



SSC-JE

STAFF SELECTION COMMISSION

ELECTRICAL ENGINEERING

STUDY MATERIAL

Estimation and Costing & Utilization of Electrical Energy

Estimation and Costing & Utilization of electrical Energy

Estimation and Costing & Utilization of electrical Energy

Estimation and Costing & Utilization of electrical Energy

CONTENT**Part-1: Estimation and Costing**

1.	Installation and Indian Electricity Rules (1956)	03-11
2.	EARTHING PRACTICE AND IE RULE	12-17
3.	Estimation of Energy Requirements for Lighting	18-26
4.	Electric Drives and Motors	27-30
5.	Electroplating	31-34
6.	Illumination	35-46
7.	Practice Set	47-52

Part-2: UTILIZATION OF ELECTRICAL ENERGY 53-86

- Introduction
- Methods of Electric Heating
- Electric welding
- Electroplating

1. Installation and Indian Electricity Rules (1956)

Rule 28: Voltage

Rule 30: Service Lines and apparatus on consumer premises.

Rule 31: Cut-out on consumer's premises.

Rule 46: Periodical inspections and testing of consumer's installation.

Rule 47: Testing of consumer's installation.

Rule 54: Declared voltage of supply to consumer.

Rule 56: Sealing of meters and cut-outs.

Rule 57: Meters, maximum demand indicators and other apparatus on consumer Premises.

Rule 77: Clearance above ground of the lowest conductor.

Rule 79: Clearance from buildings of low and medium voltage lines and service lines.

Rule 87: Line crossing or approaching each other.

Rule 88: Guarding.

Rule 28: Voltage:

Rule 30: Service Lines and apparatus on consumer premises.

1. The supplier shall ensure that all electric supply lines, wires, fittings and apparatus belonging to him or under his control, which are on a consumer's premises are in safe condition and in all respects fit for supplying energy and the supplier shall take due precautions to avoid danger arising on such premises from such supply lines, wires, fittings and apparatus.
2. Service lines placed by the supplier on the premises of a consumer which are underground or which are accessible shall be so insulated and protected by the supplier as to be secured under all ordinary conditions against electrical, mechanical, chemical or other injury to the insulation.
3. The consumer shall, as far as circumstances permit, take precautions for the safe custody of the equipment on his premises belonging to the supplier.
4. The consumer shall also ensure that the installation under his control is maintained in a safe condition.

Rule 31: Cut-out on consumer's premises:

1. The supplier shall provide a suitable cut-out in each conductor of every service line other than an earthed or earthed neutral conductor or the earthed external conductor of a concentric cable within a consumer's premises, in an accessible position. Such cut-out shall be contained within an adequately enclosed fireproof receptacle.

Where more than one consumer is supplied through a common service line, each such consumer shall be provided with an independent cut-out at the point of junction to the common service.

2. Every electric supply line other than the earthed or earthed neutral conductor of any system or the earthed external conductor of a concentric cable shall be protected by a suitable cut-out by its owner.

Rule 46: Periodical inspections and testing of consumer's installation:

(1) (a) Where an installation is already connected to the supply system of the supplier, every such installation shall be periodically inspected and tested at intervals not exceeding five years either by the Inspector [or any officer appointed to assist the Inspector] or by the supplier as may be directed by the State Government in this behalf or in the case of installations belonging to, or under the control of the Central Government, and] in the case of installations in mines, oil-fields and railways, by the Central Government.

(aa) the periodical inspection and testing of high voltage and extra high voltage installations belonging to supplier, shall be carried out at intervals not exceeding five years by the inspector or any officer appointed to assist the inspector.]

(b) where the supplier is directed by the Central or the State Government, as the case may be, to inspect and test the installation he shall report on the condition of the installation to the consumer concerned in a form approved by the Inspector and shall submit a copy of such report to the Inspector or to any officer appointed to assist the Inspector and authorised under sub-rule of rule.

(c) subject to the approval of the inspector, the forms of inspection report contained in Annexure IXA may, with such variations as the circumstances of each case require, be used for the purposes of this sub-rule.

(2) (a) The fees for such inspection and test shall be determined by the Central or the State Government, as the case may be, in the case of each class of consumers and shall be payable by the consumer in advance.

(b) In the event of the failure of any consumer to pay the fees on or before the date specified in the fee-notice, supply to the installation of such consumer shall be liable to be disconnected under the direction of the Inspector. Such disconnection, however, shall not be made by the supplier without giving to the consumer seven clear days, notice in writing of his intention so to do.

[(c) In the event of the failure of the owner of any installation to rectify the defects in his installation pointed out by the Inspector or by any officer appointed to assist him and authorised under sub-rule(2) of rule 4A in the form set out in Annexure IX and within the time indicated therein, such installation shall be liable to be disconnected [under the directions of the Inspector] after serving the owner of such installation with a notice:

PROVIDED that the installation shall not be disconnected in case an appeal is made under rule 6 and the appellate authority has stayed the orders of disconnection:

PROVIDED FURTHER that the time indicated in the notice shall not be less than forty-eight hours in any case:

PROVIDED ALSO that nothing contained in this clause shall have any effect on the application of rule 49.]

(3) Notwithstanding the provisions of this rule, the consumer shall at all times be solely responsible for the maintenance of this installation in such condition as to be free from danger.

Indian Electricity Rules

Rule 47: Testing of consumer's installation.

1. Upon receipt of an application for a new or additional supply of energy and before connecting the supply or reconnecting the same after a period of six months, the supplier shall inspect and test the applicant's installation. The supplier shall maintain a record of test results obtained at each supply point to a consumer, in a form to be approved by the Inspector.

2. If as a result of such inspection and test, the supplier is satisfied that the installation is likely to constitute danger, he shall serve on the applicant a notice in writing requiring him to make such modifications as are necessary to render the installation safe. The supplier may refuse to connect or reconnect the supply until the required modifications have been completed and he has been notified by the applicant

Rule 47A. Installation and testing of generating units:

Where any consumer or occupier installs a generating plant, he shall give a thirty days' notice of his intention to commission the plant to the supplier as well as the Inspector :

PROVIDED that no consumer or occupier shall commission his generating plant of a capacity exceeding 10KW without the approval in writing of the Inspector.]

Rule 54. Declared voltage of supply to consumer:

Except with the written consent of the consumer or with the previous sanction of the State Government a supplier shall not permit the voltage at the point of commencement of supply as defined under rule 58 to vary from the declared voltage-

(i) in the case of low or medium voltage, by more than 6 per cent; or

(ii) in the case of high voltage, by more than 6 per cent on the higher side or by more than 9 per cent on the lower side; or

(iii) in the case of extra high voltage, by more than 10 per cent on the higher side or by more than 12.5 per cent on the lower side:]

PROVIDED that in the case of high voltage, the voltage variation limit of 12.5 per cent may continue till the 31st March, 1974.]

Rule 55. Declared frequency of supply to consumer:

Except with the written consent of the consumer or with the previous sanction of the State Government a supplier shall not permit the frequency of an alternating current supply to vary from the declared frequency by more than 3 per cent.

Rule 56. Sealing of meters and cut-outs:

(1) A supplier may affix one or more seals to any cut-out and to any meter, maximum demand

indicator, or other apparatus placed upon a consumer's premises in accordance with section 26, and no person other than the supplier shall break any such seal.

(2) The consumer shall use all reasonable means in his power to ensure that no such seal is broken otherwise than by the supplier.

Rule 57. Meters, maximum demand indicators and other apparatus on consumer's premises:

(1) Any meter or maximum demand indicator or other apparatus placed upon a consumer's premises in accordance with section 26 shall be of appropriate capacity and shall be deemed to correct if its limits of error [are within the limits specified in relevant Indian Standard Specification where no such exists, error] do not exceed 3 per cent, above or below absolute accuracy at all loads in excess of one tenth of full loads and up to full load:

[PROVIDED that for extra high voltage consumers the limit of error shall be $\pm 1\%$.]

(2) No meter shall register at no load.

(3) Every supplier shall provide and maintain in proper condition such suitable apparatus as may be prescribed or approved by the Inspector for the examination, testing and regulation of meters used or intended to be used in connection with the supply of energy:

PROVIDED that the supplier may with the approval of the Inspector and shall, if required by the Inspector, enter into a joint arrangement with any other supplier for the purpose aforesaid.

(4) Every supplier shall examine, test and regulate all meters, maximum demand indicators and other apparatus for ascertaining the amount of energy supplied before their first installation at the consumer's premises and at such other intervals as may be directed by the State Government in this behalf.

(5) Every supplier shall maintain a register of meters showing the date of the last test, the error recorded at the time of the test, the limit of accuracy after adjustment and final test, the date of installation, withdrawal, reinstallation, etc. for the examination of the Inspector or his authorised representative

(6) Where the supplier has failed to examine, test and regulate the meters and keep records thereof as aforesaid, the Inspector may cause such meters to be tested and sealed at the cost of the owner of the meters in case these are found defective.]

Rule 77: Clearance above ground of the lowest conductor:

(1) No conductor of an overhead line, including service lines, erected across a street shall at any part thereof be at a height less than-

(a) for low and medium voltage lines 5.8 metres

(b) for high voltage lines 6.1 metres

(2) No conductor of an overhead line, including service, lines, erected along any street shall at any part thereof be at a height less than-

(a) for low and medium voltage lines 5.5 metres

(b) for high voltage lines 5.8 metres

(3) No conductor of an overhead line including service lines, erected else- where than along or across any street shall be at a height less than-

(a) for low, medium and high voltage lines up to and including 11,000 volts, if bare ; 4.6 metres

(b) for low, medium and high voltage lines up to and including 11,000 volts, if insulated 4.0 metres 4.0 metres

(c) for high voltage lines above 11,000 volts 5.2 metres

(4) For extra-high voltage lines the clearance above ground shall not be less than 5.2 metres plus 0.3 metre for every 33,000 volts or part thereof by which the voltage of the line exceeds 33,000 volts:

PROVIDED that the minimum clearance along or across any street shall not be less than 6.1 metres.

Rule 79. Clearance from buildings of low and medium voltage lines and service lines:

(1) Where a low or medium voltage over-head line passes above or adjacent to or terminates on any building, the following minimum clearances from any accessible point, on the basis of maximum sag, shall be observed:-

(a) for any flat roof, open balcony, verandah roof and lean-to-roof-

(i) when the line passes above the building a vertical clearance of 2.5 metres from the

highest point; and

(ii) when the line passes adjacent to the building a horizontal clearance of 1.2 metres from the nearest point, and

(b) for pitched roof

(i) when the line passes above the building a vertical clearance of 2.5 metres immediately under the lines, and

(ii) when the line passes adjacent to the building a horizontal clearance of 1.2 metres.

(2) Any conductor so situated as to have a clearance less than that specified in sub-rule (1) shall be adequately insulated and shall be attached suitable intervals to a bare earthed bearer wire having a breaking strength of not less than 350 kg.

(3) The horizontal clearance shall be measured when the line is at a maximum deflection from the vertical due to wind pressure.

[Explanation-For the purpose of this rule, expression "building" shall be deemed to include any structure, whether permanent or temporary .]

Rule 87:Lines crossing or approaching each other:

(1) Where an over-head line crosses or is in proximity to any telecommunication line, either the owner of the over-head line or the telecommunication line, whoever lays his line later, shall arrange to provide for protective devices or guarding arrangement, in a manner laid down in the Code of Practice or the guideline prepared by the Power and Telecommunication Co-ordination Committee and subject to the provisions of the following sub-rules.

(2) When it is intended to erect a telecommunication line or an over-head line which will cross or be in proximity to an over-head line or a telecommunication line, as the case may be, the person proposing to erect such line shall give one- month ' s notice of his intention so to do along with the relevant details of protection and drawings to the owner of the existing line.

(3) Where an over-head line crosses or is in proximity to another overhead line, guarding arrangements shall be provided so as to guard against the possibility of their coming into contact with each other. Where an over-head line crosses another over-head line, clearances shall be as under :

[Minimum clearances in metres between lines when crossing each other

S.No	Nominal System Voltage	11-66 KV	110-132KV	220KV	400KV	800KV
1.	Low and medium	2.44	3.05	4.58	5.49	7.94
2.	11-66 KV	2.44	3.05	4.58	5.49	7.94
3.	110-132KV	3.05	3.05	4.58	5.49	7.94
4.	220KV	4.58	4.58	4.58	5.49	7.94
5.	400KV	5.49	5.49	5.49	5.49	7.94
6.	800KV	7.94	7.94	7.94	7.94	7.94]

PROVIDED that no guardings are required when an extra-high voltage line crosses over another extra-high voltage, high voltage, medium or low voltage line or a road or a tram subject to the condition that adequate clearances are provided between the lowest conductor of the extra-high voltage line and the topmost conductor of the overhead line crossing underneath the extra-high voltage line and the clearances as stipulated in rule 77 from the topmost surface of the road is maintained.]

(4) A person erecting or proposing to erect a line which may cross or be in proximity with an existing line, may normally provide guarding arrangements on his own line or require the owner of the other over-head line to provide guarding arrangements as referred to in sub-rule (3).

(5) In all cases referred to in the preceding sub-rules the expenses of providing the guarding arrangements or protective devices shall be borne by the person whose line was last erected.]

(6) Where two lines cross, the crossing shall be made as nearly at right angles as the nature of the case admits and as near the support of the lower line shall not be erected below the upper line:

[PROVIDED that the angle of crossing of power lines shall not be less than 60°.]

(7) The guarding arrangements shall ordinarily be carried out by the owner of the supports on which it is made and he shall be responsible for its efficient maintenance.

(8) All work required to be done by or under this rule shall be carried out to the satisfaction Inspector.

Rule: 88. Guarding:

- (1) Where guarding is required under these rules the provisions of sub-rules (2) to (4) shall apply.
- (2) Every guard-wire shall be connected with earth at each point at which its electrical continuity is broken.
- (3) Every guard-wire shall be an actual breaking strength of not less than 635
- (4) Every guard-wire or cross-connected system of guard-wires, shall have sufficient current-carrying capacity to ensure the rendering dead, without risk of fusing of the guard-wire or wires till the contact of any live-wire has been removed.
- (5) Lines crossing trolley-wires-In the case of crossing over a trolley-wire the guarding shall fulfill the following conditions, namely:
 - (a) where there is only one trolley-wire, two guard-wires shall be erected as in diagram A;
 - (b) where there are two trolley-wires and the distance between them does not exceed 40 cms., two guard-wires shall be erected as in diagram B;
 - (c) where there are two trolley-wires and the distance between them exceeds 40cms. but does not exceed 1.2 metres, three guard-wires shall be erected
 - (d) where there are two trolley-wires and the distance between them exceeds 1.2 metres, each trolley-Wire shall be separately guarded as in diagram
 - (e) the rise of the trolley boom shall be so limited that if the trolley leaves the trolley-wire, it shall not foul the guard, wires ; and
 - (f) where a telegraph-line is liable to fall or be blown down upon an arm, stay -wire or span-wire, and so slide down upon a trolley-wire-, guard hooks shall be provided to prevent such sliding.

To buy Complete Course Materials

Contact: 9990657855, 9278800100

Email : eiidelhi@gmail.com

Website : www.sscje.com

Classroom Coaching Program

Postal Coaching Program

Online Test Series

