REPUBLIC OF SOUTH AFRICA

ADMINISTRATION: HOUSE OF ASSEMBLY

DEPARTMENT OF EDUCATION AND CULTURE

NATIONAL EXAMINATIONS

SYLLABUS

FOR

# MECHANOTECHNICS N4

| DATE OF IMPLIMENTATION | FIRST EXAMINATION |
| --- | --- |
| AUGUST 1989 | NOVEMBER 1989 |

# MECHANOTECHNICS N4

1. GENERAL AIMS

1.1 To acquaint the student with workshop processes, procedures, practices and calculations needed for the practical work situation.

1.2 To help the student to gain insight into the installation, maintenance and application of equipment in mechanical engineering.

2 SPECIFIC AIMS

2.1 To provide the prospective craftsman and maintenance supervisor with the required theoretical knowledge.

2.2 To acquaint the person specialising in the aspects prescribed by the syllabus with the basic principles and theory with regard to his field of study.

2.3 To prepare the person following the N5 Mechanotechnics course by prior discussion in N4, of the basic principles.

3. OBJECTIVES

The student should be able to:

3.1 Plan the lay-out of a workshop with due consideration of all the principles, advantages and disasdvantages, factors, types of construction and various different types of processes.

3.2 Do calculations with flat, vee and conveyor belt drives.

3.3 Do calculations regarding forces acting on machine cutting tools and also determine machine efficiency and power.

3.4 Define the various types of corrosion, testing for corrosion and the relevant processes for preserving metal.

3.5 Do precision measuring of, and relevant calculations on machine parts by means of precision measuring instruments.

3.6 Define the various types and applications of bearings, the advantages and disadvantages of each type and the mounting and maintenance of the different types.

3.7 Do elementary calculations in respect of spur gear systems, as well as epicyclic gear systems.

3.8 Do elementary calculations on hydroulic systems, specifically of flow of water through pipes and venturi meters.

4. EXAMINATION

4.1 A three-hour paper will be set having a total of 100 marks.

5. PRESENTATION

5.1 One trimester over a period of 11 weeks.

5.2 Period of instruction consists of 7,5 hours per week on a full-time basis and 6 hours per week on a part-time basis.

SYLLABUS MECHANOTECHNICS N4
(With effect from August 1989)

1. ORGANIZATION AND LAY-OUT OF WORKSHOPS

1.1 Advantages of a good lay-out.

1.2 Principles of a good lay-out.

1.3 Factors which have to be taken into consideration in the lay-out of a workshop.

1.4 Types of production and the most important requirements of each type:

1.4.1 Mass production.

1.4.2 Batch production.

1.4.3 Individual production.

1.5 Product lay-out.

1.6 Process lay-out.

1.7 Lay-out of machines: Special requirements.

1.8 Lay-out procedures.

2. CALCULATIONS: FLAT, VEE AND CONVEYOR BELT DRIVES. (centrifugal forces included).

2.1 Flat belts (open and crossed drives).

2.1.1 Velocity ratio of the pulleys.

2.1.2 Maximum tension in the belt.

2.1.3 Ratio of tensions: tension tight side of belt to tension slack side of belt.

2.1.4 Effective tension in the belt.

2.1.5 Power transmitted by flat belt drives.

2.1.6 Length of open belt.

2.1.7 Length of crossed belt.

2.1.8 Force exerted on the shaft bearings.

2.2 Vee belts (as for flatbelts, crossed belts excluded).

2.2.1 Finding the number of belts.

2.2.2 Force exerted on the shaft bearings.

2.3 Conveyor belts.

2.3.1 Slanted and horizontal drives.

2.3.2 Calculating the power required.

2.3.3 Tension in the tight side and slack side of the belt.

3. METAL CUTTING MACHINES: FORCES ACTING ON THE CUTTING TOOLS. (including shaping, drilling, milling and surface grinding machines).

3.1 Calculating machine efficiency.

3.2 Calculations regarding forces acting on cutting tools.

3.3 Power exerted by cutting tools.

4. METAL PROTECTION.

4.1 Causes of corrosion.

4.2 Corrosion testing.

4.2.1 Salt spray test.

4.2.2 Humidity test.

4.2.3 Sulphur dioxide test.

4.3 Metal protection processes.

4.3.1 Cathodic protection.

4.3.2 Electroplating.

4.3.3 Anodizing.

4.3.4 Galvanizing.

4.3.5 Phosphating.

4.4 Surface preparation for painting.

4.4.1 Sand and shot blasting.

4.4.2 Descaling.

4.4.3 Grease removal.

4.5 Painting processes.

4.5.1 Air-spray painting.

4.5.2 Airless spray painting.

4.5.3 Electrostatic painting.

4.5.4 Dip painting.

5. PRECISION MEASURING OF MACHINE PARTS.

5.1 Measuring of tapers: balls, rollers and sine bar.

5.2 Measuring of threads: three-wire method, thread micrometer and adjustable slip guages.

5.3 Measuring of gear teeth: the constant chord method.

6. BEARINGS.

6.1 Sliding bearings (journal bearings).

6.1.1 Radial, thrust and guide bearings.

6.1.2 Friction and hydrodynamic lubrication.

6.1.3 Bearing metals.

6.1.4 Surface finishing and running in of bearings.

6.1.5 Lubricating holes and grooves.

6.1.6 Reasons for bearing failure.

6.1.7 Various types of lubricating devices.

6.2 Anti-friction bearings.

6.2.1 Radial, axial and combined loads.

6.2.2 Types of bearings: ball bearings, roller bearings, tapered bearings, needle bearings and self aligning bearings.

6.2.3 Applications of the various types.

6.2.4 Installation and maintenance of bearings.

7. GEAR DRIVES.

7.1 Spur gears.

7.1.1 Gearing terms and dimensions: pitch circle, pitch circle diameter, module, addendum, dedendum, centre distances, etc.

7.1.2 Elementary calculations in respect of the:
Pitch circle diameter, module, number of teeth, approximate and actual centre distances.

7.1.3 Velocity ratios of simple and compound drives.

7.2 Elementary calculations in respect of:

7.2.1 Simple epicyclic gearing.

8. HYDRAULIC SYSTEMS: ELEMENTARY CALCULATIONS.

8.1 Water flowing through round orifices.

8.2 The three coefficients of flow: (Cv, Cc and Cd).

8.3 Water flowing through single pipes (constant diameter pipes only).

8.4 The theorem of Bernoulli and its application on piping installations.

8.5 Flow of water through single pipes from one reservoir to another with constant pipe diameters only.

8.6 Velocity of rate of flow of water flowing through venturi meters and tapered pipes.

REPUBLIC OF SOUTH AFRICA

ADMINISTRATION: HOUSE OF ASSEMBLY

DEPARTMENT OF EDUCATION AND CULTURE

POST-SCHOOL EDUCATION IN TECHNICAL COLLEGES

NATIONAL EXAMINATIONS

# S Y L L A B U S

FOR

# MECHANOTECHNICS N5

DATE OF IMPLEMENTATION: JANUARY 1990

DATE OF FIRST EXAMINATION: APRIL 1990

AFRIKAANS OP KEERSY

MECHANOTECHNICS N5

1. GENERAL AIMS

1.1 To familiarize students with practices and calculations that may occur in their work situation

1.2 To give students insight into the installation, maintenance and use of equipment in mechanical engineering

2. SPECIFIC AIMS

2.1 To provide the prospective craftsman of the necessary theoretical knowledge

2.2 To prepare the person who wants to follow the N6 Mechanotechnics course by already dealing with the basic principles in N5

2.3 After the successful completion of this course, the student should be prepared for further studies in this field

3. OBJECTIVES

The student must be able to:

3.1 Make calculations with regard to epicyclic gears and reduction gearboxes

3.2 Make calculations with regard to flat belt, v-belt and conveyor belt drives

3.3 To understand and be able to make calculations concerning the working and construction of the different types of bucket elevators

3.4 To understand the working, and be able to make the concommitant calculations of rope haulages and aerial cableways

3.5 To understand the working and construction of elevators, and be able to make the concommitant calculations

3.6 To make calculations concerning rail and road resistance

3.7 To make calculations concerning flywheels

4. EXAMINING

4.1 One three hour examination with a maximum of 100 percent will be set

5. ENTRY REQUIREMENTS

5.1 A pass in mechanotechnics N4

MECHANOTECHNICS N5

1. EPICYCLIC GEARS AND GEAR TRAINS

1.1 Epicyclic gears made up of spur gears or bevel gears

1.2 Application of epicyclic gears on the Cyclometer mechanism, Humpages gear mechanism and differential mechanism

1.3 Calculations of simple epicyclic gear trains by tabular method (Torque included)

2. REDUCTION GEARBOXES

2.1 Construction and uses

2.2 Three-speed and reverse gearbox

2.3 Calculations on reduction gearboxes

2.4 Calculations on worm reductions

3. BELT DRIVES

3.1 Calculations only, on flat- and v-belt drives (centrifugal force included)

3.1.1 Flat belts (open and cross drives)

(a) Speed ratios between pulleys

(b) Maximum force in belt

(c) Ratio between forces, tight side to slack side

(d) Effective belt force

(e) Power transmitted by flat belts

(f) Length of open belts

(g) Length of crossed belts

3.1.2 V-belts as for flat belts (3.1.1(a)-(f))

3.1.3 Determining the number of belts (v-belts)

3.1.4 Force on bearings

3.1.5 Moments of inertia

3.2 BELT CONVEYORS

3.2.1 Horizontal and inclined belts

3.2.2 Construction of belts; driving mechanisms; methods employed to prevent belt slippage; belt tensioning devices

3.2.3 Care of belts; methods used in joining belts; safety devices; belt conveyor rollers

3.2.4 Calculations in respect of: belt speeds, belt tensions (tight and slack side), contact angle on pulley, power transmitted, belt capacity, drive efficiency and tandem drives (combined horizontal and inclined belts to be considered)

3.2.5 Loading of conveyor belts

3.2.6 Off-loading of conveyor belts

3.2.7 Removal of steel from non-magnetic materials

3.2.8 Correct belt speeds; interlocking sequence; government regulations applicable to elevators

4. BUCKET ELEVATORS

4.1 Purpose of bucket elevators; different types of bucket elevators

4.1.1 Centrifugal discharge of bucket elevators; positive or gravity discharge elevators; types of material that can be conveyed; methods of loading and discharge

4.1.2 Mounting of buckets to belt or chain

4.1.3 Safety devices: Stopping and hold back devices; tensioning devices

4.1.4 Service platforms; driving mechanisms; main problems experienced with bucket elevators; construction of tail pulley

4.1.5 Calculations of: pulley diameters; belt lengths; volume and mass per bucket; power and efficiency

4.2 BUCKET CONVEYORS

4.2.1 Methods of loading and discharge; various arrangements of bucket conveyors

4.2.2 Driving mechanisms

5. ROPE HAULAGES

5.1 General arrangement: a) endless ropes and b) main and tail rope types

5.1.1 Gearbox construction; chimes wheel; methods of imparting motion to the rope on the endless rope type haulage; types of brakes used; return and sheave wheels; rollers (pineapple and conical types)

5.1.2 Methods of attaching cars to rope

5.1.3 Safety devices; derailment devices

5.1.4 Tensioning devices; common faults

5.1.5 Calculations of: Number of trucks; capacity; moment of inertia; rope diameter; ultimate rope strength; factor of safety; power and efficiency

5.1.6 Capstan winches

5.2 AERIAL ROPEWAYS

5.2.1 Construction;different types;advantages and disadvantages

5.2.2 Calculations of: Span; deflection; number of containers; capacity and power (vertical component excluded)

6. ELEVATORS

6.1 Goods and passenger elevators; construction of elevators; construction of hoisting drum; electro magnetic brake

6.2 Balancing of elevator; safety catches on elevator

6.3 Lay-out of elevator shaft for passenger and goods elevators; guide rails for elevator and counterweight; construction of counterweight

6.4 Springs and hydraulic buffers at the bottom of the hatchway; automatic door locks on entrances to hatchways

6.5 Over-winding of elevators

6.6 Composition and construction of ropes

6.7 Government regulations applicable to elevators

6.8 Calculations of: Tension in the ropes; acceleration and deceleration; moment of inertia of drum; total torque; power and efficiency

7. RAIL AND ROAD TRACTION CALCULATIONS (Including inclines)

7.1 Locomotive tractive effort

7.2 Drawbar pull

7.3 Acceleration and deceleration

7.4 The effect of centrifugal force around curves and conditions for no side thrust (super elevation included)

7.5 Maximum safe speed to prevent skidding and overturning

7.6 Power

8. FLYWHEELS

8.1 Purpose of a flywheel

8.2 Elementary calculations concerning Moment of inertia; torque and power required for angular acccelerations

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REPUBLIC OF SOUTH AFRICA

ADMINISTRATION: HOUSE OF ASSEMBLY

DEPARTMENT OF EDUCATION AND CULTURE

POST-SCHOOL EDUCATION AT TECHNICAL COLLEGES

NATIONAL EXAMINATIONS

# S Y L L A B U S

FOR

# MECHANOTECHNICS N6

IMPLEMENTATION DATE:

MAY 1990

FIRST EXAMINATION:

AUGUST 1990

AFRIKAANS OP KEERSY

# MECHANOTECHNICS N6

## 1. GENERAL AIMS

To create opportunities for study which will result in a meaningful educational experience enabling the student to take up his place in the world of industry

Study opportunities must be directed in such a manner that Christian National norms will be appreciated

## 2. SPECIFIC AIMS

2.1 To equip artisans, maintenance supervisors, designers of projects and equipment, engineers as well as other students to accomplish their task effectively and with perception. This comprises, inter alia, direct knowledge, understanding, application and higher proficiencies in essential and relevant concepts

2.2 The proficiency that the student should acquire must be on a scale of 10 in accordance with the following classification. The ratios given below should be regarded as guidelines only:

| | |
|---|---|
| Direct knowledge (merely memory) | 1 |
| Insight/understanding (reproduction ability) | 4 |
| Applications (should include unusual situations) | 3 |
| Higher efficiencies (evaluation, synthesis, analysis) | 2 |

## 3. OBJECTIVES

The student must be able to do advanced calculations from basic principles

### 3.1 CLUTCHES

Plate, cone and centrifugal types

### 3.2 BRAKES

Band and block brakes

### 3.3 LINE SHAFTS

Combined reactions on solid shafts bearings, torque and power

Moments of gears, pulleys and flywheels on a shaft

3.4 FLYWHEELS

Moments of inertia, angular motion and fluctuation of speed

3.5 REDUCTION GEARBOXES

Acceleration of the different gearbox components

3.6 RAIL TRACTION AND VEHICLE DYNAMICS

Rail traction on level tracks and on inclines. Super-elevation

3.7 BALANCING

Static and dynamic balancing

3.8 KINEMATICS

Velocity and acceleration diagrams

4. EXAMINATION

One three hour examination paper with a maximum of 100 percent

5. PRESENTATION

5.1 One term over a period of 11 weeks

5.2 Tuition consists of 7,5 hours per week full-time and 6 hours per week part-time

6. ENTRY REQUIREMENTS

A pass in Mechanotechnics N5

7. MECHANOTECHNICS N6

7.1 CLUTCHES

Calculations on plate, cone and centrifugal clutches including axial forces, torque and power

7.2 BRAKES

Calculations on band and block brakes,including tensions,torque and braking time

7.3 LINE SHAFTS

Calculations of simultaneous reactions on solid shaft bearings (including torque and power on solid shaft bearings), moments of gears, pulleys and fly-wheels on the shaft

7.4 FLYWHEELS

Calculations of moment of inertia, angular velocity and acceleration, including fluctuation of speed and energy

7.5 REDUCTION GEARBOXES

7.5.1 Calculations of torque and power (including acceleration of different gearbox components)

7.5.2 Calculations on worm gear drives including helix angle of worm screw thread and axial forces on worms and worm wheels

7.6 RAIL TRACTION AND VEHICLE DYNAMICS

7.6.1 Calculations of acceleration and deceleration of-trains on level tracks and inclines including locomotive tractive efforts, resistances

7.6.2 Calculations on the effect of centrifugal force around curves, maximum safe speeds, side thrust on rails, conditions for no side thrust with banking

7.6.3 VEHICLE DYNAMICS

Calculations concerned with the movement of vehicles on roads

Moment of inertia (linear motion) torque and power Moments about front and rear wheels.Centres of gravity of vehicles and load mass on front and rear wheels

Transmission efficiency and gear ratios Load transfer during braking, acceleration and cornering

7.7 BALANCING

7.7.1 Balancing of masses rotating in the same plane

7.7.2 Balancing of masses rotating in different planes

7.7.3 Dynamic forces on bearings

## 7.8 KINEMATICS

Velocity and acceleration diagrams

7.8.1 Relative velocity diagrams, fourbar chain, direction of angular velocity inversion

7.8.2 Instantaneous centre of rotation, three instantaneous centres in line

7.8.3 Slider crank mechanism

Graphical determination of velocity and acceleration of a slider or piston

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REPUBLIEK VAN SUID-AFRIKA

ADMINISTRASIE: VOLKSRAAD

DEPARTEMENT VAN ONDERWYS EN KULTUUR

NASIONALE EKSAMENS

# S I L L A B U S

VIR

# MEGANOTEGNIEK N4

IMPLEMENTERINGSDATUM:
AUGUSTUS 1989

EERSTE EKSAMENDATUM:
NOVEMBER 1989

# MEGANOTEGNIEK N4

1. ALGEMENE DOELSTELLINGS

1.1 Om studente kennis te laat maak met werkswinkel-prosesse, prosedures, praktyke en berekenings wat moontlik in sy werksituasie mag voorkom.

1.2 Om studente insig te gee in die installering, onderhoud en gebruik van toerusting in meganiese ingenieurswese.

2. SPESIFIEKE DOELSTELLINGS

2.1 Om die voornemende vakman en instandhoudingstoesighouer die nodige teoretiese kennis te gee.

2.2 Om die persoon wat gaan spesialiseer in die aspekte soos in die sillabus voorgeskryf, bloot te stel aan die basiese beginsels en teorie van sy vakrigting.

2.3 Om die persoon wat die N5 Meganotegniekkursus wil volg voor te berei deur die basiese beginsels reeds in N4 te behandel.

3. DOELWITTE

Die studente moet in staat wees om:

3.1 Die uitleg van 'n werkwinkel te beplan met inagneming van al die beginsels, voordele en nadele, faktore, tipes aanlegte en verskillende soorte prosesse.

3.2 Berekeninge te kan doen met platband, vee-band en vervoerbandaandrywings.

3.3 Berekeninge te kan doen met kragte wat op snymasjienbeitels inwerk en ook die rendement en drywing op die masjiene kan bepaal.

3.4 Die verskillende tipes korrosie kan identifiseer en beskryf, asook die toetsing vir korrosie en die gepaardgaande metaalbeskermingsprosesse.

3.5 Presisiemeting te kan doen op masjienonderdele met behulp van presisiemeetinstrumente en die gepaardgaande berekeninge te kan doen.

3.6 Verskillende tipes laers kan identifiseer, asook gebruike, voor- en nadele van die verskillende tipes, toepassings, montering en onderhoud aan die laers te kan doen.

3.7 Om elementêre berekenings te kan doen met reguittand, asook episikliese ratstelsels.

3.8 Om elementêre berekeninge te kan doen met hidrouliese stelsels, beperk tot die vloei van water deur pype, stuwergate en venturi-meters.

4. EKSAMINERING

4.2 Eksaminering sal bestaan uit een vraestel van 3 ure lank met 'n totaal van 100 punte.

5. AANBIEDING

5.1 Een trimester oor 'n tydperk van 11 weke.

5.2 Onderrigtyd is 7,5 uur per week voltyds en 6 uur per week deeltyds.

SILLABUS MEGANOTEGNIEK N4
(Met ingang Augustus 1989)

1. ORGANISASIE EN UITLEG VAN WERKWINKELS.

1.1 Voordele van 'n goeie uitleg.

1.2 Beginsels van 'n goeie uitleg.

1.3 Faktore wat in aanmerking geneem moet word by die uitleg van 'n werkwinkel.

1.4 Tipe produksie en die belangrikste vereistes van elkeen:

1.4.1 Massaproduksie.

1.4.2 Lotproduksie.

1.4.3 Individuele produksie.

1.5 Produkuitleg.

1.6 Prosesuitleg.

1.7 Masjienuitleg: Spesiale vereistes.

1.8 Uitlegprosedures.

2. BEREKENINGE: PLAT-, VEE- EN VERVOERBANDAANDRYWINGS (sentrifugale krag ingesluit).

2.1 Platbande (oop en gekruisde aandrywings).

2.1.1 Spoedverhouding tussen katrolle.

2.1.2 Maksimum trekkrag in band.

2.1.3 Verhouding van trekkrag stywe kant teenoor trekkrag slapkant van platband.

2.1.4 Effektiewe trekkrag in die band.

2.1.5 Drywing oorgedra deur platbandaandrywings.

2.1.6 Lengte van oopband.

2.1.7 Lengte van gekruisde band.

2.1.8 Kragte uitgeoefen op die aslaers.

2.2 Veebande (soos vir platbande, gekruisde bande uitgesluit).

2.2.1 Bepaling van aantal bande.

2.2.2 Kragte uitgeoefen op die aslaers.

2.3 Vervoerbande.

2.3.1 Skuinsbande en horisontale bande.

2.3.2 Bepaling van die drywing benodig.

2.3.3 Trekkrag in die stywe en slap kante van die band.

3. METAALSNYMASJIENE: KRAGTE WAT OP DIE SNYBEITELS WERK (Insluitend skaaf-, boor-, frees-, en vlakslypmasjiene).

3.1 Berekening van masjienrendement.

3.2 Berekeninge met betrekking tot kragte wat op snybeitels uitgeoefen word.

3.3 Drywing wat deur snybeitels uitgeoefen word.

4. METAALBESKERMING.

4.1 Oorsake van korrosie.

4.2 Korrosietoetsing.

4.2.1 Soutsproeitoets.

4.2.2 Humiditeitstoets.

4.2.3 Swaweldioksiedtoets.

4.3 Metaalbeskermingsprosesse.

4.3.1 Katodiese beskerming.

4.3.2 Elektroplatering.

4.3.3 Anodisering.

4.3.4 Galvanisering.

4.3.5 Fosfatering.

4.4 Oppervlakvoorbereiding vir verfwerk.

4.4.1 Sand- en haelbestraling.

4.4.2 Ontskaling.

4.4.3 Ghriesverwydering.

4.5 Verfprosesse.

4.5.1 Lugspuitverfwerk.

4.5.2 Luglose spuitverfwerk.

4.5.3 Lugspuitverfwerk.

4.5.4 Dompelverfwerk.

5. PRESISIEMETING VAN MASJIENONDERDELE.

5.1 Meting van tapsheid: koeëls, rollers en sinusstaaf.

5.2 Meting van skroefdraad: driedraadmetode, skroefdraad-mikrometer en verstelbare bekmate.

5.3 Meting van rattande: konstante koord metode.

6. LAERS.

6.1 Glylaers (astaplaers).

6.1.1 Radiaal-, druk en leilaers.

6.1.2 Wrywing en hidrodinamiese smering.

6.1.3 Laermetale.

6.1.4 Oppervlakafwerking en inloop van laers.

6.1.5 Smeergate en groewe.

6.1.6 Redes vir laerversaking.

6.1.7 Verskillende soorte smeertoestelle.

6.2 Wrywingwerende laers.

6.2.1 Radiale, aksiale en gekombineerde belastings.

6.2.2 Soorte koeëllaers, rollaers, tapse rollaers, naaldlaers en selfriglaers.

6.2.3 Toepassings van die verskillende soorte.

6.2.4 Installering en versorging van laers.

7. RATAANDRYWINGS.

7.1 Reguittandratte.

7.1.1 Ratterme en afmetings: steeksirkel, steeksirkeldiameter, module, addendum, dedendum, hartafstande, ens.

7.1.2 Eenvoudige berekeninge met betrekking tot:

7.1.3 Snelheidsverhoudings van enkelvoudige en saamgestelde ratstelsels.

7.2 Eenvoudige berekeninge met betrekking tot:

7.2.1 Eenvoudige episikliese ratstelsels.

8. HIDROULIESE STELSELS: EENVOUDIGE BEREKENINGE.

8.1 Water wat deur ronde openinge en spuitstukke vloei.

8.2 Die drie koëffisiënte van vloei (Cv, Cc en Cd).

8.3 Water wat deur enkelpype vloei (konstante grootte pype alleenlik).

8.4 Bernoulli se beginsel en die toepassings daarvan by pyp-aanlegte.

8.5 Vloei van water deur enkelpype van een reservoir na 'n ander, konstante pypdiameters alleenlik.

8.6 Snelheid en vloeitempo van water wat deur venturimeters en tapse pype vloei.

REPUBLIEK VAN SUID-AFRIKA

ADMINISTRASIE: VOLKSRAAD

DEPARTEMENT VAN ONDERWYS EN KULTUUR

# NASKOOLSE ONDERWYS IN TEGNIESE KOLLEGES

## NASIONALE EKSAMENS

# S I L L A B U S

VIR

# MEGANOTEGNIEK N5

| IMPLEMENTERINGSDATUM | EERSTE EKSAMENDATUM |
|---|---|
| JANUARIE 1990 | APRIL 1990 |

ENGLISH OVERLEAF

MEGANOTEGNIEK N5

1. ALGEMENE DOELSTELLINGS

1.1 Om studente kennis te laat maak met praktyke en berekenings wat moontlik in die werksituasie mag voorkom

1.2 Om studente insig te gee in die installering, onderhoud en gebruik van toerusting in meganiese ingenieurswese

2. SPESIFIEKE DOELSTELLINGS

2.1 Om die voornemende vakman die nodige teoretiese kennis te gee

2.2 Om die persoon wat die N6 Meganotegniekkursus wil volg voor te berei deur die basiese beginsels reeds in N5 te behandel

2.3 Na die suksesvolle afhandeling van hierdie kursus behoort die student voorbereid te wees vir verdere studies in hierdie rigting

3. DOELWITTE

Die student moet instaat wees om:

3.1 Berekeninge te kan doen van episikliese ratstelsels en reduksieratkaste

3.2 Berekeninge te kan doen van platband-, veeband- en vervoerbandaandrywings

3.3 Om die werking en konstruksie van die verskillende tipes bakhysers te verstaan en ook om berekeninge daarvan te doen

3.4 Om die werking van trektouvervoerders en kabelsweefbane te verstaan en ook om die gepaardgaande berekeninge te doen

3.5 Om die werking en konstruksie van hysers te verstaan en ook om die gepaardgaande berekeninge te kan doen

3.6 Berekeninge te kan doen van spoor en padweerstand

3.7 Berekeninge van vliegwiele te kan doen

4. EKSAMINERING

4.1 Een drie-uur vraestel met 'n maksimum van 100 persent sal gestel word

MEGANOTEGNIEK N5

1. EPISIKLIESE RATTE EN RATSTELSELS

1.1 Episikliese ratte wat bestaan uit reguittandratte en konieseratte

1.2 Toepassing van episikliese ratte, soos by die siklusteller; ewenaarmeganisme en Humpageratstelsel

1.3 Berekeninge m.b.t. eenvoudige episikliese ratstelsels m.b.v. die tabelmetode (wringkrag ingesluit)

2. REDUKSIERATKASTE

2.1 Konstruksie en gebruike

2.2 Driespoed ratkas en trurat

2.3 Berekeninge m.b.t. reduksieratte

2.4 Berekeninge m.b.t. wurmreduksies

3. BANDAANDRYWINGS

3.1 Slegs berekeninge van plat- en v-bandaandrywings (sentrifugale kragte ingesluit)

3.1.1 Platbande (oop en gekruisde aandrywings)

(a) Spoedverhouding tussen katrolle

(b) Maksimum trekkrag in band

(c) Verhouding van trekkragte, stywekant tot slapkant

(d) Effektiewe trekkrag in die band

(e) Drywing oorgedra deur platbandaandrywings

(f) Lengte van oopband

(g) Lengte van gekruisde band

3.1.2 V-bande soos vir platbande (3.1.1(a)-(f))

3.1.3 Bepaling van aantal bande (v-bande)

3.1.4 Krag op laers

3.1.5 Traagheidsmomente

3.2 VERVOERBANDE

3.2.1 Horisontale en skuinsbande

3.2.2 Konstruksie van vervoerbande; aandryfmeganismes; metodes om bandglip te voorkom; bandspanningsopnemers

3.2.3 Versorging van bande; las van bande; veiligheidstoestelle; vervoerband-leirollers

3.2.4 Berekeninge m.b.t. bandsnelheid; bandtrekkragte (slap en stywe kant); kontakhoek op katrol; drywing oorgebring; kapasiteit; rendement Berekeninge van tandemaandrywings en gekombineerde horisontale en skuinsbande

3.2.5 Laai van vervoerbandmasjiene

3.2.6 Aflaai van vervoerbande

3.2.7 Verwydering van staal uit nie-magnetiese materiaal

3.2.8 Korrekte bandsnelhede volgorde koppeling; staatsregulasies m.b.t. hysers

4. BAKHYSERS

4.1 Doel van bakhysers; verskillende tipes bakhysers

4.1.1 Sentrifugale lewering-bakhysers; positiewe of swaartekraglewering-bakhysers; tipes materiaal wat vervoer word; metodes van laai en aflaai

4.1.2 Montering van bakkies aan bande of kettings

4.1.3 Veiligheidsmeganismes ; Rem- en terughoumeganismestellers

4.1.4 Diensplatforms; aandryfmeganisme; probleme wat ondervind word; konstruksie van stertkatrol

4.1.5 Berekeninge van: katroldiameters; bandlengtes; volume en massa per bakkie; drywing en rendement

4.2 BAKVERVOERDERS

4.2.1 Metodes van laai en aflaai; verskillende rangskikkings van bakvervoerders

4.2.2 Aandryfmeganismes

5. TREKTOUVERVOERDERS

5.1 Algemene uitleg: a) entlose touvervoerders b) hoof- en sterttouvervoerders

5.1.1 Ratkas konstruksie; touaandryfwiel; metodes om toubeweging te verkry by die entlose toutipe vervoerder; tipes remme; omloop en defleksieskywe; rollers; (pynappel en koniese tipe)

5.1.2 Metodes om trokke aan toue vas te heg

5.1.3 Veiligheidstoestelle; ontsporingstoestelle

5.1.4 Spanningstoestelle; algemene foute

5.1.5 Berekeninge t.o.v.: aantal trokke; kapasiteit; traagheidsmoment; toudiameter; breekspanning in tou; veiligheidsfaktor; drywing en rendement

5.1.6 Kaapstanders (Capstans)

5.2 KABELSWEEFBANE

5.2.1 Konstruksie; verskillende tipes; voor- en nadele

5.2.2 Berekeninge van: Span; defleksie; aantal houers; kapasiteit en drywing (sonder inagneming van vertikale komponente)

6. HYSERS

6.1 Goedere en passasiershysers; konstruksie van die hysers; konstruksie van hyserdrom; elektromagnetiese rem

6.2 Balansering van hyser; veiligheidstoestelle aan hyser

6.3 Uitleg van hysskag vir passasiers en goederehysers; leispore vir hyser en teengewig; konstruksie van teengewig

6.4 Veer en hidrouliese buffers onder in die skag; outomatiese sluittoestelle aan deure wat toegang tot die skag verleen

6.5 Spoedoorskryding van hysers

6.6 Samestelling en konstruksie van toue

6.7 Staatsregulasies m.b.t. hysers

6.8 Berekeninge van: Trekkragte in die toue; versnelling en vertraging; traagheidsmoment van drom; totale wringkrag; drywing en rendement

7. SPOOR EN PADWEERSTAND BEREKENINGE
(Hellings ingesluit)

7.1 Lokomotieftrekkrag

7.2 Trekstangtrekkrag

7.3 Versnelling en vertraging

7.4 Uitwerking van sentrifugalekrag om draaie en voorwaardes vir geen sywaartse druk (dwarshellings ingesluit)

7.5 Maksimum veilige spoed vir voorkoming van gly en omslaan

7.6 Drywing

8. VLIEGWIELE

8.1 Doel van vliegwiel

8.2 Elementêre berekeninge m.b.t. traagheidsmoment; draaimoment en drywing benodig vir hoekversnelling

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REPUBLIEK VAN SUID-AFRIKA

ADMINISTRASIE:VOLKSRAAD

DEPARTEMENT VAN ONDER#WYS EN KULTUUR

# NASKOOLSE ONDERWYS IN TEGNIESE KOLLEGES

## NASIONALE EKSAMENS

# S I L L A B U S

VIR

# MEGANOTEGNIEK N6

IMPLEMENTERINGSDATUM: MEI 1990

EERSTE EKSAMEN: AUGUSTUS 1990

ENGLISH OVERLEAF

# MEGANOTEGNIEK N6

## 1. ALGEMENE DOELSTELLINGS

1.1 Die daarstelling van leergeleenthede wat sal uitloop op sinvolle leerervarings sodat die student sy plek sal kan volstaan in die nywerheid

1.2 Die leergeleenthede moet so gerig word dat die student onder andere waarde in Christelike Nasionale norme sal sien

## 2. SPESIFIEKE DOELSTELLINGS

2.1 Om vakmanne, instandhoudingstoesighouers, ontwerpers van aanlegte en toerusting, ingenieurs asook alle ander studente toe te rus om hulle taak doeltreffend en met insig te verrig. Sodanige toerusting behels onder andere direkte kennis, insig (begrip), toepassing en hoër bekwaamhede van noodsaaklike relevante begrippe

2.2 Die bekwaamhede wat die student moet verwerf, moet uit 'n skaal van 10 volgens die volgende klassifikasie gemerk word. Die verhoudings gegee moet slegs beskou word as riglyne in dié verband:

| | |
|---|---|
| Direkte kennis (blote geheue) | 1 |
| Insig/begrip (reproduksievermoë) | 4 |
| Toepassings (moet ook buitengewone omstandighede insluit) | 3 |
| Hoër bewaamhede (evaluasie, sintese en analise) | 2 |

## 3. DOELWITTE

Die student moet instaat wees om gevorderde berekeninge vanaf die basiese beginsels te kan doen met betrekking tot:

### 3.1 KOPPELAARS

Plaat, koniese en sentrifugale tipes

### 3.2 REMME

Band- en blokremme

### 3.3 LYNASSE

Gelyktydige reaksies op soliede aslaers, wringkrag en drywing

Momente van ratte, katrolle en vliegwiele op 'n as

3.4 VLIEGWIELE

Traagheidsmomente, hoekbeweging en wisseling van snelhede

3.5 REDUKSIERATKASTE

Versnelling van die verskillende ratkaskomponente

3.6 SPOORTREKKRAGTE EN VOERTUIGDINAMIKA

Spoortrekkragte op gelykspore en spore teen hellings en dwarshellings

3.7 BALANSERING

Statiese- en dinamiese balansering

3.8 KINEMATIKA

Snelheids- en versnellingsdiagramme

4. EKSAMINERING

Een drie-uur vraestel met'n maksimum van 100 persent sal gestel word

5. AANBIEDING

5.1 Een trimester oor 'n tydperk van 11 weke

5.2 Onderrigtyd is 7,5 uur per week voltyds en 6 uur per week deeltyds

6. TOELATINGSVEREISTES

'n Slaagpunt in Meganotegniek N5

7. MEGANOTEGNIEK N6

7.1 KOPPELAARS

Berekeninge op plaat-, koniese- en sentrifugale koppelaars insluitende aksiale kragte, wringkrag en drywing

7.2 REMME

Berekeninge op band- en blokremme insluitende trekkragte, wringkrag en remtyd

7.3 LYNASSE

Berekeninge van gelyktydige reaksies op soliede aslaers insluitende wringkrag en drywing op soliede aslaers

Momente van ratte, katrolle en vliegwiele op die as

7.4 VLIEGWIELE

Berekeninge van traagheidsmomente, hoeksnelheid en versnelling insluitende fluktuasie van snelhede en energie

7.5 REDUKSIERATKASTE

7.5.1 Berekeninge van wringkrag en drywing insluitende versnelling van verskillende ratkaskomponente

7.5.2 Berekeninge op wurmrataandrywings insluitende helikshoek van wurmskroefdraad en aksiale kragte op wurms en wurmwiele

7.6 SPOORTREKKRAGTE EN VOERTUIGDINAMIKA

7.6.1 Berekenings van versnelling en vertraging van treine op horisontale spore en hellings, insluitende lokomotieftrekkragte en weerstande

7.6.2 Berekeninge van die uitwerking van middelpuntvliedende krag op draaie; maksimum veilige spoede; sywaartse druk op spore; voorwaardes vir geen sywaartse druk by dwarshellings

7.6.3 VOERTUIGDINAMIKA

Berekeninge in verband met die beweging van voertuie op paaie insluitende:

Traagheidsmomente (linière beweging), wringkrag en drywing

Momente om voor- en agterwiele

Swaartepunte van voertuie en vragmassa op voor- en agterwiele

Transmissie rendement en ratverhoudings

Verplasing van vragmassa tydens remming, versnelling en om draaie

7.7 BALANSERING

7.7.1 Balansering van massas wat in dieselfde vlak roteer

7.7.2 Balansering van massas wat in verskillende vlakke roteer

7.7.3 Dinamiese kragte op laers

7.8 KINEMATIKA

Snelheid en versnellingsdiagramme

7.8.1 Relatiewe snelheidsdiagramme, Vierskakelketting, rigting van hoeksnelheid, omkeerbaarheid

7.8.2 Oombliklike draaipunt van rotasie. Drie oombliklike draaipunte in lyn

7.8.3 Glyerkrukmeganisme

Grafiese bepaling van snelheid en versnelling van die glyer of suier

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