13. Courses of Study and Scheme of Assessment

BE ELECTRICAL AND ELECTRTONICS ENGINEERING (SANDWICH) (2019 Regulations)

Course Code	Course Title	Periods / week				Maximum Marks			
		Lecture	Tutorial	Practical	Credits	CA	FE	Total	CAT
SEMESTER IX									
19E____	Professional Elective III	3	0	0	3	50	50	100	PE
19E____	Professional Elective IV	3	0	0	3	50	50	100	PE
19E____	Professional Elective V	3	0	0	3	50	50	100	PE
19_____	Open Elective II	3	0	0	3	50	50	100	OE
19E720	Project Work I	0	0	4	2	100	0	100	EEC
19E900	Industrial Training IX	0	0	10	5%	100	0	100	EEC
	Total 16 periods	**12**	**0**	**4+10**	**14+5%**	**400**	**200**	**600**	
SEMESTER X									
19E	Professional Elective VI	3	0	0	3	50	50	100	PE
19E820	Project Work II	0	0	8	4	50	50	100	EEC
	Total 11 periods	**3**	**0**	**8**	**7**	**100**	**100**	**200**	

% Will be counted for TGPA computation
CA Continuous Assessment
FE Final Examination

CAT - Category; BS - Basic Science; HS - Humanities and Social Sciences; ES - Engineering Sciences; PC - Professional Core; PE - Professional Elective; OE - Open Elective; EEC - Employability Enhancement Course; MC – Mandatory Course

PROFESSIONAL ELECTIVES

Group A: Electrical/Power

19E001 Flexible AC Transmission Systems
19E002 Special Machines and Controllers
19E003 Utilization and Conservation of Electrical Energy
19E004 Advanced Control Systems
19E005 Smart Grid
19E006 Industrial Automation
19E007 HVDC Transmission
19E008 Power Quality Management
19E009 Power System Operations and Control
19E010 Hybrid Electric Vehicles
19E011 High Voltage Engineering

Group B: Electronics / Embedded

19E012 Embedded Systems and Internet of Things
19E013 System Design using FPGA
19E014 VLSI Design
19E015 Mixed Signal VLSI Design
19E016 Virtual Instrumentation
19E017 Communication Systems
19E018 Automotive Electrical and Electronics Systems
19E019 Wearable Electronics
19E020 Electronic Product Design
19E021 Digital Image Processing

Group C : Computer

19E022 Advanced Data Structures
19E023 Computer Networks
19E024 Software Project Management and Quality Assurance
19E025 Advanced Computer Architecture
19E026 Internetworking and Applications
19E027 Java Programming
19E028 Relational Database Management Systems
19E029 Operating systems
19E030 Neural Networks and Fuzzy Systems
19E031 Linux Architecture
19E032 Total Quality Management

ONE-CREDIT COURSES

19EF01 LV Switchgears
19EF02 Energy Auditing and Conservation Techniques
19EF03 Electrical Safety Standards and Practices
19EF04 Automotive Electrical Systems
19EF05 CAD Tools for VLSI Design Automation
19EF06 Digital Design with Verilog HDL
19EF07 Graphical Programming
19EF08 Advanced Graphical Programming
19EF09 Low Power Microcontrollers and Applications
19EF10 Controller Design and Simualtion Using Dspace
19EF11 Solar PV Systems Design Simulation Monitoring and Control
19EF12 Power Electronics in More-Electric Aircraft
19EF13 Field Programmable Analog Array for Analog System Design
19EF14 Systems Engineering for Automotive Applications
19EF15 Electrical Vehicles
19EF16 Phasor Measurement Units and Applications
19EF17 Industrial Drives for Automation
19EF18 Data Science and Analytics for Electrical Engineers
19EF19 Electrical Power on-board War Vessels and Aircraft
19EF20 Aerospace Avionics
19EF21 1-D Model Based System Design for Control System Applications
19EF22 Printed Circuit Board Design and its Fabrication
19EF23 Digital System Design and Verification Using System Verilog
19EF24 Metrology for Electrical Engineers
19EF25 Embedded Linux
19EF26 Internet of Things using CC3200

LANGUAGE ELECTIVES

19G001 Communication Skills for Engineers
19G002 German- Level A1.1
19G003 French Language Level 1
19G004 Basic Japanese

ENGLISH
19GF01 Interpersonal and Organizational Communication
19GF02 Human Values Through Literature

HUMANITIES
19OFA1 Export – Import Practices
19OFA2 Insurance - Concepts and Practices
19OFA3 Public Finance
19OFA4 Security Analysis and Portfolio Management

Summary of Credit Distribution

BE ELECTRICAL AND ELECTRONICS ENGINEERING (SANDWICH)												
S. No	**Course Category**	**Credits Per Semester**										**Total Credits**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
1	HS	3	2	3	0	0	0	0	0	0	0	8
2	BS	10	12	4	3	0	0	0	0	0	0	29
3	ES	5	4	9	8	0	0	0	0	0	0	26
4	PC	0	0	4	8	19	16	7	12	0	0	66
5	PE	0	0	0	0	0	0	3	3	9	3	18
6	OE	0	0	0	0	0	0	0	3	3	0	6
7	EEC	0+5%	0+2+5%	0+5%	1+5%	1+5%	1+5%	1+5%	0+5%	2+5%	4	12
8	MC	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	**18+5%**	**18+2+5%**	**20+5%**	**20+5%**	**20+5%**	**17+5%**	**11+5%**	**18+5%**	**14+5%**	**7**	**165**

% Will be counted for TGPA (Training Grade Point Average) computation

CAT - Category; BS - Basic Science; HS - Humanities and Social Sciences; ES - Engineering Sciences; PC - Professional Core; PE - Professional Elective; OE - Open Elective; EEC - Employability Enhancement Course; MC – Mandatory Course.

19E100 INDUSTRIAL TRAINING I

0 0 10 5*

MODULE 1 – INTRODUCTION TO INDUSTRIAL ENVIRONMENT AND PRACTICES: Definition of industry, types of industry - product, process, hybrid; Different scales of operations - large, medium, small, tiny; Industry definitions and examples; Organizational structure and various departments, functions within an industry; Equipment and personal industrial safety (general and electrical) and discipline outside industries. [10]

MODULE 2 - FAMILIARIZATION OF MECHANICAL HAND TOOLS: Screw drivers, spanners, pliers, hammers, chisels and wrenches; Dismantling and assembly - CPU, pump, etc. [10]

MODULE 3 - FAMILIARIZATION OF ELECTRICAL AND ELECTRONICS TOOLS: Tester, clamp meter, multi meter, crimper, wire cutter, Philip screw drivers, soldering iron etc; Simple exercises - checking the fuse, junction box wiring, soldering a circuit, crimping of wires and USB socket. [10]

MODULE 4 - FAMILIARIZATION OF CARPENTRY HAND TOOLS: Chisel, mallets, jack planes, mortise gauge, hand saw, etc; Simple exercises - sawing and planning, nailing a wooden box, making of different type of joints, making a table /wooden box/ models. [10]

MODULE 5 - FAMILIARIZATION OF FITTING TOOLS: Files, hacksaw, tri-square, rulers, punches, chisel, etc; Simple exercises - filing, marking, cutting, fitting, forming. [10]

MODULE 6 - FAMILIARIZATION OF MEASURING TOOLS AND INSTRUMENTS: Measuring tape, foot ruler, vernier, micrometer, calipers, bore-dial, gauges, anemometer, hygrometer/sling psychrometer, thermo-couples, pyranometer, etc; Measurement of various pump components, wind speed, humidity, temperature, and radiation. [10]

MODULE 7 - FAMILIARIZATION OF PLUMBING TOOLS: Pipe wrench, threading die, etc; Simple exercises - threading of pipes, construction of water line using GI and PVC fittings etc. [20]

MODULE 8 - FAMILIARIZATION OF FOUNDRY TOOLS: Moulding boxes, board, trowels, riser and sprue pins, vent wires, strike bar, bellows, rammers, etc; Simple exercises - moulding of solid pattern, split pattern, core making, gate , runner and riser cutting, casting of simple component with aluminum etc. [20]

MODULE 9 - FAMILIARIZATION OF CIVIL TOOLS: Trowels, plumb block, water level, spirit level, etc; Simple exercises - making of small model with cement mortar, stacking of bricks as a wall, fabrication of reinforcement structures in MS, etc. [20]

MODULE 10 - CONCEPTS OF BASIC SCIENCE: Hands-on experiments relating to concepts of Basic Physics and Chemistry – Forces, Hooke's Law, Newton's Law, Work Energy Theorem, gyroscope, flow sensors, models mimicking human mechanisms – applications in industry. [20]

MODULE 11 - INDUSTRIAL VISITS: Motor and pump manufacturing, engineering machinery manufacturing and foundry. [10]

Total: P: 150

REFERENCES:

1. Module-wise "Industrial Training Manual" prepared by Training Department, PSG Industrial Institute.

19E200 INDUSTRIAL TRAINING II

0 0 10 5*

MODULE 1 – INTRODUCTION TO INDUSTRIAL SAFETY: Procedure, equipment, safety programme, safety standards, OSHA act, first aid and safety symbols. [10]

MODULE 2- DISMANTLING AND ASSEMBLY OF DOMESTIC APPLIANCES - Wet grinder, mixie, electric iron box, fan, etc. [10]

MODULE 3 – EXPOSURE AND HANDS ON EXERCISES ON DOMESTIC ELECTRICAL WIRING - Tube light fitting, two-way switch, fan and regulator, motor starter, etc. [10]

MODULE 4 – HANDS ON EXERCISES ON ELECTRONIC COMPONENTS: PC boards, bread boards, gates, microprocessors and other electronic components. [20]

MODULE 5 - DISMANTLING AND ASSEMBLY OF HYDRAULIC COMPONENTS - Water taps, flush tanks, hand pump and gear pump, valves, etc. [20]

MODULE 6 - HANDS ON EXERCISES ON ROTATING MACHINES – MONOBLOCK PUMPS - Winding, assembly, stator and rotor fabrication, inspection, painting, testing, balancing, and machining etc. [10]

MODULE 7 - HANDS ON EXERCISES ON ROTATING MACHINES – SUBMERSIBLE PUMPS - Winding, assembly, stator and rotor fabrication, inspection, painting, testing, balancing, and machining etc. [10]

MODULE 8 - HANDS ON EXERCISES – BASIC FOUNDRY PRACTICES – Understanding of fundamental Foundry processes and practices – melting, pouring, pattern-making, machining, testing and inspection. [10]

MODULE 9 - HANDS ON EXERCISES - BASIC LATHE ASSEMBLY – Headstock, tailstock, apron and feedbox, gearbox assembly. [10]

MODULE 10 – BASIC SCIENCE CONCEPTS: Hands-on experiments with wireless sensors – acceleration, pressure, light, current, voltage, heart rate, conductivity, spirometer, CO2, O2 - applications in Industry. [20]

MODULE 11 – INDUSTRIAL VISITS TO VARIOUS PROCESS INDUSTRIES [20]

Total: P: 150

REFERENCES:

1. Module-wise "Industrial Training Manual" prepared by Training Department, PSG Industrial Institute.

19E300 INDUSTRIAL TRAINING III

0 0 10 5*

MODULE 1 - ELECTRICAL MOTOR AND PUMP ASSEMBLY I : Motor - Induction motor- parts and materials - principles of working – construction - preparation of exploded view of TEFC motor assembly - testing and inspection - industrial applications. **Pump**: Principle of operation - parts and materials- working- pump casing - types of impeller - specifications - industrial applications. [20]

MODULE 2 - ELECTRICAL AND ELECTRONICS MEASUREMENTS - Electrical: Definition of instruments – classification - absolute - secondary: indicating instruments, recording, integrating, and electro mechanical- ammeter - voltmeter – wattmeter – energy meter - transformer- transducer- CRO – DSO – Megger - digital multimeter - Industrial applications. **Electronics:** analog meter - MI-MC- Industrial applications . [10]

MODULE 3 - E-LEARNING USING ELECTRICAL SOFTWARE PORTAL – On-line training modules in areas specific to Industry aspects of Electrical and Electronics Engineering. [30]

MODULE 4 – **EARTHING AND LIGHTNING ARRESTER -** Earthing **–** Types of Earthing and their operating principles and applications – Lightning Arrester – Working Principle. [10]

MODULE 5 - WELDING: Introduction- types of welding- arc welding- MIG and TIG welding -gas welding- working principle – types of welding joints and their applications [20]

MODULE 6 - TURNING: Types of Lathes and their electrical characteristics and control systems - parts and materials- principle- construction- working -assembly – testing- painting- applications. [20]

MODULE 7 - FOUNDRY ELECTRICAL PRACTICES - Moulding boxes, board, trowels, riser and spruce pins, vent wires, strike bar, bellows, rammers; Simple exercises – types of foundry machines and equipment – electrical characteristics and control systems [10]

MODULE 8 - CNC MACHINES : CNC - Open and closed loop Systems - Motion Control systems -Elements of CNC systems - Input devices – CPU / Machine Control unit - Machine tool driving systems - Types of motors used in CNC – feedback devices – Display unit machine axes – Machine programming -advantages and disadvantages- Industrial applications. [20]

MODULE 9 - INDUSTRIAL VISITS: Visits to Industry specific to the topics within the other modules, and submission of a report on Industrial applications of these topics. [10]

Total: P: 150

REFERENCES:

1. Sharma PC, "Machine Tools and Tool Design", S. Chand & Company, 2004.
2. Sawhney AK, "Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai& Sons Company,2004.
3. Parmar RS , "Welding, Turning Process & Technology", Khanna Publisher,2011.
4. Naidu MS, Kamaraju V, Wadhwa CL,"High Voltage Engineering", McGraw-Hill Education-Europe ,2006.

19E400 INDUSTRIAL TRAINING IV

0 0 10 5*

MODULE 1 – ELECTRICAL PARAMETERS IN MACHINING OPERATIONS - Electrical characteristics and control mechanisms in Drilling, Milling, Boring, Broaching and Vertical Turret Lathe. [20]

MODULE 2 - PCB LAYOUT & FABRICATION - Designing and Layout of PCB's – applications of PCB's in different types of Industries - Trouble shooting and Testing [20]

MODULE 3 - ELECTRICAL MOTOR AND PUMP ASSEMBLY II - Winding – Types of Winding, Slots, Insulation - **Testing -** Megger Test, High Voltage and Resistance testing**.** [20]

MODULE 4 - E-LEARNING USING ELECTRICAL SOFTWARE PORTAL – On-line training modules in areas specific to Industry aspects of Electrical and Electronics Engineering. [30]

MODULE 5 – AUTOMOTIVE WIRING - Types of automotive wiring in 2-wheelers and 4-wheelers - Battery types – Alternator – Relays and other protection devices. [20]
MODULE 6 – COMPUTER ASSEMBLY – Parts and function - assembly –installation - trouble shooting, [10]

MODULE 7 – TRANSFORMERS - Types of transformers - function – working principle - windings-advantages and disadvantages – Industrial applications. [10]

MODULE 8 – CIRCUIT BREAKERS – Types of circuit breakers – need, Miniature Circuit Breakers, nomenclature and applications – hands-on experiments on load and circuit breakers. [10]

MODULE 9 - INDUSTRIAL VISITS: Visits to Industry specific to the topics within the other modules, and submission of a report on Industrial applications of these topics. 10]

Total: P: 150

REFERENCES:

1. Dasgupta Indrajit,"Design of Transformers", Tata McGraw-Hill Publishing Company, New Delhi,2002.
2. Singh Ravindra P.,"Power system switchgear and protection", PHI Learing Pvt.Ltd., 2009.
3. Volk Michael ,"Electrical motor & Pump Assembly", Taylor &Francis, 2008.
4. Khandpur RS ,"PCB Design, fabrication, Assembly & testing", Tata McGraw-Hill Education, 200

19E500 INDUSTRIAL TRAINING V

0 0 10 5*

MODULE 1 – PROJECT MANAGEMENT I - Ongoing in-campus projects **-** Project formulation and definition of scope and objectives – Project Charter and Plan – Project methodology and status monitoring and reporting – tracking milestones – managing resources, risks and variances. [40]

MODULE 2 – E-LEARNING USING ELECTRICAL AND ELECTRONICS SOFTWARE PORTAL – On-line electrical and electronics related modules in areas of Internet of Things, Business Excellence, Quality, Safety, Industry 4.0. [30]

MODULE 3 – INDUSTRIAL AUTOMATION - Hands-on exercises in advanced Industrial Automation Laboratories relating to Electro-hydraulics, Electro-pneumatics, Mechatronics, Drives and Controls, Industry 4.0 kits. [60]

MODULE 4 – INDUSTRIAL VISIT – Visit to an Industry specific to the topics within the other modules, and submission of a report on Industrial applications of these topics. [20]

Total: P: 150

REFERENCES:

1. Walter RB, "Hydraulic & electric hydraulic control system",1991.
2. Obodovski, Daniel ," The silent Intelligence : The internet of things", Elsevier Science,2013.
3. Asfakhi C.Ray & Rieske, David W," Industrial safety and health management 6th edition",Pearsons Education, 2009.
4. Schwab, Klaus ,"The fourth industrial revolution", Penguin Books Ltd, 2016.

19E600 INDUSTRIAL TRAINING VI

0 0 10 5*

MODULE 1 – PROJECT MANAGEMENT II - Ongoing in-campus projects **-** Data analytics and project dashboard preparation – project financial planning. [40]

MODULE 2 – E-LEARNING USING ELECTRICAL AND ELECTRONICS SOFTWARE PORTAL – On-line electrical and electronics related modules in areas of Internet of Things, Business Excellence, Quality, Safety, Industry 4.0. [30]

MODULE 3 – INDUSTRIAL AUTOMATION - Hands-on exercises in advanced Industrial Automation Laboratories relating to Electro-hydraulics, Electro-pneumatics, Mechatronics, Drives and Controls, Industry 4.0 kits. [60]

MODULE 4 – INDUSTRIAL VISIT – Visit to an Industry specific to the topics within the other modules, and submission of a report on Industrial applications of these topics. [20]

Total: P: 150

REFERENCES:

1. Obodovski ,Daniel ,"The silent Intelligence : The internet of things", Elsevier Science , 2013.
2. Asfakhi C.Ray & Rieske, David W," Industrial safety and health management 6th edition , Pearsons Education ,"2009.
3. Klaus Schwab ,"The fourth industrial revolution", Penguin Books Ltd, 2016.
4. Krishnan R" Electric motor drives : modeling, analysis and control", Prentice Hall ,2015.

19E700 INDUSTRIAL TRAINING VII

0 0 10 5*

EXTERNAL INTERNSHIP –Internship at a suitable manufacturing industry and / or university within India or overseas as per the timeline indicated in the scheme of syllabus. (150)

Norms and guidelines for internship:

The students of seventh semester will undergo Internship as detailed below.

No. of working hours - 8 hours per day or as instructed by the industry; students will strictly follow the industry norms and timings.

During the course of internship, students will study the following with respect to the industry, with specific emphasis on work allocation as provided by the Industry supervisor:Industry profile, product range, catalogue, infrastructure, turnover, labor force, industrial structure, location, layout, ISO9000 and other standards, product development, manufacturing and material handling systems, and quality systems.

Evaluation of students' performance during the internship will be carried out through faculty visit to industry, presentation, viva-voce and technical report.

Students will identify the scope for future assignments which could be extended as projects.

Total: P: 150

REFERENCES:
As this is an industry-oriented course, students will be governed by the regulations of the industry they are assigned to, and hence no specific reference books are prescribed.

19E800 INDUSTRIAL TRAINING VIII

0 0 10 5*

MODULE 1 – INDUSTRIAL STATUTES AND GOVERNANCE : Governance aspects of an Industry - Wages and salary administration, Welfare Benefits – ESI, PF, Bonus, Incentive schemes - Statutes and Labour Laws. Standing Orders - Disciplinary action and domestic enquiry - Negotiations with unions on wages and Bonus - Representation before Tribunals, Labour Court - Training and Development – career planning and performance appraisals - Rewards and Incentive schemes - Counselling and attrition planning – exit interviews - Pollution norms and Workmen's Compensation Act. [70]

MODULE 2 – INDUSTRY OPERATIONS AND FINANCIAL INDICES – Industry Operational parameters and indices, Financial performance indicators, Assets and Capital Management - Balance sheets and annual reports , Pollution compliance reports. [60]

MODULE 3 – TOTAL QUALITY MANAGEMENT – TQM Evolution, Quality Gurus, Deming's 14 points, Customer Satisfaction, 5S, Six Sigma, CMM, Quality Management Tools - Industrial Safety and standards - Indian Standards relating to Manufacturing and Electrical Engineering. [20]

Total: P: 150

REFERENCES:

1. R.K.Jain, Sunil S.Rao, "Industrial Safety, Health and Environment Management Systems", Khanna Publishers, 2000
2. Taxmann, Labour Laws, Taxmann's Store, 2019
3. James Riggs, David Bedworth, Sabah Randhawa, "Engineering Economics", 4th edition, Tata McGraw Hill, 2004
4. Nandan H., "Fundamentals of Entrepreneurship" , Prentice Hall India, New Delhi, 2013

19E900 INDUSTRIAL TRAINING IX

0 0 10 5*

MODULE 1 – ENVIRONMENTAL AND SOCIETAL IMPACT OF INDUSTRY : Corporate Social Responsibility relevant to an Industry – societal and environmental issues relating to Industry and their possible solutions – regional, state, national and global statistics relating to Manufacturing and Industry. [50]

MODULE 2 – PREPARATION OF INDUSTRY ANNUAL REPORT – Factors and parameters relating to various aspects of Industry, and preparation of an Industry Annual Report. [100]

Total: P: 150

REFERENCES:

1. R.K.Jain, Sunil S.Rao, "Industrial Safety, Health and Environment Management Systems", Khanna Publishers, 2000
2. Taxmann, Labour Laws, Taxmann's Store, 2019
3. James Riggs, David Bedworth, Sabah Randhawa, "Engineering Economics", 4th edition, Tata McGraw Hill, 2004
4. Nandan H., "Fundamentals of Entrepreneurship" , Prentice Hall India, New Delhi, 2013