Department of Production Engineering
Syllabi for Summer Examinations 2020 of Final Year of UG (AY 2019-20)
Second Year B. Tech. (Production Engineering)

Name of Subject: Engineering Mathematics - IV Subject Code: PR 241

Sr. No.	Syllabus
01	Chapter 1- Moments about mean moments about the mean in terms of moments about any point, skewness and kurtosis, introduction of correlation, regression coefficients, lines of regressions. Probability distribution, discrete and continuous probability distribution, Binomial, Poisson and normal distribution and its applications and importance in engineering field.
02	Chapter 3- Picard's Method, Euler's Method.

Name of Subject: Machine Drawing and CAD Subject Code: PR 245

Sr. No.	Syllabus
01	Introduction to Machine Drawing And CADD Machine drawing, CAD concept, Drawing Standards
02	Bureau of Indian Standards (BIS) Conventions and Conventional Representation: Surface Finish, Welded Joints, Riveted Joints: Single and Double Riveted Butt and Lap Joints
03	Computer Aided Drafting and Documentation: Sketching in CAD, Commands for geometry creation, editing, viewing, and printing.
04	Machine Parts: Cotter and knuckle joints
05	Production Drawings and Blue Print Reading: Assembly and part drawings

Name of Subject: Mathematics - III Subject Code: MA 203

Sr. No.	Syllabus
01	Chapter 1- Basic Concepts & Ideas, Geometric Meaning of $y' = f(x, y)$, direction field, exact equations, Integrating factors, Linear differential equation, Bernoulli's equations, orthogonal trajectories, applications to electrical circuits.
02	Chapter 2- Second Order Differential equations, Homogeneous linear differential equation for real & complex roots, Euler Cauchy equation, existence & uniqueness theorem (Without proof) & Wronskian.
03	Chapter 3- Non homogeneous equation, solutions by undetermined coefficients

Name of Subject: Strength of materials Subject Code: PR 232

Sr. No.	Syllabus
01	Simple stress and strain
02	Strain energy and thin cylinder
03	Torsion
04	SFD and BMD

Name of Subject: Theory of Machines Subject Code: PR 242

Sr. No.	Syllabus
01	Turning Moment and Flywheels: Turning moment diagram for an IC engine, fluctuation of energy and speed, design of flywheel.
02	Governors: Introduction, types of governors, centrifugal governors, watt governor, porter governor, proell governor, spring loaded governors, Hartnell governor, sensitiveness, stability, Isochronisms, Hunting, governor effort and power, controlling force.
03	Gears: Concept of friction wheel, types of gears, gear terminology, law of gearing, velocity of sliding, forms of teeth, gear profiles, path of contact, arc of contact, Interference and undercutting in involute gears, methods of eliminating reducing/ Interference.

Name of Subject: Thermal Engineering - I Subject Code: PR 233

Sr. No.	Syllabus
01	Air standard cycles Definitions, Air Standard Analysis, Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Cycle.
02	Internal Combustion Engines Classification of IC engines, components of engines, petrol engines, diesel engines, comparison between petrol and diesel engines, comparison between two-stroke and four-stroke engines, advantages and disadvantages of two-stroke cycle engines, air–fuel mixture, carburetion, fuel-injection system, combustion, governing of I.C. engines, ignition systems, firing order, engine-cooling systems, engine lubrication systems, performance of internal combustion engines and heat balance sheet, efficiencies, supercharging
03	Nozzle Types of steam nozzles, steam flow through a nozzle and flow through actual nozzles, supersaturated expansion of steam.

Third Year B. Tech. (Production Engineering)

Name of Subject: Mathematics - IV Subject Code: MA 302A

Sr. No.	Syllabus
01	Chapter 1- Introduction to Complex Variables.
02	Chapter 2- Function of complex variables: Limit, continuity, differentiability, analytic functions and their properties, Cauchy Riemann equation, harmonic functions, elementary complex functions and their properties.

Name of Subject: Mathematics - IV Subject Code: MA 302C

Sr. No.	Syllabus
01	Chapter 1- Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation.
02	Chapter 2- Numerical integration, composite rules, error formulae.
03	Chapter 3- Solution of a system of linear equations, implementation of Gaussian elimination and Gauss-Seidel methods, partial pivoting, row echelon form, LU factorization Cholesky's method, ill-conditioning, norms.

Name of Subject: Production Planning and Control Subject Code: PR 355

Sr. No.	Syllabus
01	Introduction: Functions of PPC, types of production, production consumption cycle, coordination of production decisions.
02	Product Development and Design: Product Design and Company Policy, Product Analysis: Marketing Aspect, Product Characteristics, Economic Analysis, production Aspect.
03	Forecasting: Introduction, Time Series Methods, Casual Methods, Forecast Errors
04	Facility Layout: Introduction, Flow Systems, Types of Layout: Product, Process, Group Layout, Computerized Layout Planning

Name of Subject: Tool Design Subject Code: PR 356

Sr. No.	Syllabus
01	Theory of Metal Cutting: Elements of machining by cutting, Tool geometry of single point cutting tool, tool signature, effect of tool angles on machining, Tool materials - properties, selection and applications.
02	Chip-formation, types of chips, built-up-edge, chip breakers, orthogonal cutting and force diagram, Merchant's circle, Force measurement by dynamometers, introduction to multipoint cutting tools and recent advances in cutting tools. . Cutting Tool Materials.
03	Machinability: Definition, Factors affecting, machinability index, machinability of aluminium, metallurgical aspects of tools and their performance.

04	Tool Life: Factors affecting tool life, Taylor's equation, tool failure, tool wears, types of tool failures, Tool condition monitoring. Effect of various parameters on tool life Problems based on shaping, turning, tool life, marchant circle.

Name of Subject: Operation Research Subject Code: PR 364

Sr. No.	Syllabus
01	Introduction to OR
02	Transportation and Assignment Model
03	Introduction to Queuing Theory
04	Game Theory

Name of Subject: Mechanical Working of Metals Subject Code: PR 351

Sr. No.	Syllabus
01	Introduction: Principle of metal forming, classification of metal-forming process, plastic deformation, cold working, Hot working, materials for cold and hot working.
02	Dies for Sheet Metal Cutting And Shaping: Press working terminology and equipments; Press tool operations, Press selection and rating, Principle of metal cutting, working of cutting die, die clearance and its effect, types of die construction.
03	Forging Dies: Types of forging dies, advantages and limitations; forging equipment and machines, press forging, drop forging, open die forging, close forging, dogging defects. Forging design, factors-draft, fillet, corner radius, parting line, shrinkage, die wear, mismatch, and tolerances, forging operations stock size determination, forging die design, forging Analysis.
04	Rolling of Metals: Classification of rolling processes, rolling mills, hot rolling, cold rolling, rolling of bars and shapes, Forces and geometrical relationships in rolling, problems and defects in rolled products, process Analysis.
05	Extrusion: Classification of extrusion processes, Extrusion equipment, hot extrusion, cold extrusion, Deformation, Lubrication and defects in extrusion, hydrostatic extrusion, Extrusion of tubing. Production of seamless pipe and tubing.
06	Introduction to Drawing of Rods, Wires and Tubes

Name of Subject: Elective I: Finite Element Analysis Subject Code: PR 365

Sr. No.	Syllabus
01	Fundamental Concept of FEM: Introduction, History background, stresses & equilibrium boundary conditions, strain displacement relations, stress – strain relations, temperature, effects, variational approach solution techniques
02	Description of The Method: Step wise procedure of Finite element method, variational techniques for derivation of finite element equations, assembly procedure, solution methods.
03	FEA of One Dimensional Problems: Introduction, finite element modelling, shape functions, variational approach, weighted residual approach, Assembly of finite element equations, Higher- order element, Boundary conditions, Temperature effects.

04	FEA of Two Dimensional Problems: Introduction, FE modelling, formulation of constant strain triangular element, problem modelling & boundary conditions Problems on rod, truss and beam by stiffness matrix

Name of Subject: Machine Design Subject Code: PR 352

Sr. No.	Syllabus
01	Introduction :Mechanical Engineering design, Traditional design methods, Design synthesis, Aesthetic considerations in design, Ergonomic considerations in design, Use of standard in design, Selection of preferred sizes, value analysis, Engineering materials, Selection of materials, manufacturing considerations in design, statistical considerations in design
02	Power Screws: Forms of threads, force analysis of square threads and trapezoidal threads, self-locking in power screws, collar friction, stresses in screw, Differential and compound screws, Recirculating type ball screws
03	Friction Clutches: Torque transmitting capacity, single disc and multiple disc clutches, fraction materials, cone clutches, and centrifugal clutches
04	Gears: Types of gears, V. R. for each type, selection of types of gear, modes of failure, gear design for maximum power transmitting capacity, Design of spur and helical gear, Lewis equation, Buckingham's Equation, Wear strength of spur & helical gears, gear lubrication

Name of Subject: CAM and Robotics Subject Code: PR 353

Sr. No.	Syllabus
01	Introduction to CAM and NC CAM applications and phases, benefits of CAD/CAM, NC machines, elements of NC manufacturing system, preparation of CAD data for NC, types of NC systems, reference points, component dimensioning, NC motion control modes, types of interpolations, axis designation (coordinate system), steps in NC manufacturing (NC procedure), applications of NC, advantages and disadvantages of NC technology, limitations of conventional NC, CNC technology, CNC controllers, features and advantages of CNC, adaptive control, advantages of adaptive control, direct numerical control (DNC), types of DNC, advantages and disadvantages of DNC, new trends in CNC and DNC
02	Automation Concepts in manufacturing systems, automation, types of automation, advantages and limitations of automation, strategies in automation, group technology (GT), merits and demerits of GT, concept of machine cell, flexible manufacturing systems (FMS), elements of FMS, work piece handling, automated guided vehicles (AGV), applications of FMS, merits and demerits of FMS, Computer integrated manufacturing (CIM), machining centers

03	Robotics Industrial robot, robot anatomy, degrees of freedom, robot drives, robot controller unit (RCU), manipulator and end effectors, industrial robot applications, robot cell layout, types of robot, robot axis and configurations, robot sensors, parameters in robot selection, engineering analysis of Industrial robots

Name of Subject: Casting and Welding Techniques — Subject Code: PR 354
Subject Code: PR 231

Sr. No.	Syllabus
01	Welding: Introduction, weldability, metal properties and its significance in welding, Classification of welding processes, applications and need of welding processes
02	Metal arc welding: Introduction, welding procedure, accessories, power supplies in arc welding, flux, factors of arc welding, electrodes, coding, weld nomenclature, types of joints, positions of welding, weld defects, causes and remedies D&NDT of welds, design of weld joints,
03	Types of Arc Welding Processes: Principle, working, advantages, limitations and applications of carbon arc, submerged arc, electro slag, electro-gas, flux-cored arc welding and plasma arc welding,
04	Gas welding: Types of flames, equipment, working, applications of gas welding, MIG, TIG, Oxy-acetylene cutting, arc cutting
05	Resistance Welding: Introduction, 4-period welding, types like Butt, Spot, Seam, flash, stud, Projection, Percussion, and Thermit welding.

Name of Subject: Quality and Reliability Engineering — Subject Code: PR 383

Sr. No.	Syllabus
01	Control charts
02	Acceptance sampling.

Name of Subject: Fluid Mechanics and Heat Transfer — Subject Code: PR 362

Sr. No.	Syllabus
01	Introduction: Definition of fluid, Properties of fluids, Viscosity, Compressibility, Bulk modulus of elasticity, Surface tension and capillarity
02	Fluid Statics: Pressure at a point, Pascal's law, Hydrostatic pressure on plane and curved surfaces, Absolute, Gauge, Atmospheric and vacuum pressures, pressures, Measurement of pressure by manometers and gauges.

03	Introduction to Heat Transfer: Introduction, modes of heat transfer, steady state heat transfer, thermal conductivity and coefficient of heat transfer, factors affecting the above properties, unsteady state of heat transfer, heat transfer with internal heat generation, practical applications. Steady State heat conduction, one-dimensional conduction, Fourier's equation, and heat conduction through objects solid slabs Steady heat conduction through cylindrical objects heat conduction through composite cylinders. Critical thickness of insulation, Effect of variable conductivity. Fins, types of fins, steady state heat conduction with heat dissipation to surrounding, Thermometric well, electrical analogy for study of heat transfer problems.
04	Heat Exchangers: Classification, concept of overall heat transfer coefficient, LMTD relations, effectiveness, and effectiveness by NTU method.

Name of Subject: Fluid Mechanics and Hyd. System Subject Code: PR 373

Sr. No.	Syllabus
01	Introduction: Definition of fluid, Properties of fluids, Viscosity, Compressibility, Bulk modulus of elasticity, Surface tension and capillarity
02	Fluid Statics: Pressure at a point, Pascal's law, Hydrostatic pressure on plane and curved surfaces, Absolute, Gauge, Atmospheric and vacuum pressures, pressures, Measurement of pressure by manometers and gauges
03	Fluid Kinematic: Types of fluid flows: Steady, Unsteady, Uniform and non-uniform, laminar and turbulent, Compressible and incompressible, rotational and irrotational, Rate of flows, continuity equation for one dimensional, Velocity and acceleration, Velocity potential function and stream function.
04	Fluid Dynamics: Equation of motion, Euler's equation, Bernoulli's equation, and practical applications of Bernoulli's equation: Venturi meter, orifice meter, Pitot tube

Name of Subject: Elective: Renewable Energy Sources Subject Code: PR 377

Sr. No.	Syllabus
01	Energy Resources and Utilization Conservation and forms of energy, energy reserves in India, energy efficiency and conservation, new technologies
02	Environmental aspects of electric energy generation Atmospheric pollution, hydrocarbons, particulates, thermal pollution, hydroelectric projects, GHG emissions from various energy sources, energy options for Indian economy
03	Solar radiation and measurement Solar constant, terrestrial solar radiation, solar radiation geometry, empirical equation of for estimating the availability of solar radiation, solar radiation measurement and Solar radiation data for India.
04	Solar collector and applications Solar Thermal energy collectors, analysis, performance. Solar thermal energy conservation systems - Solar water heating, solar distillation, solar cooker.
05	Solar photovoltaic systems Solar photovoltaic system, efficiency, applications PV system, photovoltaic in India

06	Wind energy Classification, wind power generation in India, advantages and disadvantages
07	Ocean Energy Introduction to tidal energy
08	Geothermal energy Introduction to geothermal energy

Final Year B. Tech. (Production Engineering)

Name of Subject: Tools for Six Sigma Quality Subject Code: PR 403

Sr. No.	Syllabus
01	Overview of six SIGMA, DMAIC, Quality Cost, VOC, CTQ, DOE, TAGUCHI, & QFD.

Name of Subject: CAD/CAM and Robotics Subject Code: PR 404

Sr. No.	Syllabus
01	Introduction CAD, CAE and CAM, History, Scope, Need and Necessity, Applications, Hardware & software facilities in CAD.
02	Mathematical aspects Vector algebra in CAD modelling, 2D transformation-scaling, translation, rotation etc.
03	Computational geometry- Different types of curves & surfaces, Geometric modelling-Classification, wire frame, surface and solid modelling, advantages and disadvantages, CSG, B-Rep and FBM.
04	Introduction to CAM: applications and phases, benefits of CAD/CAM, NC machines, elements of NC manufacturing system, types of NC systems, reference points, NC motion control modes, steps in NC manufacturing (NC procedure), applications of NC, CNC technology, CNC controllers, features and advantages of CNC, direct numerical control (DNC), types of DNC
05	Robotics Industrial robot, robot anatomy, degrees of freedom, robot drives, robot controller unit (RCU), manipulator and end effectors, industrial robot applications, robot cell layout, types of robot.

Name of Subject: Operation Research Subject Code: PR 405

Sr. No.	Syllabus
01	Introduction to OR
02	Transportation and Assignment Model
03	Introduction to Queuing Theory
04	Game Theory

Name of Subject: Production & Operation Management Subject Code: PR 401

Sr. No.	Syllabus
01	Operations Strategy: Competitive priorities, Strategic decisions in operations, Strategy deployment

02	Push Production Systems: i. Resource Planning: Overview of Material Requirement Planning (MRP), Master production schedule (MPS), Inputs to MRP, The MRP process, Lot sizing in MRP systems, MRP outputs, ii. Capacity Planning: Defining and measuring capacity. Determinants of effective capacity, Capacity planning decisions, Tools for capacity planning iii. Shop-Floor Control: Framework for Shop-floor Control, Basic Shop-Floor Control Concepts, Shop Floor Control Techniques, Finite Loading Using the Shop Floor Control System, Performance Measurement and Lead Time Management.
03	Theory of Constraints: Introduction, Goal and Performance measures, Capacity, Synchronous manufacturing, Marketing and Production
04	Supply Chain Management: The management of supply chains, Distribution, Integration, supply chain and competitive advantage, marketing and logistics interface, principles of logistics costing, lead time management, Information Technology – A supply chain enablers, Suppliers, outsourcing, Measuring supply chain performances. Warehousing, VMI, Role of Internet in Supply chain.

Name of Subject: Elective: Elements of PLM Subject Code: PR 409

Sr. No.	Syllabus
01	Introduction: Background, Overview, Need, Benefits, and Concept of Product Life Cycle, Product lifecycle management systems, Components / Elements of PLM, Emergence of PLM.
02	Product organizational structure, Integration of the PLM system with other applications, The PLM Strategy.
03	Product Data, Product and Product Data, Product Data Examples, Product Data Issues, Metadata, Product Data Models.
04	Product structure, workflow, Terminologies in workflow, The Link between Product Data and Product Workflow, PLM applications, PDM applications.

Name of Subject: Elective: Project Management Subject Code: PR 408

Sr. No.	Syllabus
01	Introduction to PM:- What is a project? Evolution of project management, the need of project management, Where is project management appropriate? Characteristics of projects, Characteristics of project management, Projects in contemporary organizations, Project lifecycle.
02	Project Organization and Planning:- Project manager, Cross-functional team, Dedicated project organization, Influence project organization, Matrix organization, Advantages and disadvantages of project organizations, Selection of project organization, Work Breakdown Structure (WBS), Integration of project organization and WBS, WBS and responsibility matrix.

03	Project Scheduling and Resource Management:- Gantt chart, Milestone chart, Network techniques: PERT and CPM, AON and AOA representation, Three-time estimates, Probability of project completion, Early start and late start schedules, Resource allocation, Crashing a project.

Name of Subject: Elective: Costing & Estimation Subject Code: PR 406

Sr. No.	Syllabus
01	Cost estimation for various manufacturing process: machining, sheet metal working, forging, welding and foundry.
02	Depreciation, Depreciation fund and its calculation.
03	Cost accounting, cost control and cost reduction.
04	Elements of Economics
05	Tools for planning and control: Budgets

Name of Subject: Productivity Improvement Techniques Subject Code: PR 402

Sr. No.	Syllabus
01	Introduction to Work Study: Definition: Purpose of study, objectives, brief history and evolution, work study and productivity, human factor in application of work study, scope, applications, relationship, between Productivity & standard of living, basic work content, excess work content Management, techniques to reduce excess work content due to product process and ineffective time in control of workers and Management.
02	Ergonomics: Introduction, Principles, Work system design, Man-machine system, Human behaviour and equipment design, Tools, Techniques and applications, Effect of environment on performance of worker, working conditions, prevention accidents and hazards, lighting, ventilation etc.
03	Method Study: Definition, Concept, Objectives and Procedure of method study, Flow and handling of materials; Process chart symbols, recording techniques like Flow process charts, Operation, Flow and Two handed Process charts, Flow diagram, String diagram, Multiple Activity chart, travel chart, Operation Analysis, Analysis of motion, analysis and critical examination of existing methods and development of improved methods, Motion economy, Design of work place layout, Therbligs, SIMO chart.

Name of Subject: Quality and Reliability Engineering Subject Code: PR 473

Sr. No.	Syllabus
01	Control charts
02	Acceptance sampling.

Name of Subject: Micro-Nano Fabrication Techniques Subject Code: PR 483

Sr. No.	Syllabus
01	Introduction: Need, evolution, fundamentals and trends in micro and nano technologies; Consequences of the technology and society; Moore's law , challenges to manufacturing technology; evolution of precision in manufacturing, tooling and current scenario; micro- nana fabrication tool, requirements, scales and size effect.
02	Mechanical Micro Machining: Introduction, principle, tools and application of: Micro - Drilling, Turning, Milling, Diamond turning, Grinding, honing, lapping, and super finishing.
03	Non-conventional micro-nano manufacturing and finishing approaches: Manufacturing and finishing approaches like, WAJM,USM, AFM, MAF micro: ECM, EDM, WEDM, LBM, EB, Focused ion beams, Hybrid processes, ELID-process principle, application and technological information, chemical machining and mechanochemical finishing.