

(One 3 hour paper)

Note:

- (i) The presentation of this subject should be supplemented by demonstrations wherever possible.
 - (ii) Care must be exercised to take the level of study for this grade into account, and consequently all calculations and problems should be of appropriate standard.
1. Direct current machines: Principles and general construction. Explanation and connection diagrams of simple lap and wave windings. Explanation of armature reaction and its effect. Simple treatment of commutation; methods to improve commutation.
 2. Direct current generators: Characteristic curves and uses of series, shunt and compound ^{machines} meters.
 3. Direct current motors: Back e.m.f. Torque and speed equations. Characteristic curves and the application of series, shunt and compound motors.

Speed control by armature resistance and field control.
Reversing the rotation of motors with and without interpoles.
Simple direct current starters (Face-plate sliding contact).
 4. Efficiency and losses: Determination of efficiency and losses by means of direct, indirect and back-to-back tests.
 5. Alternating current circuits: Generation of an alternating e.m.f. (i.e. $e = E_m \sin \omega t$). Illustration of an alternating quantity by a wave and phasors; instantaneous, maximum and average values; determination of average and effective values by using the mid-ordinate rule.

Determination of the form factor. The effect of resistance, inductance and capacitance in an alternating-current circuit.

The application of an alternating sinusoidal potential difference with regard to resistance, inductance and capacitance in series and parallel circuits including sketches of phasor diagrams.

6. Transformers: Principle of operation of single- and three-phase transformers. Connecting single-phase transformers in star and delta. Voltage, current and turns ratio including basic calculations.
7. Electronics: Comparisons between mechanical switching, series (mathematical) and the applicable logic symbols and truth tables for AND, OR, NOR and NAND gates. PNP and NPN characteristics. Forward and reverse bias. Concept of a diode; elementary concept of pulses and waveforms. Principles and application of the silicon controlled rectifier.

Introduction to the use of the calibrated oscilloscope so that pulses and waveforms may be recognised and compared.

The transistor as a simple current and voltage amplifier in the three basic configurations.

8. Measuring instruments: Shunts; series resistors; applicable calculations. Instrument transformers and their connections.

(Een 3-uurvraestel)

Notas:

- (i) Die aanbieding van hierdie vak behoort sover as moontlik aangeval te word met demonstrasies.
 - (ii) Die studievlak vir dié graad moet voortdurend in ag geneem word en gevolglik moet alle berekeninge en probleme op die toepaslike vlak wees.
1. Gelykstroombasiese: Beginsels en algemene konstruksie. Verduideliking en verbindingsdiagramme van eenvoudige lus- en golfwikkelings. Verduideliking van ankerreaksie en die uitwerking daarvan. Eenvoudige behandeling van kommutasie; metodes om kommutasie te verbeter.
 2. Gelykstroombasiese: Kenlyne en gebruike van serie-, sjunt- en serie-parallelbasiese.
 3. Gelykstroombasiese: Teen- e_m .k. Draaimoment en spoedvergelings. Kenlyne en die toepassing van serie-, sjunt- en serie-parallelbasiese.

Spoedbeheer deur ankerweerstand en veldbeheer. Omkering van rotasie van motore met en sonder tussenpole.

Eenvoudige gelykstroombasiese-aansitters (vlakplaatskuifkontak)
 4. Verliese en rendement: Bepaling van verliese en rendement deur middel van direkte, indirekte en rug-aan-rugtoetse.
 5. Wisselstroombasiese: Opwekking van 'n wisselende em.k. (dit is $e = E_m \sin \omega t$). Voorstelling van 'n wisselende kwantiteit deur 'n golf en fasors; oombliklike, maksimum en gemiddelde waardes; bepaling van gemiddelde en effektiewe waardes deur middel van die middelordinaatreeël.

Bepaling van die vormfaktor. Die uitwerking van weerstand, induktansie en kapasitansie in 'n wisselstroomkring. Toepassing van 'n wisselende sinusoidale potensiaalverskil ten opsigte van weerstand, induktansie en kapasitansie in serie- en parallel-kringe, insluitend sketse van fasordiagramme.

6. Transformators: Werkbeginsels van eenfasige en driefasige transformators. Koppeling van eenfasige transformators in ster en delta. Spanning-, stroom- en wikkelingsverhoudings met inbegrip van eenvoudige berekeninge.
7. Elektronika: Vergelykings tussen meganiese skakelings, reekse (wiskundig) en die toepaslike logikasimbole en waarheidstabelle vir EN-, OF-, NOG- en NEN-hekke. PNP- en NPN-eienskappe. Begrip van 'n diode; elementêre begrip van vuurpulsse en golfvorme; die beginsels en toepassing van 'n silikonbeheerde gelykrichter.

Inleiding tot die gebruik van die gekalibreerde ossilloskoop sodat pulse en golfvorme herken en vergelyk mag word.

Die transistor as 'n eenvoudige stroom- en spanningsversterker in die drie basiese konfigurasies.

8. Meetinstrumente: Sjunte; serieresistors; toepaslike berekeninge. Instrumenttransformators en hul verbindings.