SUBJECT A 3 : ENGINEERING

1. **BASIC PRINCIPLES:** The SI and the SABS standards.

2. CHEMISTRY:

- The nature and structure of matter
- Mass and the mole
- Patterns in gaseous matter
- The matter we breathe
- Matter and electricity
- Matter and energy
- Acids, bases and salts
- Organic chemistry - basics.

3. PHYSICS:

- Vector addition displacement, velocity, force etc
- Kinematics linear and angular
- Dynamics - motion in incline and sliding friction
- Work, power, energy, torque, efficiency, machines and laws
- Statistics and structures
- Optics - as applicable to instrumentation

4. **MACHINERY COMPONENTS:**

- Mechanical transmission of energy
    - Belts and belt drives, gearboxes, clutches, braking systems, etc, fluid transmission of energy
    - Couplings hydraulics components, pumps, pumping, pipe sizes and selection, air compression and compressors

5. DIESEL ENGINES:

- Operation and use safety devices

6. FLAME PROOFING:

- Specifications and practical examples e.g use of light alloys in fiery mines

7. MATERIALS TECHNOLOGY:

- Principles of strengths of materials stress, strain, shear, Young's Modules, Poison Ration, S F comparisons
- Concrete technology - terms

8. FLUID FLOW SCIENCE AND HYDRAULIC:

9. MACHINERY DRAWINGS:

- Elementary drawings of perspective and 3D - interpretation of simple technical drawing of machines.

10. TENDERS AND CONTRACTS:

- Systems and procedures

11. MACHINERY ECONOMICS:

12. ELECTRICITY:

- Definitions,
- Ohms law, resistances, circuit networks for d.c, and a.c. power heat losses, cost of electricity
- Electro magnetic effects and simple motors and generators. Low current control circuits and units basic applied electronics

13. ELECTRICAL APPLICATIONS AND THEORY:

- Generating of a.c and d.c multi phase and smoothing rectification
- Transmission of electrical energy power losses and design of cables and star and delta
- Motors a.c and d.c control - advantages and disadvantages - components of motors.
- Resistance, capacitance inductance - relationship with power factor and cost.
- Earthling and leaking protection
- Calculation

14. MOTOR TYRES AND APPLICATION:

15. BASIC THERMODYNAMICS:

- Temperature, pressure, volume, gas laws
- Specific heat capacities of materials - significance
- Energy and power

16. HOIST ELEVATORS, CHAIRLIFTS AND SHAFT SINKING:

Application and theory
Legal requirements
Calculations

17. TRANSPORT:

- Primary, secondary and other (metal & coal) men, materials and rock handling - conveyor systems
- L H D machines
- Scraper winches
- Transport on inclines
- Locomotive and trains
  - Rail traction
  - Track design and layout

18. DRILLS AND DRILLING TECHNOLOGY:

- Terminology
- Cost effectiveness

19. MAINTENANCE SYSTEMS

- Monitoring and reporting
- Tribology-corrosion
- Planned maintenance
- Preventative maintenance
- Breakdown maintenance

20. SELECTED ENGINEERING REGULATIONS:

21. SURFACE PLANT:

(a) Sewerage, waste disposal including rock dumps and slime dams water purification, boilers etc

(b) Treatment plant equipment

- crushers
- mills
- screens
- stockpiles

22. (a) MACHINES - COAL OPTION:

Construction. Application, merits and demerits of various machines used in collieries e.g. drag lines, loader, shuttle cars, stacker/reclaims etc.

(b) MACHINES - METAL OPTION:

Construction, application, merits and demerits of various machines used in metal mines

23. CONVEYORS:

- Design and components
- Calculations

24. WATER HANDLING:

- Pumping – water, mud, slurry
- Storage – dams – design and layout
- Pump curves
- Sump and settlers
- Pumping problems and solution
- Pumping calculations

25. CONCRETE TECHNOLOGY:

- Mixes
- Curing
- Terminology
- Reinforcing
- Placement
- Quality control

26. CORROSION:

- Principles and prevention techniques

27. WORKSHOPS:

- Design and practice:- Surface & underground

28. CIVIL CONTRUCTION :- SURFACE & UNDERGROUND:

- Dams
- Roads
- Power lines
- Pipe suspension