

COURSE CODE:	<i>MCE 507</i>
COURSE TITLE:	<i>Machine Design II</i>
NUMBER OF UNITS:	<i>3 Units</i>
COURSE DURATION:	<i>6 hours (Three hours lecture, three hours practical) per week</i>

COURSE DETAILS:

Course Coordinator:	Engr. Adekunle, N .Olatunde <i>B.Sc, M.Sc</i>
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Office Location:	Room 4 PG School
Other Lecturers:	None

COURSE CONTENT:

Belt, Bolt Loading, Brakes, Clutches and Couplings. Gears and Gear drives, springs, Ropes, Chain drives. Hoist. Welding design. Surface finish . Friction and wear . Bearing and lubrication . Pressure cylinders . Vibration consideration in designs . Design project.

COURSE REQUIREMENTS:

This is a compulsory course for all students in engineering. In view of this, students in the college of engineering are strongly advised to attend classes regularly and have a minimum of 75% attendance to be eligible to write the final examination.

READING LIST:

LECTURE ONE

Belt Drives

- used to transmit power from one shaft to another by means of pulleys. Factors to be considered in transmitting power
 - Belt Velocity
 - Tension

-Arc of contact between the belt and pulley (smaller)

-service condition.

Types of Belt Drives

Light Drive/Medium/Heavy.

Types of Belts.

Flat Belt /V Belt/ Circular belt.

Materials used for Belts

Determination of velocity of Belt

Velocity ratio, Belt Lengths,

Contact Angles for for Open and Crossed Belts

Length of belt for open drive/cross drive. Angle of contact for open belt drive on smaller pulley
contact for open belt drive on larger pulley.

Determination of Tension in the Belt

Determination of Ratio of Driving Tensions at low speeds

Determination of Ratio of Driving Tensions at high speeds

Determination of centrifugal force . Determination of Effective pull initial tension without
centrifugal force .

Determination of with centrifugal force

Determination of Unit elongation of belt.

Determination of Power transmitted without Centrifugal Force.

Determination of width and Thickness of Belt.

Example One

Find the width of the belt necessary to transmit 10KW to a pulley 300mm diameter, if the pulley makes 1600 rpm and the co-efficient of friction between the belt and the pulley is 0.22. Assume the angle of contact as 210° and the maximum tension in the belt is not to exceed the belt is not to exceed 8N/mm width.

LECTURE TWO

CHAIN DRIVE

This is another positive drives mechanism.

Major problems of slipping associated with belt drive and rope drive can be eliminated.

Chains are made up of numbers of rigid links, usually joined together by pin joint. Steel is used to produce chain. Wheel with projected teeth (sprocket) of special profile are used. Chain and sprocket are constrained to move together without slipping.

Determination of Transmission Ratio

Determination of Average speed of the chain

Determination of Pitch

Determination of Allowable pull or Tension

Determination of Power needed

Determination of Centre Distance Chain length

Determination of Roller chain sprocket

Determination of pitch Diameter of Sprocket

LECTURE THREE

ROPE DRIVE

-They are widely used when a large amount of power is to be transmitted from one pulley to another

They are used when the distance between the two pulleys is more than 8 meters.

Types of ropes

(i) Fibre rope and Wire rope.

Advantages of Fibre Rope Drives.

Formulae for finding Ratio of Driving Tensions.

Illustration with simple applications. Advantages of Wire rope.

Determination of the ultimate load

- Determination of maximum tension on the tight side

Determination of coil friction

Determination of Area of useful X-section

Determination of number of turns of the drum,

Determination of Length of the Drum.

Determination of Maximum Bending stress

Determination of Depth of the groove,

Determination of maximum Torque,

Computation of Maximum shearing stress,

Computation of crushing stress

Computation of Holding capacity of Wire

LECTURE FOUR

Pressure Vessels

Classification of Pressure Vessels. Base on: dimension of Diameter and Thickness

The type of end construction.

Determination of Longitudinal stress,

Determination of Hoop or circumferential Stress.

Case 1. Thin cylinder

Cylindrical shell subjected to an internal pressure

Computation of Maximum shear stress, Computation of thickness of pressure tank, Computation of Diameter of the tank,

Computation of change in diameter,

Computation of change length ,

Computation of change Volume.

Case 2 Thick cylinders subjected to an internal pressure

- Major equations to find the stresses in thick cylinders are given by:

Lame's equation,

Birne's equation,

Clavarino's equation,

Barlow's Lamé's equation to estimate Axial stress, Tangential stress, Radial stress, shear stress

These equations are used to estimate :

Axial stress,

Tangential stress,

Radial stress,

shear stress,

Comparison of the result

LECTURE FIVE

Welding Design

General Introduction to Welding Process

Advantages and Disadvantages of Welded joint.

Welding processes.

Types of Welded Joints:

Lap Joint,

Butt Joint.

Introduction of Basic Weld Symbols

Determination of strength of Transverse Fillet Welded Joint.

The throat thickness

Allowable Load,

Allowable Tensile strength,

Normal Tensile stress

Butt Welding

Determination of strength of Butt Welds

Consideration for special cases of Fillet Welded Joints.

Case1 Circular rod welded to plate subjected to Torsion.

Case2 Circular rod welded to plate subjected to Bending moment.

LECTURE SIX

Clutches

Introduction

Function of clutches, Area of Application

Types of Clutches – Positive, Friction Clutches.

Brief description of Clutches.

Characteristics of materials used for lining of friction surfaces.

Factors to be considered in designing a friction Clutch.

Types of Friction Clutches.

Design of a clutch using uniform pressure approach.

Determination of required Torque, Axial Force, Number of friction or Active surface, Number of plates, Minimum number of plate, Allowable stress, Inner radius, Outer Radius, Centrifugal force, spring force on each shoe, Friction Torque, Length of shoe, Width of shoe