Switchgear and Protection (315334)

MSBTE Diploma · K-Scheme · Electrical Engineering, Semester 5 · Important Questions

How this list was made: Based on MSBTE papers **W-2025 and S-2026** available on msbte.ac.in (these are the only two K-scheme papers of this course so far). Every question of both papers (52 sub-questions) was grouped by topic. **High** = asked in both papers, **Medium** = asked in one paper, **Low** = in the K-scheme syllabus but not asked yet. With only two papers, this is a weak signal — study the whole syllabus. Practice guidance only — not a prediction of the exam.

Paper pattern (both papers): Q.1 any 5 of 7 (2 M) · Q.2 any 3 of 4 (4 M) · Q.3 any 3 of 4 (4 M) · Q.4 any 3 of 5 (4 M) · Q.5 any 2 of 3 (6 M) · Q.6 any 2 of 3 (6 M) = 70 marks, 3 hours. Syllabus weightage: Unit I – 12, Unit II – 16, Unit III – 18, Unit IV – 24 marks.

Topics asked in both papers

#	Topic	Unit	Times asked
1	Current limiting reactors – need, generator / feeder / bus-bar reactors	I	3 (S-26, W-25)
2	Comparison: fuse vs circuit breaker, circuit breaker vs isolator, fuse vs MCCB	II	3 (S-26, W-25)
3	Microprocessor based (digital) relay – block diagram, flow chart, advantages	III	3 (S-26, W-25)
4	Buchholz relay – location, construction and working	IV	3 (S-26, W-25)
5	Symmetrical short-circuit calculation (fault current / fault MVA, % reactance on common base)	I	2 (S-26, W-25)
6	Protective system – components, protective zones and back-up protection	I	2 (S-26, W-25)
7	Methods of arc extinction (high resistance and low resistance / current-zero)	II	2 (S-26, W-25)
8	HT circuit breakers – SF6 and vacuum CB (construction, working, advantages)	II	2 (S-26, W-25)
9	Fundamental quality requirements of protective relay	III	2 (S-26, W-25)
10	Relay terminology – pick-up current, current setting, relay time, PSM, TSM	III	2 (S-26, W-25)
11	Static relay – block diagram; applications of static / induction / MHO relays	III	2 (S-26, W-25)
12	Single phasing preventer for 3-phase induction motor	IV	2 (S-26, W-25)
13	Pilot wire protection of transmission lines – working, applications, limitations	IV	2 (S-26, W-25)
14	Bus-bar protection – differential and fault-bus protection	IV	2 (S-26, W-25)

Unit I – Fundamentals of Protection (12 M)

Question / topic	Marks	Asked in	Probability
Current limiting reactors – need, generator / feeder / bus-bar reactors • State the need of current limiting reactors. *(W-25 Q.1a, 2 M)* • Explain bus-bar reactors to control the SC current in the power system. *(W-25 Q.3a, 4 M)* • Draw neat circuit diagram of feeder reactor and generator reactor. *(S-26 Q.4b, 4 M)*	2 M, 4 M	S-26, W-25	**High**
Symmetrical short-circuit calculation (fault current / fault MVA, % reactance on common base) • Alternator 10 MVA, 20 % + transformer 5 MVA, 10 % + 50 km line: find current fed to a 3-phase fault. *(W-25 Q.2a, 4 M)* • Two 3000 kVA, 15 % generators in parallel + 6000 kVA, 5 % transformer: fault current and fault MVA on HT side. *(S-26 Q.4a, 4 M)*	4 M	S-26, W-25	**High**
Protective system – components, protective zones and back-up protection • State the components used in protective system; importance of protection zones and backup protection. *(W-25 Q.4a, 4 M)* • With the help of suitable diagram state the importance of back-up protection. *(S-26 Q.2a, 4 M)*	4 M	S-26, W-25	**High**
Causes of faults in power system • List out any four causes of faults in electrical power system. *(S-26 Q.1a, 2 M)*	2 M	S-26	**Medium**
% reactance, its importance and base kVA • State the term % reactance, its importance related to ohmic reactance, and importance of base kVA. *(W-25 Q.2b, 4 M)*	4 M	W-25	**Medium**
Types of faults (symmetrical / unsymmetrical) and their effects In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**
Necessity and functions of protective system; normal and abnormal conditions In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**

Unit II – Circuit Interrupting Devices (16 M)

Question / topic	Marks	Asked in	Probability
Comparison: fuse vs circuit breaker, circuit breaker vs isolator, fuse vs MCCB • State any two differences between fuse and circuit breaker. *(W-25 Q.1b, 2 M)* • Distinguish between circuit breaker and isolator (any four points). *(S-26 Q.3b, 4 M)*	2 M, 4 M	S-26, W-25	**High**

Question / topic	Marks	Asked in	Probability
• Compare fuse and MCCB on size, cost, reliability, replacement strategy. *(S-26 Q.4c, 4 M)*			
Methods of arc extinction (high resistance and low resistance / current-zero) • Explain the low resistance arc extinction method. *(W-25 Q.3b, 4 M)* • State and explain different methods used for arc extinction in circuit breaker. *(S-26 Q.3a, 4 M)*	4 M	S-26, W-25	**High**
HT circuit breakers – SF6 and vacuum CB (construction, working, advantages) • With neat diagram explain the working of SF6 CB; any four advantages. *(W-25 Q.5a, 6 M)* • VCB: neat sketch, two advantages and two disadvantages, four constructional features. *(S-26 Q.5a, 6 M)*	6 M	S-26, W-25	**High**
HRC fuse – construction, fusing factor • Define fusing factor; value of fusing factor for protection purpose. *(S-26 Q.1b, 2 M)* • Using neat sketch explain the construction of HRC fuse. *(S-26 Q.2b, 4 M)*	2 M, 4 M	S-26	**Medium**
Arc voltage, restriking voltage and recovery voltage (waveform) • With waveform state arc voltage, restriking voltage and recovery voltage. *(W-25 Q.2c, 4 M)*	4 M	W-25	**Medium**
Air insulated vs gas insulated substation / switchgear (GIS) • Two differences between air insulated and gas insulated substation. *(W-25 Q.1c, 2 M)*	2 M	W-25	**Medium**
Selection of circuit breakers; Ring Main Unit (RMU) • Four factors for selection of CB; RMU and its main components with functions. *(W-25 Q.6a, 6 M)*	6 M	W-25	**Medium**
Isolators – vertical break, horizontal break, pantograph In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**
Fuse terms – pre-arcing time, arcing time, cut-off current, prospective current In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**
LT breakers – MCB, MCCB, MPCB, RCCB / ELCB, ACB In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**
RRRV; Type-1 and Type-2 coordination In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**

Unit III – Protective Relays (18 M)

Question / topic	Marks	Asked in	Probability
Microprocessor based (digital) relay – block diagram, flow chart, advantages • With flow chart explain microprocessor based relay; four advantages. *(W-25 Q.5b, 6 M)* • Two advantages of microprocessor based digital relay. *(S-26 Q.1d, 2 M)* • With block diagram state sequence of operation for microprocessor based over-current protection. *(S-26 Q.5b, 6 M)*	2 M, 6 M	S-26, W-25	**High**
Fundamental quality requirements of protective relay • State the terms sensitivity and reliability as fundamental requirements of protective relay. *(W-25 Q.1d, 2 M)* • Name any four fundamental quality requirements for protective relay. *(S-26 Q.1c, 2 M)*	2 M	S-26, W-25	**High**
Relay terminology – pick-up current, current setting, relay time, PSM, TSM • State the terms pick-up current and current setting of protective relay. *(W-25 Q.1e, 2 M)* • Define relay time, pick-up current, PSM, TSM. *(S-26 Q.2c, 4 M)*	2 M, 4 M	S-26, W-25	**High**
Static relay – block diagram; applications of static / induction / MHO relays • With block diagram explain the working of static relay. *(W-25 Q.4b, 4 M)* • Two applications each of static relay, induction relay and MHO relay. *(S-26 Q.6a, 6 M)*	4 M, 6 M	S-26, W-25	**High**
Relay operating time numerical (PSM, TMS, Time/PSM curve) • 5 A, 3 s O/C relay, 125 % setting, TSM 0.6, CT 400/5, fault 4000 A: find operating time. *(W-25 Q.3c, 4 M)*	4 M	W-25	**Medium**
Thermal relay • With neat diagram explain the working of thermal relay. *(W-25 Q.2d, 4 M)*	4 M	W-25	**Medium**
Directional relay – need and block diagram • With block diagram explain operation of directional relay. *(W-25 Q.3d, 4 M)*	4 M	W-25	**Medium**
Differential relay – definition, current / voltage balance type • Define differential relay; explain voltage balanced differential relay. *(S-26 Q.6b, 6 M)*	6 M	S-26	**Medium**
CT and PT specifications as protective transformers • State the specification of CT and PT as protective transformers. *(S-26*	4 M	S-26	**Medium**

Question / topic	Marks	Asked in	Probability
Q.3c, 4 M)			
Induction disc (IDMT) electromagnetic relay – construction and characteristic In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**
Over-current, over-voltage and earth-fault relays In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**
Distance relaying principle; numerical relays (introduction) In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**

Unit IV – Protection of Alternators, Motors, Transformers, Bus-bars and Transmission Lines (24 M)

Question / topic	Marks	Asked in	Probability
Buchholz relay – location, construction and working • With neat diagram explain construction and working of Buchholz relay. *(W-25 Q.5c, 6 M)* • State the location where Buchholz relay is installed. *(S-26 Q.1g, 2 M)* • Draw neat labelled sketch of Buchholz relay. *(S-26 Q.4e, 4 M)*	2 M, 4 M, 6 M	S-26, W-25	**High**
Single phasing preventer for 3-phase induction motor • Explain single phasing preventer to protect 3-phase induction motor. *(W-25 Q.4d, 4 M)* • With neat sketch state the importance of single phasing preventer. *(S-26 Q.3d, 4 M)*	4 M	S-26, W-25	**High**
Pilot wire protection of transmission lines – working, applications, limitations • Explain differential pilot wire protection of transmission lines; four limitations. *(W-25 Q.6c, 6 M)* • State the application of pilot wire protection scheme. *(S-26 Q.1f, 2 M)*	2 M, 6 M	S-26, W-25	**High**
Bus-bar protection – differential and fault-bus protection • With diagram explain fault-bus protection to protect the bus-bar system. *(W-25 Q.4e, 4 M)* • State the working of differential protection scheme provided for bus-bar. *(S-26 Q.2d, 4 M)*	4 M	S-26, W-25	**High**
Alternator differential (Merz-Price) protection, % differential, limitations of differential protection • State any two limitations of differential protection. *(W-25 Q.1g, 2 M)* • Differential protection of alternator; two limitations; % differential protection. *(W-25 Q.6b, 6 M)*	2 M, 6 M	W-25	**Medium**
Faults / abnormalities in alternator • List out any four faults that occur in alternator. *(S-26 Q.1e, 2 M)*	2 M	S-26	**Medium**

Question / topic	Marks	Asked in	Probability
Earth-fault protection of alternator • With diagram explain earth-fault protection of 3-phase alternator. *(W-25 Q.4c, 4 M)*	4 M	W-25	**Medium**
Abnormalities / faults in transformer • State any four abnormalities in case of transformer. *(W-25 Q.1f, 2 M)*	2 M	W-25	**Medium**
Merz-Price protection of star-delta transformer – CT ratio numerical • 33/6.6 kV star-delta transformer, LV CTs 300/5: find HV CT ratio; draw circuit. *(S-26 Q.5c, 6 M)*	6 M	S-26	**Medium**
Induction motor faults; short-circuit protection of small and large motors • Faults in induction motor; protection for small HP and high HP motors. *(S-26 Q.6c, 6 M)*	6 M	S-26	**Medium**
Time-graded protection of feeders using IDMT relays • Principle of time graded protection of feeders using IDMT over current relays. *(S-26 Q.4d, 4 M)*	4 M	S-26	**Medium**
Reverse power protection of alternator In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**
Transformer over-current, restricted earth-fault and overheating protection In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**
Motor overload protection In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**
Distance protection of transmission lines In syllabus, not asked yet — prepare for a surprise question.	—	Not yet	**Low**

Exam tips from the two papers

- Both papers had a **4-mark fault-current numerical** (% reactance converted to a common base kVA). Practise base conversion, series/parallel reactances, fault MVA and fault current.
- **Buchholz relay** came three times (location, sketch, construction + working) — learn the labelled sketch.
- A **comparison question** on fuse / circuit breaker / isolator / MCCB appeared in both papers.
- One 6-mark question on an **HT breaker** each time: SF6 (W-25) and VCB (S-26). Learn both sketches.
- **Microprocessor relay** (block diagram + flow chart + advantages) was asked for 6 marks in both papers.
- Numericals seen once: relay operating time (PSM, TMS) and Merz-Price CT ratio for a star-delta transformer — both are short and scoring.
- Diagrams expected: reactor arrangements, protective zones, arc chute, SF6 / VCB, HRC fuse, static and microprocessor relay blocks, Merz-Price schemes, Buchholz relay, single phasing preventer, bus-bar and pilot-wire schemes.

Note: This is a **important-question list prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — anandatechnologies.in