions, Inverse Laplace Transform, Partial fraction method. Definition of Transform function, Impulse response and Transform functions, Poles & Zeros of Transfer function, Mathematical modeling of physical systems-physical model and mathematical model - modeling of mechanical systems –Translation motion and Rotational motion-Analogous electrical systems, Force voltage analogy, Force current analogy, Advantages of analogous systems.

3. TIME DOMAIN ANALYSIS:

Block diagram fundamentals, basic rules for block diagram reduction, Introduction to signal flow graph algebra, Node elimination in signal flow graph, Mason's Gain formula, Time domain specifications, Standard test inputs, Step, Ramp, Parabolic and Impulse response, rise time, delay time, overshoot, Steady state error, Error Coefficients.

4. FUZZY LOGIC: Concept, Basic motion

5. STABILITY OF CONTROL SYSTEMS:

Characteristics equation of a control system, Location of roots of characteristics equation on s-plane and their effects on the response of the system, Routh-Hurwitz Stability Criterion, Special cases in RH Tabulation, Determination of the range of K for stable operation.

6. Hydraulic and Pneumatic System :

Characteristic of hydraulic components control valves, sources of hydraulic power hydraulic meters, pumps and transmission, elements of circuit design, Accumulation control circuit such as position control and speed control circuit.

Pneumatic systems pneumatic power supply, Amplifiers with different controlling actions, Pneumatic valves and cylinders, theory of four way and pilot valves.

7. Electrical Systems :

Speed control of D.C. motors, Remote center positional serve mechanism (including effect of gearing between motor and load).

8. Control Components :

Pneumatic relays, control mechanisms for liquid level, boiler feed control, pressure regulation, throttle valve, temperature regulations and industrial process regulation.

9. FREQUENCY DOMAIN ANALYSIS :

Sinusoidal response of linear control system, Magnitude and phase curve, Polar plot, Nyquist plot and stability criterion, Relative stability, margin and phase margin, Bode plots, determination of absolute and relative stability from Bode plot.

10. ROOT LOCUS PLOT :

Angle and Magnitude criterion for plotting root locus, General rules for plotting root locus, Prediction of system response from root locus plot, Effect of addition of pole or zero on root locus.

REFERENCE BOOKS :

1. Modern Control Engineering {By KATSUHIKO OGATA.}
Prentice – Hall of India.
2. Control Systems - Principles and Design, {By M. Gopal }
Prentice Hall of India
3. Automatic Control Systems - seventh Edition {By Benjamin C Kao}
Tata McGraw Hill
4. Automatic Control Systems {By Verma }
5. Industrial Control & Instrumentation { By W. Bolton }
University Press(I) Ltd ,Hyderabad.

GANPAT UNIVERSITY
B.TECH. SEM. VI – MECHANICAL ENGINEERING
ME- 602 MECHANICAL MEASUREMENT AND METROLOGY

Teaching scheme (Hrs)			<i>Examination scheme (Marks)</i>							
			Theory				Practical			Grand Total
L	P	Total	Internal Asses.	Sem End		Total	Internal Asses.	Sem. End	Total	
				Marks	Hrs					
4	2	6	30	70	3	100	25	25	50	150

METROLOGY

- Standards of measurements, sources of error on measurements, limits, fits, tolerances and allowances, IS for limits and fits.
- Methods for measuring lengths, diameter inside a deep hole, small inside diameters, angles, profiles and positions, measurements of flatness, squareness, parallelism and alignment deflection measurement, linear transverse and torsional.
- Gauges including their design IS for plug & ring gauges, Interchangeable manufacturing.
- Amplifying devices and comparators.
- Surface assignment.
- Gear measurement.
- Screw thread measurement.

MECHANICAL MEASUREMENT

- Motion Measurement:** Measurement of displacement, velocity, acceleration and vibrations by potentiometer, strain gauges, seismic pick ups, velocity pickups and acceleration pickups, calibration of pickups.
- Force :** Torque and shaft power measurement, Basic method of force measurements, elastic force transducers, torque measurement on rotating shaft, shaft power measurement.
- Pressure measurement :** Basic method of pressure measurement, dead weight gauges and manometers, elastic transducers and force balance transducer.
- Flow measurement :** Gross flow rate measuring meters, constants area, variable pressure drop meters (obstruction meters) constant pressure drop variable arc meters (Rotameter), local flow velocity magnitude and direction meters, pitostatic tube and vawtube, Hotwire anemometer velometer.
- Temperature measurement :** Measurement of temperature by liquid – in – glass thermometers, pressure thermometers, thermocouples, their calibration, resistance thermometer, bimetallic thermometer, thermistors, radiation and optical pyrometers.

TERM WORK : The term work shall be based on the experimental work on the topic mentioned above.

PRACTICAL/ORAL : The candidate shall be examined on the cases of above term-work.

TEXT BOOKS :

1. A Text Book of Engineering Metrology – By I.C. Gupta
2. A Text Book of Engineering Metrology – By R.K. Jain
3. Mechanical Measurement & Control – By D.S. Kumar

REFERENCE BOOKS :

1. Dimensional Metrology – By Khare & Vajpayee
2. Instrumentation – By N. Chaudhary
3. Engineering Metrology – By Kumar
4. I.S. 919 Recommendation for limits and fits for engg.,
5. Mechanical Measurements – By Doebelin
6. Metrology for Engineers – By Galyer & Shotbolt (Elbs)
7. Engineering Metrology – By K.J. Hume

GANPAT UNIVERSITY
B.TECH. SEM. VI – MECHANICAL ENGINEERING
ME – 603 HEAT AND MASS TRANSFER

Teaching scheme (Hrs)			Examination scheme (Marks)							
			Theory				Practical			Grand Total
L	P	Total	Internal Asses.	Sem End		Total	Internal Asses.	Sem. End	Total	
				Marks	Hrs					
4	2	6	30	70	3	100	25	25	50	150

- 1. Introduction:** Modes of heat transfer, Conduction, Convection and Radiation.
- 2. Conduction:** Fourier's law. General Three-dimensional heat conduction equation in Cartesian, cylindrical and spherical co-ordinates. One dimensional steady conduction through plane wall, cylinder and sphere, dependence of thermal conductivity of gases, liquids, metals, refractory material and humidity, Temperature distribution and heat flow in steady state through plane, cylindrical and spherical walls with constant and variable thermal conductivity, composite walls, Electrical analogy. Heat transfer from fins of uniform cross section. One dimensional unsteady state heat conduction.
- 3. Convection:** Free and Forced convection.
 Forced Convection: Energy integral equation of the boundary layer on a Flat plate and integral solution for evaluation of heat transfer from a fluid Friction and heat transfer; Similarity conditions in heat transfer processes,
 Dimensional analysis. Free Convection from a vertical flat plate, Grashoff number. Empirical Relations and their use. Fundamentals of boiling heat transfer.
- 4. Radiation:** Thermal radiation, monochromatic and total emissive power.
 Basic laws of radiation. Radiation shape factors, black and grey surfaces, Heat transfer in presence of re-radiating surfaces. Effect of radiation Shields.
- 5. Heat Exchangers:** Basic types of heat exchangers, fouling factors, LMTD; Effectiveness - NTU methods of design, comparison and selection.
- 6. Mass transfer:** Fick's law, equimolar diffusion of vapours through a Stagnant medium, similarity between heat and mass transfer, Heat and Mass transfer in humidification and dehumidification, application to Engineering problems.

- Term work: -
The term work shall be based on experimental and analytical work on topics mentioned above
- Practical & Oral: -
The candidate shall be examined orally / practically on the base of above term work.

BOOKS:

1. D.S. Kumar, Heat and Mass Transfer, Dhanpat Rai Publication.

REFERENCE BOOKS:

1. S.P. Sukhatme, Heat Transfer, Universities Press (India), (1996).
2. J.P. Holman, Heat Transfer, McGraw Hill Book Co., (1992).
3. Eckert and Drake, Heat and Mass Transfer, McGraw Hill, (1960).

GANPAT UNIVERSITY
B.TECH. SEM. VI – MECHANICAL ENGINEERING
ME – 604 POWER PLANT ENGINEERING

Teaching scheme (Hrs)			Examination scheme (Marks)							
			Theory				Practical			
L	P	Total	Internal Asses.	Sem End		Total	Internal Asses.	Sem. End	Total	Grand Total
				Marks	Hrs					
4	2	6	30	70	3	100	25	25	50	150

1. Modern Thermal Power Station and High Pressure Boilers:

Layout of Modern Thermal Power Station, Coal and ash circuit, Air and gas circuit, Water and steam Circuit, Cooling water circuit of Thermal Power Plant, Methods of water circulation – Furnace walls, furnace bottom. Description and working of Lamount, Benson, Loeffeler, Schmidt-Hartmann, Velox, Super-critical and super charged boilers.

2. Fuel and Ash Handling:

Fuels for thermal power plant, storing of fuel at plant site, Dead and Live storage, out plant and in plant handling of coal, unloading of coal, preparation and transfer of coal, different types of conveyors used, storing procedure, pulverized fuel handling systems, pulverizing mills, Ash handling systems – Mechanical, hydraulic, pneumatic and steam ash handling.

3. Fuel Feeding and Burning:

Different types of Liquid fuel burners such as evaporation type, rotating type, re-circulating type, and atomizing type, burners, pulverized fuel burners such as long flame, U – flame, stream lined, short flame, turbulent tangential, cyclone burners.

4. Pollution and its control:

Air pollution by thermal power plants, different pollutant and their effects, control of particulates cyclone & electromagnetic precipitators, control of So₂, No_x, Fluidised bed combustion system, Control of atmospheric pollution, Noise pollution and its control.

5. Condensers, Cooling Tower and Heat Exchangers in Boilers:

Jet and Surface Condensers, Air leakages in condensers, Vacuum efficiency, Condenser water cooling systems, Various water cooling methods, Performance of condensers and cooling towers, Condensate pump, Principle of operation of economizers, air pre-heaters, super heaters, attemperator, and reheaters.

6. Feed Water treatment:

Different types of impurities in water, Effects of impurities, different methods of water treatment, internal boiler water treatment, External water treatment system,

Sedimentation, Filtration, Removal of dissolved gases, Removal of solids, Hot – lime soda process, zeolite process catexer-nexer (Dimineralizing) process, and evaporating process.

7. Combined Cycle Co-generation Power Plant:

Definition of combined cycle and cogeneration power plants, their layout and principle of working, advantages over conventional gas turbine and steam turbine power plants, calculation of efficiency.

8. Nuclear Power Plant:

Principles of Nuclear Energy, types of reactors, fuels used, waste disposal, Nuclear Power Plants, typicality of nuclear turbines and comparison with working of conventional steam turbines.

- **Term work:** -

The term work shall be based on experimental and analytical work on topics mentioned above

- **Practical & Oral:** -

The candidate shall be examined orally / practically on the base of above term work.

BOOKS:

1. Power Plant Engg., By - (Domkundwar and Arora)
2. Power Plant Engg., By - (P.C. Sharma)
3. Power Plant Engg., By - (G.D. Rai)

REFERENCE BOOKS :

1. Power Plant Engineering By – R. Yadav

GANPAT UNIVERSITY
B. TECH. SEM. VI – MECHANICAL ENGINEERING
ME - 605 DESIGN OF MACHINE ELEMENTS

Teaching Scheme (Hrs)			Examination Scheme							
			Theory				Practical			Grand Total
L	P	Total	Internal Asses.	Sem. End		Total	Internal Asses.	Sem End	Total	
				Marks	Hrs					
4	2	6	30	70	3	100	25	25	50	150

1. Manufacturing consideration in design:

Manufacturing consideration for casting, welding, forging, hot and cold working and machining. Assembly considerations in design. Design for creep – thermal considerations and wear considerations. Human considerations in design.

2. Selection of Materials for various Components: such as Shaft, Gear, Key, Spring, coupling, clutch, break etc

3. Standardization:

Utility of Standardization, preferred numbers, standard series, derived series of preferred number, progress ratio for derived series, applications.

4. Design of welded joints:

Weld design for fillet joints, lap joints, butt joints and eccentrically loaded welded joints.

5. Design for strength and rigidity:

Design of shaft based on rigidity. Hertz contact stresses and its applications in design.

6. Fatigue loading:

Completely reversed or cyclic stresses; stress v/s cycle (S-N) curves; fatigue and endurance limit; effect of surface finish, size and loading on endurance strength; Finite and infinite life; design for finite and infinite life; stress concentration, notch sensitivity and fatigue stress concentration factor; factor of safety for fatigue loading; Gerber, Goodman and Soderberg criteria for design of parts subjected to variable loading; Combined variable normal and shear stresses; applications of fatigue loading for design of shafts, axles etc.

7. Design of pressure vessels:

Classification of pressure vessels; design of thin cylindrical and spherical shells subjected to internal pressure, design of thick cylindrical shell subjected to internal and external pressure, compound cylinders subjected to internal and external pressure. Design of interference joints, press / shrink fitted assemblies, Design of cylinder covers, cover plates, pipes, pipe flanges for pipe joints.

8. Belt and chain drives:

Types of belt drives, selection of belt drives, type of belts, materials for belt and their properties, velocity ratio, center distance and length of belt for various types of belt drives, power transmitted by flat and V belts drives, design of belt drives, selection of flat and V belts using manufacturers catalogues. Design of flat and V belt pulleys. Types of chains used for power transmission, selection of standard roller, bush chains and sprockets for power transmission by chain drive using standard data. Stresses in the elements of chain drive.

9. Design of clutches:

Positive clutches, friction clutches, design of cone, single plate, multiple plate and centrifugal clutches, application of friction clutches in automotive and industrial machinery.

10. Design of brakes:

Design of band brake, external and internal shoe breaks internal expanding shoe brakes, design of disc brakes, and applications of brakes in automotive and industrial machinery.

TERM WORK:

1. Exercise on material selection of various machine elements
2. Preparation of design report consisting of one of the following problems along with drawing (parts and assembly).
 - Spring loaded, lever loaded, dead weight safety valve.
 - Steam stop valve
 - Brakes – external shoe brake, internal expanding shoe brakes.
 - Clutches–cone, disc, single and multiple plate and centrifugal clutches.
 - Hydraulic press.
 - Power screw applications – such as fly press, screw press etc.
 - Another topic covered in above topics.
3. Preparation of design report for at least ten minor problems and may be solved by computer programme.

Practical / Oral: The candidate shall be examined on the basis of term-work.

Books :

1. Design Of Machine Elements by V B Bhandari., Tata McGraw Hill Pub
2. Machine Design by Sharma & Agrawal., S.K.Kataria Pub.
3. Mechanical Engineering Design by Dr. Sadhusingh., Khanna Pub.
4. Mechanical Engineering Design by Joseph Shiglay, Mc-Graw Hill
5. Elements Of Machine Design by Pandya and Shah, Charotar Publishing House

6. Machine Design Vol. I & II by Patel, Pandya, Singh & Rajput., C.Jamnadas & Co
7. Machine Design by R K Jain, Khanna Pub.
8. Design Of Machine Elements Vol. II& III by Farazdak Haideri, Nirali Prakashan,Pune
9. P S G Data Book.