

P.D.1293.

Officers' 33 L
Conversion Course

OFFICERS' 33.L. CONVERSION COURSE

PRELIMINARY MATHEMATICS, D.C. AND A.C.
 MECHANICS.
 ADVANCED ELECTRICAL TECHNOLOGY.

PRELIMINARY MATHEMATICS

| Week | Day | Period | Syllabus Details |
|------|-------|--------|---|
| 1 | Mon. | a.m. | Simple equations; simultaneous equations; factorisation; quadratics. |
| | | p.m. | Simultaneous quadratics; indices; theory of logarithms. |
| | Tues. | a.m. | Surds; variation; progression. |
| | | p.m. | Binomial Theorem. |
| | Wed. | a.m. | Partial fractions; limiting values. |
| | | p.m. | Trigonometry; circular measure. |
| | Thur. | a.m. | Solution of triangles. |
| | | p.m. | Compound angles. |
| | Fri. | a.m. | Calculus, definitions, differential coefficient. |
| | | p.m. | Differentiation, sum, difference, product, quotient. |
| 2 | Mon. | a.m. | Differential coefficient of trigonometrical ratios; function of a function. |
| | | p.m. | Maximum and minimum; turning points. |
| | Tues. | a.m. | Exponential series; Maclaurin's Theorem. |
| | | p.m. | De Moivre; expansion of $\sin x$ and $\cos x$. |
| | Wed. | a.m. | Integration, introduction and standard forms. |
| | | p.m. | Applications; areas; mean values; R.M.S. values. |
| | Thur. | a.m. | Hyperbolic and Exponential Functions. |
| | | p.m. | Vector representation. |
| | Fri. | a.m. | Vector representation |
| | | p.m. | TEST - no marks to count. |

D.C. BASIC: FUNDAMENTALS, GENERATORS, MOTORS, DISTRIBUTION, PHOTOMETRY

D.C. FUNDAMENTALS

| | | | |
|----|-------|------|---|
| 3. | Mon. | a.m. | Fundamental quantities; units of energy, work, power. Kirchoff's Laws. |
| | Tues. | a.m. | Magnetism; Electromagnetism - fields of st. wire, single turn coil and solenoid. Magnetic blowouts. |
| | Wed. | a.m. | Magnetic circuits; calculations, including tractive power. |
| | Thur. | a.m. | Electromagnetic induction; self and mutual induction; time constant; breaker discrimination. |
| | Fri. | a.m. | Hysteresis; energy of magnetic field; B/H loop. |

D.C. GENERATORS

| Week | Day | Period | Syllabus Details |
|------|-------|--------|--|
| 4 | Mon. | a.m. | Construction; armature windings; E.M.F. formula. |
| | Tues. | a.m. | Equalising connections; selective commutation, |
| | Wed. | a.m. | Commutation; armature reaction. |
| | Thur. | a.m. | Aids to sparkless commutation. |
| | Fri. | a.m. | Characteristics, series, shunt and compound; parallel operation. |

D.C. GENERATORS (cont'd); D.C. MOTORS

| | | | |
|---|-------|------|---|
| 5 | Mon. | a.m. | Losses, efficiency and temperature rise of generators. |
| | Tues. | a.m. | D.C. motor action; back E.M.F.; armature reaction; $f = \frac{E \cdot I}{10}$ dynes. |
| | Wed. | a.m. | Torque; losses; efficiency. |
| | Thur. | a.m. | Characteristics; speed control. |
| | Fri. | a.m. | Shunt motor starters, hand operated and automatic. |

DISTRIBUTION; PHOTOMETRY

| | | | |
|---|-------|------|---|
| 6 | Mon. | a.m. | Distribution systems. Kirchoff application. |
| | Tues. | a.m. | Ring main and 3 wire systems. |
| | Wed. | a.m. | Photometry; definitions; laws of illumination; illuminants; illumination. |
| | Thur. | a.m. | ----- do ----- |
| | Fri. | a.m. | D.C. EXAMINATION - 100 marks (to count). |

PRELIMINARY A.C.

| | | | |
|----|-------|------|--|
| 12 | Mon. | a.m. | Production of A.C.; sine wave ; R.M.S.; average value; form factor; crest factor simple vector representation; - addition and subtraction. |
| | Tues. | a.m. | Reactance; impedance for R, L and C combinations in series; phase angle; series resonance; power in S.P. circuits - K.W., K.V.A., K.V.A.R. |
| | Wed. | a.m. | ----- do ----- |
| | Thur. | a.m. | ----- do ----- |
| | Fri. | a.m. | ----- do ----- |

PRELIMINARY A.C. (cont'd)

| Week | Day | Period | Syllabus details |
|------|-------|--------|---|
| 13 | Mon. | a.m. | Parallel circuits, admittance method; parallel resonance; power factor correction. |
| | Tues. | a.m. | ----- do ----- |
| | Wed. | a.m. | Electrostatics, principles, units; types of condenser; parallel plate condenser; voltage gradient; energy stored. |
| | Thur. | a.m. | Time constant; condensers in series & parallel; capacity of single core cable. |
| | Fri. | a.m. | TEST - no marks to count. |

ADVANCED ELECTRICAL TECHNOLOGY

Transformer; Alternator; 3 Phase Systems; Induction Motor; N.S. Motor; Synchronous Motor; A.C. Switch Gear; Mercury Arc Rectifier; Servo Mechanism Theory; Electrical & Mechanical Computation; Mechanics.

TRANSFORMER (a.m.) MECHANICS (p.m.)

| Week | Day | Period | Syllabus details |
|------|-------|--------|---|
| 14 | Mon. | a.m. | "j" Operator applied to circuits. |
| | | p.m. | Force; Newton's 3rd Law; equilibrium; resultant; moment. |
| | Tues. | a.m. | "j" Operator applied to circuits (cont'd). |
| | | p.m. | Parallelogram & Triangle of Forces; Lami's Theorem. |
| | Wed. | a.m. | S.P. Transformer; E.M.F. equation; no load current and its wave form; resistance and leakage reactance; transformer on load; complete vector diagram. |
| | | p.m. | Friction. |
| | Thur. | a.m. | Equivalent circuit; open and short circuit tests; regulation; approximate drop formula. |
| | | p.m. | Centre of gravity. |
| | Fri. | a.m. | Losses and efficiency; maximum efficiency; separation of hysteresis and eddy current losses. |
| | | p.m. | Couples and resultants. |

TRANSFORMER (cont'd) ALTERNATOR (a.m.) MECHANICS (p.m.)

| Week | Day | Period | Syllabus details |
|------|-------|--------|--|
| 15 | Mon. | a.m. | Transformer back-to-back test; parallel operation of transformers; auto-transformer. |
| | | p.m. | Velocity; acceleration of moving bodies. |
| | Tues. | a.m. | S.P. Transformers - Laboratory Tests. |
| | | p.m. | Mass; force; acceleration. |
| | Wed. | a.m. | S.P. Transformers - Laboratory Tests. |
| | | p.m. | Relative and resultant velocities. |
| | Thur. | a.m. | S.P. Alternators; general construction; K_D ; K_C ; K_F ; E.M.F. formula. |
| | | p.m. | Projectiles. |
| | Fri. | a.m. | Armature reaction and reactance; synchronous impedance; calculations on regulation. |
| | | p.m. | ELECTRICS & MECHANICS TEST - no marks to count. |

ALTERNATOR cont'd (a.m.) MECHANICS (p.m.)

| | | | |
|----|-------|------|---|
| 16 | Mon. | a.m. | Determination of regulation; O.C.C. & S.C.C.; Behn Eschenberg, Poitier and Harrison Jones methods of pre-determination of regulation. |
| | | p.m. | Work; horse-power; momentum. |
| | Tues. | a.m. | Laboratory tests on the alternator. |
| | | p.m. | Direct and oblique impact. |
| | Wed. | a.m. | Laboratory tests on the alternator. |
| | | p.m. | Circular motion. |
| | Thur. | a.m. | 3 phase alternator; general construction; star and delta connections of windings; armature reaction of 3 phase alternators. |
| | | p.m. | Simple harmonic motion. |
| | Fri. | a.m. | Armature reaction of 3 phase alternators (cont'd); Inductor type alternator (briefly). |
| | | p.m. | Rotation and inertia. |

ALTERNATOR (cont'd); POLYPHASE SYSTEMS (a.m.) MECHANICS (p.m.)

| Week | Day | Period | Syllabus details |
|------|-------|--------------------------------------|--|
| 17 | Mon. | a.m. | Percentage reactance; transient and sub-transient reactance; short circuit ratio; phasing out. |
| | | p.m. | Rotation and inertia (cont'd). |
| | Tues. | a.m. | Parallel operation; synchronising and stability. |
| | | p.m. | The elastic law, extension, compression, bending, twisting. |
| | Wed. | a.m. | Polyphase systems; 3 phase transformer. |
| | p.m. | Strength and stiffness of materials. | |
| | Thur. | a.m. | Balanced loads; unbalanced loads, delta and 3 phase, 4 wire. |
| | | p.m. | Torsion. |
| | Fri. | a.m. | EXAMINATION (Electrics & Mechanics) - 100 marks (to count). |

POWER IN 3 PHASE; HARMONICS; ROTATING FIELDS; A.C. INSTRUMENTS.

| | | | |
|----|-------|------|---|
| 18 | Mon. | a.m. | Power measurement; 2 and 3 wattmeter methods. |
| | Tues. | a.m. | Harmonics in 3 phase alternators; harmonics in 3 phase systems. |
| | Wed. | a.m. | Rotating fields, vectorially and analytically; principles of synchrosopes. |
| | Thur. | a.m. | Principle of frequency meters, P.F. meters, reverse current relay. Instrument transformers. |
| | Fri. | a.m. | ----- do ----- |

INDUCTION MOTOR

| | | | |
|----|-------|------|---|
| 19 | Mon. | a.m. | Induction motor, 3 phase; principle and types of squirrel cage rotor; starting torque, wound rotor. |
| | Tues. | a.m. | Development of theory of torque and slip-torque curves; condition for maximum torque. |
| | Wed. | a.m. | Transformer analogy; circle diagram. |
| | Thur. | a.m. | Methods of starting; switching transients. |
| | Fri. | a.m. | Laboratory tests on Induction Motor. |

INDUCTION MOTOR (cont'd); N.S. MOTOR; SYNCHRONOUS MOTOR;
A.C. SWITCHGEAR

| Week | Day | Period | Syllabus details |
|------|-------|--------------|---|
| 20 | Mon. | a.m. p.m. | Laboratory tests on induction motor. ----- do ----- |
| | Tues. | a.m. p.m. | ----- do ----- Locking and crawling of induction motor. |
| | Wed. | a.m. p.m. | Speed control of induction motors; the N.S. motor; N.S. motor (cont'd); A.C. series motor. |
| | Thur. | a.m. p.m. | Synchronous motor; principle; variation of I_a and P.F. with I_f (vectorially). Vee curves; starting methods, including synchronous induction motor. |
| | Fri. | a.m. p.m. | A.C. switchgear (paper by Feldbauer, I.E.E. Journal, Aug. 1948). ----- do ----- |

A.C. MACHINES; MERCURY ARC RECTIFIER

| | | | |
|----|-------|--------------|--|
| 21 | Mon. | a.m. p.m. | A.C. machines, Service applications. ----- do ----- |
| | Tues. | a.m. p.m. | Mercury arc rectifier. ----- do ----- |
| | Wed. | a.m. p.m. | ----- do ----- ----- do ----- |
| | Thur. | a.m. | FINAL EXAMINATION 150 marks, (to count). |

DIFFERENTIAL EQUATIONS; SERVO MECHANISM THEORY

| Week | Day | Period | Syllabus details |
|------|-------|--------|-------------------------|
| 25 | Mon. | a.m. | Differential equations. |
| | | p.m. | ----- do ----- |
| | Tues. | a.m. | ----- do ----- |
| | | p.m. | ----- do ----- |
| | Wed. | a.m. | Servo mechanism theory. |
| | | p.m. | ----- do ----- |
| | Thur. | a.m. | ----- do ----- |
| | | p.m. | ----- do ----- |
| | Fri. | a.m. | ----- do ----- |
| | | p.m. | ----- do ----- |

SERVO MECHANISM THEORY

| | | | |
|----|-------|------|------------------------|
| 26 | Mon. | a.m. | Servo mechanism theory |
| | | p.m. | ----- do ----- |
| | Tues. | a.m. | ----- do ----- |
| | | p.m. | ----- do ----- |

ELECTRICAL AND MECHANICAL COMPUTATION

| | | | |
|----|-------|------|--|
| 28 | Mon. | a.m. | Electrical and Mechanical Computing principles & mechanisms. |
| | | p.m. | ----- do ----- |
| | Tues. | a.m. | ----- do ----- |
| | | p.m. | ----- do ----- |
| | Wed. | a.m. | ----- do ----- |
| | | p.m. | ----- do ----- |
| | Thur. | a.m. | ----- do ----- |
| | | p.m. | ----- do ----- |
| | Fri. | a.m. | ----- do ----- |
| | | p.m. | ----- do ----- |