

INSTITUTE	DIPLOMA STUDIES
PROGRAM	DIPLOMA ENGINEERING (ELECTRICAL ENGINEERING)
SEMESTER	2
COURSE TITLE	ELECTRICAL CONTROL PANEL DESIGN
COURSE CODE	09EE3105
COURSE CREDITS	3

Objective:

- 1 The electrical control panel is the brain center for all process industry and represent important element in the proper working and performance of the system. To prepare students with the knowledge and practical skills required to design, interpret, and implement electrical control panels used in industrial and commercial applications, ensuring safety, functionality, and adherence to standards.

Course Outcomes: After completion of this course, student will be able to:

- 1 To understand & apply the use of appropriate tools and testing equipment for electrical panels, and develop panel wiring diagrams using software tools in compliance with electrical standards.
- 2 To understand & apply the concepts of switchgear, measuring equipment, earthing, busbar arrangements, contactors, and interlocking in electrical panel.
- 3 To apply skills in the installation, operation, testing, and maintenance of electrical panels.
- 4 To understand concept of automation and electrical drive.

Pre-requisite of course: Basic knowledge of DC circuit, AC circuit and electrical practices.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
0	0	6	0	30	20	25	25

Contents : Unit	Topics	Contact Hours
Total Hours		

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment 1 To apply knowledge of types of cable, cable construction, cable lying, cable joint, cable rating & size, cable tray, lug and lug crimping for connection to panel.	4
2	Experiment 2 To apply knowledge of types of wire, wire connector, wire rating, wire laying, ferrule, terminal blocks and din rails with control panel and understand fundamental of color code of wire.	4
3	Experiment 3 To apply the appropriate connections for different types of switches (such as push-button, selector, rocker, rotary cam, emergency switches, etc.) in an electrical panel according to the design specifications.	2
4	Experiment 4 To apply knowledge of tools, safety equipment and testing equipment during panel wiring.	2
5	Experiment 5 To Identify importance of different type of panel indicator lamp with its operation.	2
6	Experiment 6 To understand connection of analog and digital instruments, also perform connection of protective and control instruments- Fuse, MCB, MCCB, RCCB and ELCB.	4
7	Experiment 7 To identify measuring instruments CT, PT, volt meter, ammeter, frequency meter, energy meter, KW meter, PF meter, energy meter, reactive power meter, multi-function meter for panel parameter checking.	2
8	Experiment 8 To Identify different types of earthing and necessity of neutral and grounding for an electric panel.	4
9	Experiment 9 To prepare general arrangement diagram of bus bar for panel application with dimension	2
10	Experiment 10 To apply knowledge of relay and contactor as per application of control panel.	6
11	Experiment 11 To select circuit breaker as per rating of control panel.	4
12	Experiment 12 To demonstrate interlocking in control panel.	2
13	Experiment 13 To use DC supply, inverter, UPS, battery and battery charger for control and measuring purpose in an electrical control panel.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
14	Experiment 14 To select distribution box for LT, HT, domestic, commercial, industrial, LDB, MLDB ASB, HDB, MDB, MCB, MCCB types of control panel	2
15	Experiment 15 To prepare layout and general arrangement drawing of internal structure of panel.	6
16	Experiment 16 To identify and use different symbols, abbreviations, color code, electrical code and standards for panel wiring and prepare diagram according to requirement.	2
17	Experiment 17 To differentiate drawing of control circuit and power circuit of control panel and prepare control and wiring diagram as per requirement.	2
18	Experiment 18 To understand types of loads, load distribution, load calculation and power management of panel.	2
19	Experiment 19 To identify specification of control panel as per requirement of customer during visit.	2
20	Experiment 20 To prepared design of control panel as per connected load by using various electrical, electronics and instrumentation component.	4
21	Experiment 21 To demonstrate procedure of installation, commissioning and testing of control panel.	2
22	Experiment 22 To identify enclosure material, name plate details, capacity and arrangement of panel.	2
23	Experiment 23 To identify faulty components, perform maintenance and troubleshooting on the control panel, and analyze the protection systems provided for the panel	4
24	Experiment 24 To understand, need, application, basic concept and essential component of industrial automation.	4
25	Experiment 25 To understand basic concept of PLC, SCADA, DCS, HMI and necessity of control system.	2
26	Experiment 26 To apply knowledge of PLC for design electrical control diagram of suitable panel.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
27	Experiment 27 To understand construction, types, working details, protection, starter and its control circuit of electric drives.	4
28	Experiment 28 To demonstrate basic components, working details, protection, application, soft starter and its control panel circuit of electrical drives.	4
Total Hours		84

Textbook :

- 1 Electrical Workshop, R. P. Singh, I.K. International Publishing House Pvt Lts, 2013
- 2 Database Design for Electrical Panels, Shalini Gupta, Monte DePouw & John Ventura, NA, 2012

References:

- 1 Electrical Workshop, Electrical Workshop, R. P. Singh, I.K. International Publishing House Pvt. Ltd., 2013
- 2 Electrical Engineering Drawing I & II, Electrical Engineering Drawing I & II, Singh, S. K. Surjit, Kataria & Sons, 2012
- 3 Electrical Wiring, Estimating and Costing, Electrical Wiring, Estimating and Costing, S. L. Uppal & G. C. Garg, Khanna Publication, 2012
- 4 Handbook of Electrical Design Details, Handbook of Electrical Design Details, Neil Sclater & John E. Traister, The McGraw-Hill Companies, 1997
- 5 Electrical Wiring Industrial, Electrical Wiring Industrial, Electrical Wiring Industrial, Electrical Wiring Industrial, Stephen L. Herman, NA, 2014
- 6 Interpreting the National Electrical Code, Interpreting the National Electrical Code, Truman C. Surbrook , 9 editions , 2011
- 7 National Electrical Code 2017, National Electrical Code 2017, NA, NA, 2016

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOC setc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

- 1 <http://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/design-of-industrial-control-panels>
- 2 <http://electrical-engineering-portal.com/download-center/books-and-guides/schneider-electric/control-panel-design>
- 3 <http://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/industrial-control-wiring-guide>
- 4 <http://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/industrial-control-panels>
- 5 <http://electrical-engineering-portal.com/electrical-design-plc-panel-wiring-diagrams>
- 6 <http://electrical-engineering-portal.com/tips-wiring-industrial-control-panel>
- 7 <http://aptronnoida.in/best-dcs-and-panel-designing-training-in-noida.html>
- 8 <https://ipcsautomation.com/Electric+Control+Panel+Designing/Training/>
- 9 <https://www.siemens.com/nl/nl.html>