

13. Courses of Study and Scheme of Assessment
BE PRODUCTION ENGINEERING

(2019 Regulations)

Course Code	Course Title	Periods / week			Maximum Marks					
		Lecture	Tutorial	Practical	Credits	CA	FE	Total	CAT	
SEMESTER IX										
19P___	Professional Elective IV	3	0	0	3	50	50	100	PE	
19P___	Professional Elective V	3	0	0	3	50	50	100	PE	
19P___	Professional Elective VI	3	0	0	3	50	50	100	PE	
19___	Open Elective I	3	0	0	3	50	50	100	OE	
19P710	Industrial Engineering and Lean Practices Laboratory	0	0	4	2	50	50	100	PC	
19P720	Project Work I	0	0	4	2	50	50	100	EEC	
19P900	Industrial Training IX	0	0	10	5*	100	0	100	PC	
Total 20 periods		12	0	8+10	16+5*	400	300	700		
SEMESTER X										
19___	Open Elective II	3	0	0	3	50	50	100	OE	
19P820	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 (Training Grade Point Average) 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.

LANGUAGE ELECTIVES

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

PROFESSIONAL ELECTIVES

19P001	Mechatronics
19P002	Modeling and Control of Dynamic Systems
19P003	Maintenance and Safety Engineering
19P004	Finite Element Applications in Manufacturing
19P005	Design and Manufacture of Gears
19P006	Product Lifecycle Management
19P007	Surface Engineering and Tribology
19P008	Manufacture of Automotive Components
19P009	Lean Manufacturing
19P010	Material Handling Systems
19P011	Non -Traditional Machining Techniques
19P012	Supply Chain Management
19P013	PLC Programming and Applications
19P014	Mechanical Vibrations
19P015	Precision Manufacturing
19P016	Product Development Strategies
19P017	Composite Materials Processing
19P018	Industrial Ergonomics
19P019	Computational Fluid Dynamics
19P020	Six Sigma
19P021	Additive Manufacturing
19P022	Measurement Systems
19P023	Statistical Quality Control
19P024	Automated Assembly System Design
19P025	Sustainable Mobility and Logistics

ONE-CREDIT COURSES

PRODUCTION ENGINEERING

19PF01	Precision Machining
19PF02	Non Destructive Testing of Aircraft Structures
19PF03	Introduction to Design and manufacture of Armour Systems
19PF04	Advanced Materials for Armour Applications

HUMANITIES

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

ENGLISH

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

Summary of Credit Distribution

BE PRODUCTION ENGINEERING (SANDWICH)												
S. No	Course Category	Credits Per Semester										Total Credits
		1	2	3	4	5	6	7	8	9	10	
1	HS	5	2	3	0	0	0	0	0	0	0	10
2	BS	10	11	3	0	3	0	0	0	0	0	27
3	ES	4	5	11	10	0	0	0	0	0	0	30
4	PC	0+5*	0+5*	4+5*	5+5*	15+5*	16+5*	5+5*	12+5*	2+5*	0	59
5	PE	0	0	0	0	0	3	3	3	9	0	18
6	OE	0	0	0	0	0	0	0	0	3	3	6
7	EEC	0	0+2 [£]	0	1	1	1	0	4	2	4	15
8	MC	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	19+5*	18+2+5^{£*}	21+5*	16+5*	19+5*	20+5*	8+5*	19+5*	16+5*	7	165

£ Summer Term Course(s)

* 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.

19P100 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, crimping, 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 planing, 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.

19P200 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.

19P300 INDUSTRIAL TRAINING III

0 0 10 5*

MODULE 1 - POWER TRANSMISSION SYSTEMS I: Exposure to different modes of power transmission using V-belt and flat belt, rope, chain and sprocket, etc.; Development of schematic diagrams and models for typical applications. (10)

MODULE 2 - POWER TRANSMISSION SYSTEMS II: Familiarization of gear drive systems comprising spur gears, helical gears, bevel gears, worm and worm wheel and rack and pinion; Development of schematic diagrams and models for typical applications such as speedometer, wall clock mechanism, etc. (20)

MODULE 3 - MECHANISMS: Hands-on exercises on building replica of machines, mechanisms, bridges, and vehicles using miniature assembly kits, foam, wood, etc. (20)

MODULE 4 - SHEETMETAL WORKING: Familiarization of sheet metal tools and processes; Making of simple sheet metal objects like dust pan, measuring jar, coin bank, etc., taking into consideration aesthetic, safety and ergonomic design aspects. (10)

MODULE 5 - WELDING I: Familiarization of welding tools and welded joints; Fabrication of simple objects like letter shapes, desk stand, window frame, ladder, etc. (20)

MODULE 6 - MACHINING: Hands-on exercises on machining of industrial components using operations like facing, plain turning, step turning, taper turning, chamfering, grooving, drilling, reaming, tapping, counter boring, countersinking, etc. (20)

MODULE 7 - METROLOGY: Measurement of geometrical parameters such as straightness, flatness, angularity and perpendicularity; Measurement of surface roughness; Calibration of instruments using slip gauges. (10)

MODULE 8 - ELECTRONIC CIRCUITS II: Assembly of simple electronic systems like electronic doorbell, digital clock, electronic horn, water level indicator, etc. (20)

MODULE 9 - E-LEARNING USING MANUFACTURING SOFTWARE PORTAL: Online manufacturing related certification modules on engineering drawing, joining processes, safety, and electrical systems. (10)

MODULE 10 - INDUSTRIAL VISITS: Visit to various process industries associated with food, milk, textiles etc. (10)

Total: P: 150

REFERENCES:

1. Sharma PC, “Machine Tools and Tool Design”, S. Chand and Company, 2004.
2. Faculty of Mechanical Engineering, PSG College of Technology, “Design Data”, Kalaikathir Achchagam, 2012.
3. HMT, “Production Technology”, Tata McGraw Hill Ltd., 2009.
4. Daniel E Puncochar Ken Evans, “Interpretation of Geometric Dimensioning and Tolerancing”, Industrial Press, 2011.

19P400 INDUSTRIAL TRAINING IV

0 0 10 5*

MODULE 1 - PREPARATION OF PROCESS CHART: Interpretation of production drawings, identification of part features and their corresponding manufacturing processes, tooling and inspection gauges; preparation of process chart. (10)

MODULE 2 - PREPARATION OF PRODUCTION DRAWING I: Creation of geometric models based on 2D drawings; Assigning limits, fits and tolerances, and surface finish based on the specified functional requirements; Preparation of production drawing using modeling software. (20)

MODULE 3 - MACHINING USING SPECIAL PURPOSE MACHINES: Introduction to jigs, fixtures, work and tool holding equipment; Hands-on exercises on machining typical engineering components using milling, grinding and shaping operations. (20)

MODULE4 - CNC PART PROGRAMMING I: Generation of CNC codes for a given part using manual programming and automated programming using CAM software, and cycle time estimation. (20)

MODULE5 - ADDITIVE MANUFACTURING TECHNIQUES: Building prototype models using additive manufacturing techniques. (10)

MODULE6 - WELDING II: Familiarization of MIG and TIG welding techniques, fabrication of components and assemblies. (10)

MODULE7 - DISMANTLING AND ASSEMBLY I: Dismantling and assembly of machine sub-assemblies like headstock, tailstock, apron box, thread and feed gear box. (10)

MODULE8 - DISMANTLING AND ASSEMBLY II: Dismantling and assembly of automotive vehicles-two wheeler and BAJA vehicles. (20)

MODULE9 - METALLURGICAL AND NON-DESTRUCTIVE TESTING: Microstructure study on spheroidal graphite and steel castings; Hardness testing of various materials such as mild steel, cast iron, aluminium, brass, bronze, rubber and plastics; Ultrasonic, magnetic particle and die penetrant testing on shafts. (10)

MODULE10 - E-LEARNING USING MANUFACTURING SOFTWARE PORTAL: Online manufacturing related certification modules on machining, casting, heat treatment, plating, etc. (10)

MODULE 11 - INDUSTRIAL VISITS: Visit to various process industries such as cement, paper, automated foundries, dyeing industries. (10)

Total: P: 150

REFERENCES:

1. Daniel E Puncocchar, Ken Evans, "Interpretation of Geometric Dimensioning and Tolerancing" Industrial Press, 2011.
2. Hoffman EG, "Jigs and Fixtures Design", Thomson Learning, 2005.
3. Pham D T, Dimov SS, "Rapid manufacturing", The technologies and applications of rapid prototyping", Springer-Verlag, 2001.
4. Little R L, "Welding and Welding Technology", Tata McGraw Hill, New Delhi, 2004.

19P500 INDUSTRIAL TRAINING V

0 0 10 5*

MODULE 1 - DEVELOPMENT OF FREE HAND DRAWINGS: Free hand sketching of orthographic views and sectional views of the parts of a typical assembly like pump assembly; Dimensioning the sketches after measurement of size of the features of the part and assembly. (10)

MODULE 2 - DEVELOPMENT OF GEOMETRIC MODELS: Conversion of free hand sketches of the selected assembly into geometric models using any solid modeling software; Preparation of bill of materials. (20)

MODULE 3 - PREPARATION OF PRODUCTION DRAWING II: Identification of fits and tolerances based on the application of the selected assembly; Determination of dimensional and geometrical tolerances, and surface finish for the part features. (10)

MODULE 4 - PROCESS PLANNING AND COST ESTIMATION: Identification of suitable manufacturing processes for various parts of the selected assembly; Preparation of process plans that highlight necessary tooling, spindle speeds and feeds; Cost estimation of parts and assembly. (20)

MODULE 5 - MACHINING TIME CALCULATION: Estimation of machining time for various parts of the selected assembly; Preparation of PERT/CPM charts. (10)

MODULE 6 - CNC PART PROGRAMMING II: Manual part programming for simple parts; Generation of part programs for complex parts of the selected assembly using CAM software; Cycle time analysis. (10)

MODULE 7 - SHEET METAL MODELING: Basics of sheet metal fabrication; Introduction to any one sheet metal modeling software; Design and modeling of sheet metal components for automotive, aerospace and naval applications. (20)

MODULE 8 - FAMILIARIZATION OF SENSORS AND IOT: Familiarization of types of sensors, signal amplifiers, A/D and D/A converters used in engineering applications; Measurement and control of parameters of equipment such as fan, motor, air-conditioner, etc., through mobile phone/internet. (20)

MODULE9 - eLEARNING USING DIGITAL RESOURCE: Learning and assessment through on-line manufacturing engineering related certification modules on metal forming, polymer processing, Industry 4.0 and additive manufacturing. (20)

MODULE10 - INDUSTRIAL VISITS: Visit to industries such as foundries with modern equipment, industries with automated production lines, etc. (10)

Total: P: 150

REFERENCES:

1. Kevin Otto, Kristin Wood, "Product Design: Techniques in Reverse Engineering and New Product Development", Pearson Education, 2006.
2. James D Meadows, "Geometric Dimensioning and Tolerancing", Marcel Dekkar, 2010.
3. Peter Smid, "CNC Programming Handbook", Industrial Press, Inc, 2007.
4. ASME, "Manufacturing Planning and Estimation - Hand Book", McGraw Hill, New York.

19P600 INDUSTRIAL TRAINING VI**0 0 10 5***

MODULE 1 - MATERIAL PROCUREMENT: Procurement of raw materials as per the bill of materials prepared for the selected assembly during **Industrial Training V (MODULES1 to 6)**. (10)

MODULE 2 - MANUFACTURE OF PARTS: Manufacture of the parts as per the process plans for the selected assembly using conventional and CNC machines. (90)

MODULE 3 - ASSEMBLY OF PARTS: Assembly of mechanical, electrical and electronic parts; Inspection of the assembly to ascertain the fits and tolerances; Painting / coating of parts. (30)

MODULE4 - PERFORMANCE TESTING: Testing of the completed assembly to evaluate the performance. (10)

MODULE5 - eLEARNING USING DIGITAL RESOURCE: Learning and assessment through on-line manufacturing engineering related certification modules on engine, compressor, axles, bearing and oil seal, brake, tire, mechanical power transmission. (10)

MODULE6 - INDUSTRIAL VISIT: Visit to industries involved in the manufacture of agricultural equipment, stone crusher, etc.(10)

Total: P: 150**REFERENCES:**

1. Harry Peck, "Designing for Manufacturing", Pitman Publications, 1983.
2. Igor Karassik, Joseph Messina, Paul Cooper, Charles Heald, "Pump Handbook", McGraw Hill Professional, 2000.
3. Robert Matousek, "Engineering Design", London Blackie and Son (India) Ltd., 1974.
4. K C John, "Machine Drawing", PHI Learning Pvt. Ltd., 2009.

19P700 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**REFERENCE:**

1. 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.

19P800 INDUSTRIAL TRAINING VIII**0 0 10 5***

MODULE 1 - OVERVIEW OF NEW PRODUCT DEVELOPMENT (NPD): Overview of NPD process structure, NPD models, fuzzy front-end (FFE), product design, product implementation, fuzzy back-end, Intellectual property rights. (10)

MODULE 2 - CONCEPTUALIZATION OF NOVEL IDEA/PRODUCT: Conceptual design, performing design sensitivity analysis, idea screening and evaluation, SWOT analysis; Conceptualization of a novel idea/product. (10)

MODULE3 - DETAILED DESIGN: Design of the product/system – development of geometrical models of parts / assemblies, calculation of mechanical loads, loads on individual parts using free body diagrams, material selection, functional simulation of product/assembly, design for sustainability, ergonomics and aesthetics, development of production drawing. (50)

MODULE4 - FABRICATION AND TESTING: Fabrication of the product / assembly, testing and refinements. (60)

MODULE5 - INDUSTRIAL VISIT: Visit to industries involved in non-traditional machining, sheet metal process, composite material product manufacturing, etc. (10)

MODULE 6 – E-LEARNING USING MANUFACTURING SOFTWARE PORTAL: On-line manufacturing related certification modules in areas of gear, belt, transmission, quality and business excellence. (10)

Product should be exhibited and demonstrated at the end of the semester

Total: P: 150

REFERENCES:

1. Kevin Otto, Kristin Wood, " Product Design: Techniques in Reverse Engineering and New Product Development", Pearson Education, 2006.
2. Karl T Ulrich, Steven D Eppinger, "Product Design and Development", Tata McGraw Hill, New Delhi, 2016.
3. Michael Asbhy, "Material Selection in Mechanical Design", Butterworth-Heinemann, 2016.
4. Kenneth B Kahn, "The PDMA Handbook of New Product Development", John Wiley and Sons, Inc, 2013.

19P900 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. (20)

MODULE 2 - PREPARATION OF INDUSTRY ANNUAL REPORT: Factors and parameters relating to various aspects of industry, and preparation of an industry annual report. (10)

MODULE 3 - INDUSTRIAL STATUTES AND GOVERNANCE: Governance aspects of an industry, wages and salary administration, welfare benefits - ESI, PF, bonus, incentive schemes; statutes and labor law, standing orders, disciplinary action and domestic enquiry, negotiations with unions on wages and bonus, representation before tribunals, labor 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. (20)

MODULE 4 - 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. (10)

MODULE 5 - ENTREPRENEURIAL SKILL: Entrepreneurial competencies, creative and idea generation, out of the box thinking, spin-off and knowledge transfer, fund generation, government norms and support for entrepreneurs, Intellectual property rights. (20)

MODULE 6 - SALES: Identification of prospective buyers, handling objections, competition management sales forecasting, planning and analysis - on field sales of products in campus and nearby. (20)

MODULE 7 - MARKETING: Preparation of brochures and promotional materials, online marketing of a product, lead generation for sales team. (10)

MODULE 8 - INDUSTRIAL ENGINEERING: Design of experiments, statistical data analysis and hypothesis testing, inventory analysis, manufacturing systems simulation, line balancing of systems, poka-yoke, radio frequency identification techniques.(30)

MODULE 9 - INDUSTRIAL VISIT: Visit to specific theme oriented industry, sales and marketing departments in industries. (10)

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.