



RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

SEMESTER	:	
SCHEME	:	JUL.08
NAME OF COURSE (SUBJECT)	:	ESTIMATING AND COSTING (E - 505)
OLD PAPER CODE	:	
NEW PAPER CODE	:	6243
COMMON WITH PROGRAMME (BRANCH)	:	
LECTURE HRS. PER WEEK	:	TH. 06
LECTURE HRS. PER SEMESTER	:	TH. 90

RATIONALS

An electrical engineer has to estimate and cost for different jobs he has to undertake. Thus it is necessary to have knowledge of preparation of good estimate so that the work is carried in a systematic and efficient manner. Also, many times the technician has to decide the things according to situation, so he should have skills to make decisions.

The subject deals with these aspects. The areas are domestic installation, industrial installation, distribution lines etc.

Field visits may be arranged to have spot information.



RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

SEMESTER : **THIRD SEMESTER**

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SCHEME OF STUDIES

S. NO.	Topic	Theory (Hrs)
1.	Elements of estimating	06
2.	Domestic & industrial estimating and costing	24
3.	Service connections (Light power)	18
4.	Sub station	12
5.	H.T. & L.T. lines - overhead lines and cables	18
6.	Estimating and costing for repair/ maintenance of electrical devices/ equipments	12
		90



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S.No.	COURSE CONTENT	
1.	<p>Elements of Estimating</p> <p>Principles of estimating, purchase procedure, cost of materials, various charges like labor, stores, overhead tools, contingency etc.</p>	06
2.	<p>Domestic and Industrial Wiring</p> <p>Various types of wiring systems including P.V.C. pipe, their merits and demerits. Calculation of total load & selection of wire, preparation of estimates for a small residential building, big institution or office building. Estimate for single store yard, multistory building. Estimate for a small workshop and industrial installation, agricultural pump, domestic pump, floor mills etc. Estimation of total cost.</p>	24
3.	<p>Service connections</p> <p>For a single storey and multistoried building, single phase and three phase service connections, various methods of service connections. Distribution of circuits for light and power load. (Guidance may be taken by the M.P. Electricity Boards estimates).</p>	18
4.	<p>Substations</p> <p>Various types of sub-stations, pole-mounted in-door and out-door substations. Estimating quantity and cost for a substation of a given specification.</p>	12
5.	<p>Overhead lines : H.T. & H.T. lines</p> <p>Preparation of estimate and costing of 11KV or 33KV line. Selection of routes. Estimates for distribution lines- Location of poles for a given situation or locality. Providing street lights, necessary hardware, stay arrangements, underground cables, providing services lines using underground cables</p>	18
6.	<p>Estimating and costing for repair/maintenance of electrical devices/equipments</p> <p>Estimates for repairing electrical equipment e.g.</p> <ul style="list-style-type: none"> • Rewinding, assembling and testing of polyphase induction motor. • Repairing of 3 phase starters. • Repairing of single phase transformers. • Repairing of devices like hot plate, press, mixer fan etc. 	12



**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA,
BHOPAL**

SEMESTER :
SCHEME : JUL.08
NAME OF COURSE (SUBJECT) : Instrumentation (E – 501)
OLD PAPER CODE :
NEW PAPER CODE : 6239
COMMON WITH PROGRAMME :
(BRANCH)
LECTURE HRS. PER WEEK : TH. 05, PR. 02
LECTURE HRS. PER SEMESTER : TH. 75, PR. 30

SCHEME OF STUDIES

S.No.	Topics	Theory Hrs.	Pract.Hrs.	Total
1	Measuring System	04	02	06
2	Transducers	18	08	26
3	Signal Conditioners	07	04	11

4	Measurement of Physical Quantities	16	08	24
5	Telemetry	14	04	18
6	Data Acquisition System	06	02	08
7	Display Devices and Recorders	10	02	12
	TOTAL	75	30	105



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LECTURE HRS. PER SEMESTER	:	TH. 75, PR. 30

CONTENTS

CONTENTS	HOURS
Unit I Measuring System Elements of a measuring system, Block diagram of system configuration, performance, standards, time lag, error, distortion and distortion meters, noise and noise factor.	4
Unit II Transducers Transducers definition and classification, mechanical devices as primary detectors, Characteristic & choice of Transducers, Electrical transducers, Advantages of electric transducers, Active and passive transducers, Classification, Resistive, inductive and capacitive transducers, Potentiometric, Metallic and semiconductor strain gauges, Gauge factor, types, material used and applications. Thermistor, RTD, Inductive, LVDT, RVDT and Capacitive transducers and their application. Thermocouples, Piezo-Electric transducers, principle, materials used, mode of operation and application. Frequency generating transducers. Hall effect transducers, Opto-electronic transducers such as photo voltaic, Photo conductive, and photo conductive cells, constructional details, characteristics and applications. Photo diodes and transistors, characteristics and applications. Digital transducers, Optical encoders for linear and angular displacement measurement.	18
Unit III Signal Conditioners Purpose of signal conditioning, Classification, Input modifier, Operational amplifiers circuits used in instrumentation, D.C. amplifier, chopper amplifier. Instrumentation amplifier, characteristics, three amplifier configuration. A/D and D/A converters.	7
Unit VI Measurement of Physical Quantities: Measurement of Pressure-Types of pressure measurement devices, Force summing devices, Secondary transducers, Low pressure measurement, Pirani gauge and thermocouple gauge. Resistive, Inductive and Capacitive pressure measuring devices. Measurement of speed: Measurement of speed by stroboscope, photoelectric and reluctance pick-up devices for speed measurement. Measurement of Vibration-Necessity for Vibration Measurement, Seismic Transducer, Piezo-electric and LVDT Accelerometers. Measurement of Temperature-Temperature measuring devices, Resistance thermometers,	16

<p>Radiation and Optical Pyrometers. Measurement of Flow-Turbine and electromagnetic flow meters, Ultrasonic flow meter, Thermal flow meters. Measurement of Humidity-Humidity, absolute and relative humidity, Resistive and Capacitive hygrometers. Measurement of pH Value-Concept, pH scale, pH cell, pH meter. Measurement of Thermal Conductivity (gas analyzer). Measurement of level: Float and potentiometer method of flow measurement, Resistive and Capacitive methods, Ultrasonic and Gamma rays methods. Measurement of Force and Torque- Electronic weighing system, Hydraulic load cell. Torque measurement, concept, Stress and Deflection type torque measurement methods.</p> <p>Unit V Telemetry Necessity, Principle, classification, current and voltage telemetry, Position telemetry, synchros. Frequency and pulse telemetry, Principle of frequency and pulse modulation, PAM, PPM and PCM. Idea about landline and R.F. telemetry and multiplexing. Pulse code format, Modulation techniques of digital data transmission, Digital multiplexers.</p> <p>Unit VI Data Acquisition System Introduction data acquisition system, generalized DAS, Single and multi channel DAS, Data loggers, Special encoders.</p> <p>Unit VII Display Devices and Recorders: Digital display system and indicators like CRT, Seven Segment LED , LED, LCD. Analog and digital recorders, Strip and circular chart recorder and Magnetic tape recorder, X-Y recorders. Ultraviolet recorders, Frequency modulated (FM) recording. Digital tape recorders.</p>	<p>14</p> <p>6</p> <p>10</p>
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List of Practicals

1. Measurement of Distortion using wave distortion meter.
2. Measurement of load/weight using strain gauge and cantilever.
3. Measurement of linear displacement by LVDT and draw its characteristics.
4. Measurement of temperature by-
(a) Thermocouple (b) Resistance Thermometer
5. Measurement of pressure using LVDT and diaphragm gauge.
6. Study and use of data conversion using ADC and DAC.
7. Measurement of pH value using pH meter.
8. Measurement of Humidity by hygrometer.
9. Study and use of synchros in position telemetry system.
10. Measurement of Vibration using piezoelectric/LVDT transducer.
11. Study and flow measurement using electromagnetic flow meter.
12. Study of time division and frequency division multiplexing.
13. Measurement of liquid level by resistive/capacitive transducer.
14. Study and measurement of temperature using optical and radiation pyrometer.
15. Study of strip chart recorder and magnetic tape recorder.



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Books recommended

- (1) Electrical and Electronic Measurement and Instrumentation by A.K. Sawhney
 - (2) Instrumentation Devices and Systems by C S Rangan, G R Sharma and V S V Mani
 - (3) Digital Electronics By Malvino Leach
 - (4) Instrumentation By Cooper
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SEMESTER	:	
SCHEME	:	JUL.08
NAME OF COURSE (SUBJECT)	:	POWER ELECTRONICS AND APPLICATIONS (E – 503)
OLD PAPER CODE	:	
NEW PAPER CODE	:	6241
COMMON WITH PROGRAMME (BRANCH)	:	
LECTURE HRS. PER WEEK	:	TH. 05, PR. 02
LECTURE HRS. PER SEMESTER	:	TH. 75, PR. 30

RATIONALE

In modern industries most of the machine and processes are electronically operated, Controlled and regulated. Electronic system is tremendously fast, efficient and stable. It is useful to control MW output power with a very small input in W. It is equally good on changing the form of available electrical power into desired form for its use. Power Electronics is thus most important diversified course in electrical engineering.

The technological advancements demand the proficiency in Power Electronics. It is therefore, necessary to impart the knowledge of this area to produce skilled Diploma Holder in electrical engineering, who can operate and maintain the electronically operated and controlled machines.

The contents of this course will cover concepts, principles of operation of electronics devices and electronically operated machines. The stress has been given towards practical aspects which will develop the skill and confidence at technician level while operating the electronically operated/controlled machines.

We hope that the curriculum will provide knowledge relevant to the needs of the industry and a Technician exposed to this subject will be able to perform his job functions satisfactorily.



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LECTURE HRS. PER WEEK : **TH. 05, PR. 02**

LECTURE HRS. PER SEMESTER : TH. 75, PR. 30

Topics	Scheme Theory	Practical	Total
1. Thyristor	15	08	23
2. Rectification	12	08	20
3. Inverter	13	04	17
4. Converter	12	02	14
5.Speed control of motors	13	04	17
6. Applications	10	04	14
	75	30	105



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S.No.	COURSE CONTENT	Hours of
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		Study
1.	<p>Thyristor - SCR - Structure, Two transistor model, characteristics, turn-on methods, factor responsible for temperature rise, circuit for over voltage, over current, voltage surge & high dv/dt, Gate production. Modes of heat transfer. Triggering circuits - Resistance phase shift, UJT, Schmitt trigger. Turn-off types of commutation, methods of commutation. SCR rating, series and parallel connection. Thyristor family and other devices, DIAC, TRIAC, SCS, SUS, LASCR, MOSFET, IGRT, GTO, MCT.</p>	15
2.	<p>Rectification - Single phase HW and FW converters. Mathematical relations of I_{dc} and I_{rms}. Applications Advantages of polyphase rectification.</p>	12
3.	<p>Inverter - Series and parallel inverter, current and voltage source inverter, emergency tube light, comparison of inverters using different types of (transistor, MOSFET, IGRT) devices, block diagram of UPS (on load / off load). Applications of Inverter</p>	13
4.	<p>Converter - Block diagram of DC to DC converter. Converter duty cycle, 4-quadrant operation of choppers, applications. Working of single phase cyclo-converter, basic concept of three phase cyclo-converter, application of cyclo-converters.</p>	12
5.	<p>Speed control of Motors - Advantages of electronic speed control, 4-quadrant operation of DC motors, constant torque and constant horse power operation, speed control of separately excited DC motor, single and 3 phase controlled rectifiers, field failure protection and armature current limiter, speed control using chopper, dual converter. Speed control of induction motor using rectifier, inverter and cyclo-convector (block diagram only). Speed control of slip ring induction motor using SCRS in rotor circuit.</p>	13
6.	<p>Applications - High frequency heating - induction and dielectric, principle, applications. Resistance welding, electronic line contactor, heat control circuit. Static AC & DC switch, over voltage protection, time delay circuits, reversing switch with plugging logic and digit circuits, PF corrections</p>	10



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SUGGESTED LIST OF PRACTICAL

1. Characteristics of thyristor family devices.
2. Study of single phase controlled rectifiers.
3. Study of emergency tube light
4. Study of SCR triggering circuits
5. Study of commutation circuits
6. Electronic speed control of d.c.motor
7. Electronic speed control of induction motor
8. Study of electronic
9. Study of UPS
10. Study of chopper



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REFERENCE BOOKS

1. Power electronics : Circuits, devices & applications,
M. H. Rashid, PHI
2. Power Electronics, P.C. Jain, TMH



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SEMESTER	:	FIFTH
SCHEME	:	JUL.08
NAME OF COURSE (SUBJECT)	:	POWER SYSTEM OPERATION AND PROTECTION (E – 502)
OLD PAPER CODE	:	
NEW PAPER CODE	:	6240
COMMON WITH PROGRAMME (BRANCH)	:	
LECTURE HRS. PER WEEK	:	TH. 06, PR. 02

RATIONALE

A technician has to play an important role in the operation of a power system; so that apart from reliability of operation the system stability is also maintained within the desired limits. It is, therefore, necessary that a technician must understand the problems of system operation.

The protective equipment used in an electrical power system have an important relation with the variety of power system problems, hence the power system operation and protection are being grouped together to make one comprehensive subject.

The curriculum has been designed to meet the requirements of a technician engineer, so that he can skillfully handle the problems of the power system. The contents included in the subject are kept at a level to develop proper skills, knowledge and attitude suiting to the job requirement.



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SEMESTER : FIFTH

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OLD PAPER CODE :

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COMMON WITH PROGRAMME :

(BRANCH)

LECTURE HRS. PER WEEK : TH. 06, PR. 02

SCHEME OF STUDIES

S. NO.	TOPIC	SCHEME OF STUDIES		
		Hrs. of Study		
		Theory	Practical	Total
1	Introduction power system	05	-	05
2	Representation of power system.	07	03	10
3	Fault analysis	10	04	14
4	Modern trends.	10	03	13
5	Introduction to protection	07	04	11
6	Protective relaying.	12	04	16
7	Circuit interruption devices.	15	04	19
8	Protection against over voltages.	09	04	13
9	Protective schemes.	15	04	19
	Total	90	30	120



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LECTURE HRS. PER WEEK : TH. 06, PR. 02

COURSE CONTENT

S.No.	Detailed Course Content	Hours of Study
1.	<p>Introduction to power system -</p> <p>Growth of power system in India, future schemes, various elements of power system. Interconnection, its necessity and advantages, planning, operation and improvement of power system. Load study, type of faults. AC/DC calculating board/digital computers.</p>	3
2.	<p>Representation of power system -</p> <p>Single line diagram, use of standard symbol. Per unit quantity - definition and advantages, base impedance conversion of per unit values from one base values to other base values. Generalized ABCD constants, their values in terms of circuit parameters. To prove $AD-BC=1$ characteristics of ABCD constants. The relations of Z_{so}, Z_{ro}, Z_{rs} in terms of generalized constants.</p>	7
3.	<p>Fault analysis -</p> <p>Type of faults - symmetrical and unsymmetrical.</p> <p>Phase sequence impedance, phase sequence networks, analysis of symmetrical faults. Analysis of L-G, L-L and L-L-G fault by symmetrical components, simple numerical problems.</p>	6
4.	<p>Modern trends -</p> <p>E.H.T Lines, bundled conductors, HVDC system, block diagram, advantages and disadvantages. Block diagram of Power Line Carrier communication.</p>	5
5.	<p>Introduction to protection -</p> <p>Purpose of protective system, requirement and selection. Abnormalities in a power system and their effects. Reasons for failure. Self and non self clearing faults. Use of CT/PT in protective scheme. Definition of terms regarding CT/PT. Advantages of CT/PT. Neutral earthing, their methods and advantages.</p>	5
6.	<p>Protective relay -</p> <p>Type of relays- induction, electromagnetic, thermal. Primary and back up</p>	8

	relaying. Types of back up relays, causes of failure of primary relaying. Explanation of terms used in relaying. Principle and working of different types of relays- electromagnetic and induction type. Induction type over current relay, reverse power relay, time and current settings. Differential relays., distance relays, thermal relays, inverse current characteristics.	
7.	Circuit interruption devices - Function of fuse. fusing factor, fusing characteristic. Application of isolator and circuit breakers. Circuit breaker capacities. Arc formation in C.B. and methods of arc extinction. Definition of various terms with reference to circuit interruption wave form. working principle and operation of Bulk Oil/Minimum oil/air blast/SF CB. Merits and Demerits of different types of C.B.	10
8.	Protection against over voltages - Causes and effects of over voltage. Traveling wave. Over-voltage protection, earth wire, lightning arresters- Multiple gap type, horn gap type, line type, station type and distribution type. Surge absorber.	6
9.	Protective schemes - Protection of alternator- various abnormalities, Merz price differential protection, over current and earth fault protection. Protection of transformer - various abnormalities, differential protection, Buchholz relay. Feeder and transmission line protection - time graded and over current protection, current graded system, differential protection. Protection of Induction motors, use of thermal relays and under voltage protection	10



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LIST OF EXPERIMENTS

S.No.	Name of experiments	Hours of study
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1.	To determine the ABCD constants of a given Π / T network.	30 Hrs.
2.	To determine $Z_{so}, Z_{ss}, Z_{ro}, Z_{rs}$ for a given Π / T network.	
3.	Study of a HVDC system.	
4.	Study and use of CT/PT employed for protection and determine their ratio error.	
5.	Study of an Induction type O/C relay and plot the inverse characteristic.	
6.	To plot the inverse characteristic (current/time) of a given fuse wire.	
7.	To determine the fusing factor of different fuse wire.	
8.	To study the differential protection of transformer/alternator.	
9.	Visit to power station Study of different protective elements/schemes- ground wire Lightning arrestors, fuse, circuit breaker. Study of Min. Oil Circuit breaker.	



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<u>NAME OF COURSE (SUBJECT)</u>	<u>:</u>	<u>UTILIZATION OF ELECTRICAL POWER</u>
		<u>(E – 504)</u>
<u>OLD PAPER CODE</u>	<u>:</u>	
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<u>(BRANCH)</u>		
<u>LECTURE HRS. PER WEEK</u>	<u>:</u>	<u>TH. 04, PR. 02</u>
<u>LECTURE HRS. PER SEMESTER</u>	<u>:</u>	<u>TH. 60, PR. 30</u>

RATIONALE

Utilization of Electrical Power is the important activity in the field of Electrical Engineering. Electrical Power is used for industrial, commercial and domestic purposes. It is, therefore, quite natural that a large number of technicians are called upon to work in establishments which utilize electrical power. The syllabus of the subject is aimed at giving the student a sufficient background to understand the salient features for the utilization of Electrical energy in various fields.



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SCHEME OF STUDIES

S. NO.	TOPIC	SCHEME OF STUDIES		
		Hrs. of Study		
		Theory	Practical	Total
1.	Electrics drives	16	10	26
2.	Electric Heating	10	6	16
3.	Electric welding	6	2	8
4.	Illumination	12	4	16
5.	Power factor improvement	6	4	10
6.	Electro Chemical process & Storage Batteries	10	4	14
	Total	60	30	90



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S.No.	Detailed Course Content	Hours of Study
1.	Electric drives Merits and demerits of electric drives, factors governing selection of motors, drive requirements. Group and individual drive, starting and running characteristics of various motors. Selection of starters, hand operated and contactor type starters, liquid resistor type starter. Speed control of motors, load equalization, use of fly wheel. Motor enclosures, selection of motors for particular service, size and rating of motors.	16
2.	Electric heating Advantages and disadvantages of electric heating, methods of electric heating. Principle of electric heating. Resistance heating, heating elements and alloys. Causes of failures of heating elements.	10

	<p>Arc furnaces, principle, construction, working and uses.</p> <p>Induction heating principle, construction and use of Ajax Wyatt (core type) and coreless type. L.F. and H.F. induction furnaces. Dielectric heating principles and uses.</p>	
3.	<p>Electric welding</p> <p>Definition, classification of electrical welding, principle of arc welding. Qualities of a good weld. Welding defects.</p> <p>Resistance welding, advantages, classification, principle and working, comparison of resistance and arc welding process, A.C. & D.C. arc welding.</p>	6
4.	<p>Illumination</p> <p>Electromagnetic wave spectrum, solid and plane angle, definition of electrical terms in use, sensitivity of human eye. Luminous efficiency, horizontal and vertical laws of illumination, definition of terms used in lighting, lighting scheme, various types of lamps, their use and fittings.</p>	12
5.	<p>Power factor improvements</p> <p>Causes of low P.F., effects of low P.F., methods of improvement of P.F. and its economics.</p>	6
6.	<p>Electro-chemical processes and storage batteries</p> <p>Electro deposition and faraday's laws of electrolysis, various electro-chemical processes like electroplating, electro-extraction, regions.</p> <p>Storage batteries, classification, construction. Battery maintenance, battery charging, circuit diagram. Application of storage batteries.</p>	10



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LECTURE HRS. PER WEEK : TH. 04, PR. 02

LIST OF PRACTICALS

S.No.	Name of experiments	Hours of study
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<p>1.</p> <p>2.</p> <p>3.</p> <p>4.</p> <p>5.</p> <p>6.</p> <p>7.</p> <p>8.</p> <p>9.</p> <p>10.</p>	<p>Speed control of slip ring induction motor by variation of rotor resistance.</p> <p>To verify the change in power factor by changing load parameters and its improvement using capacitance.</p> <p>To draw 'V' curves of synchronous motor.</p> <p>Study and operation of resistance oven and to control its temperature.</p> <p>Study of dielectric / induction heating.</p> <p>Measurement of luminous efficiency of lamps by lux meter.</p> <p>Study and operation of various types of lamps.</p> <p>Study of arc welding.</p> <p>Report on visit/ video demonstration on heating system.</p> <p>Report on visit/video film on welding system</p>	<p>30 Hours</p>
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