

Syllabus of  
UNDERGRADUATE DEGREE COURSE

**Production and Industrial Engineering**



Rajasthan Technical University, Kota

Effective from session: 2024 – 2025



# RAJASTHAN TECHNICAL UNIVERSITY, KOTA

## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI2-01: DATA ANALYTICS

**Credit: 2**  
**2L+0T+0P**

**Max. Marks: 100 (IA:30,ETE:70)**

**End Term Exam: 3Hours**

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	Introduction to Multivariate Statistics-Degree of Relationship among Variables-Review of Univariate and Bivariate Statistics-Screening Data Prior to Analysis-Missing Data, Outliers, Normality, Linearity, and Homoscedasticity.	4
3	Multiple Regression- Linear and Nonlinear techniques- Backward Forward-Stepwise- Hierarchical regression-Testing interactions (2way interaction) - Analysis of Variance and Covariance (ANOVA & ANCOVA)- Multivariate Analysis of Variance and Covariance (MANOVA & MANCOVA).	6
4	Logistic regression: Regression with binary dependent variable - Simple Discriminant Analysis- Multiple Discriminant analysis Assessing classification accuracy- Conjoint analysis (Full profile method).	5
5	Principal Component Analysis -Factor Analysis- Orthogonal and Oblique Rotation-Factor Score Estimation-Multidimensional Scaling-Perceptual Map-Cluster Analysis (Hierarchical Vs Nonhierarchical Clustering).	5
6	Latent Variable Models an Introduction to Factor, Path, and Structural Equation Analysis- Time series data analysis (ARIMA model)-Decision tree analysis (CHAID,CART)-Introduction to Big Data Management.	5
	<b>TOTAL</b>	<b>26</b>

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2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI1-03/3PI1-03: MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTING

Credit: 2

Max. Marks: 100 (IA:30,ETE:70)

2L+0T+0P

End Term Exam: 2Hours

SN		Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Basic economic concepts-</b> Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	3
3	<b>Demand and Supply analysis-</b> Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
4	<b>Production and Cost analysis-</b> Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
5	<b>Market structure and pricing theory-</b> Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
6	<b>Financial statement analysis-</b> Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
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## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI1-02/3PI1-02: TECHNICAL COMMUNICATION

Credit: 2  
2L+0T+0P

Max. Marks: 100 (IA:30,ETE:70)

End Term Exam: 2Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Introduction to Technical Communication-</b> Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	3
3	<b>Comprehension of Technical Materials/Texts and Information Design &amp; development-</b> Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	6
4	<b>Technical Writing, Grammar and Editing-</b> Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.	8
5	<b>Advanced Technical Writing-</b> Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	8
	<b>Total</b>	<b>26</b>

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## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI3-04: DIGITAL ELECTRONICS

Credit: 2

2L+0T+0P

Max. Marks: 100 (IA:30,ETE:70)

End Term Exam: 2Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Semiconductor Devices and Applications:</b> Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.	4
3	<b>Operational amplifier and its applications:</b> Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.	5
4	<b>Timing Circuits and Oscillators:</b> RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.	5
5	<b>Digital Electronics Fundamentals:</b> Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.	6
6	<b>Electronic Communication Systems:</b> The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.	5
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# RAJASTHAN TECHNICAL UNIVERSITY, KOTA

## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI4-05: FLUID ENGINEERING

Credit: 4  
3L+1T+0P

Max. Marks: 100 (IA:30,ETE:70)  
End Term Exam: 3Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Fluid Properties:</b> Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity.	2
	<b>Fluid Statics and Flow Characteristics:</b> Basic equation of fluid statics, Manometers, Force on plane areas and curved surfaces, center of pressure, Buoyant force, Stability of floating and submerged bodies. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.	5
3	<b>Flow Through Circular Conduits:</b> Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram-minor losses – Flow through pipes in series and parallel.	8
4	<b>Dimensional Analysis:</b> Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.	8
5	<b>Pumps:</b> Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor-velocity triangles-Centrifugal pumps–working principle-work done by the impeller-performance curves-Reciprocating pump- working principle – Rotary pumps –classification.	8
6	<b>Turbines:</b> Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.	7
	<b>TOTAL</b>	<b>39</b>

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# RAJASTHAN TECHNICAL UNIVERSITY, KOTA

## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI4-06: MACHINING SCIENCES

Credit: 3  
3L+0T+0P

Max. Marks: 100 (IA:30,ETE:70)  
End Term Exam: 3Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	Classification of metal removal process and Classification of machine tools, Geometry of single point cutting tool and tool angles, tool nomenclature in ASA and ORS. Concept of orthogonal and oblique Cutting.	5
3	Chip Formation, Mechanics of metal cutting, shear angle and its relevance, various theories of metal cutting.	3
	Thermal aspects of machining and measurement of chip tool interface temperature.	2
	Machin ability, tool wear, tool life, Cutting fluids, Economics of machining, Measurement of cutting forces.	4
4	Lathe: Construction and cutting speed, feed, and depth of cut, machining time and power estimation. Capstan and turret lathe machines, tool layout.	5
	Shaper: Construction and working principle, Quick return mechanism.	5
5	Milling: Introduction, types of milling machines, milling cutters, milling operations, dividing head, Indexing methods, machining time and power estimation and gear cutting	5
	Gear hobbing, gear shaping. Gear finishing processes: shaving, grinding, lapping and shot blasting	4
6	Drilling: - tool geometry of twist drills, types of drills, drilling machine construction, drilling time and force estimation	4
	Grinding- Need and different methods of grinding, grinding wheel designation and selection, Dressing and truing, Types of grinding machines, Grinding process. Honing, lapping, super finishing, polishing and buffing processes.	6
	<b>TOTAL</b>	<b>39</b>

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## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI4-07: THEORY OF MACHINES

Credit: 4  
3L+1T+0P

Max. Marks: 100 (IA:30,ETE:70)  
End Term Exam: 3Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	Introduction to mechanism: Basic concept of machines, links, kinematic pair, kinematic chain and mechanism. Inversions of kinematic chains: four bar chain mechanisms, quick return mechanisms, inversions of double slider crank mechanisms.	4
	Velocity and acceleration in mechanism: Velocity and acceleration polygons, relative velocity and instantaneous centre method	3
3	Friction devices: Types and laws of friction. Pivots and collars. Power screws such as lead screw of the lathe.	3
	Clutches: Single and multi-plate clutches. Brakes: Band, block and band and block brakes.	4
4	Gears: Laws of gearing, gears terminology; tooth form; interference, undercutting and minimum number of teeth on pinion. Rack and pinion, Spur, helical, basic introduction of bevel, worm and worm gears.	6
	Gear Trains: Simple, compound and epicyclic gear trains.	3
5	Cams: Type of cams; displacement, velocity and acceleration curves for different cam followers; consideration of pressure angle and wear.	4
	Gyroscope: Principles of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicles taking a turn, stabilization of ship.	4
6	Balancing: Balancing of rotating masses in same and different planes, balancing of reciprocating masses, swaying couple, hammer blow and tractive effort.	7
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## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI3-21: DIGITAL ELECTRONICS LAB

Credit:1.5

Max. Marks: 100 (IA:60, ETE:40)

0L+0T+3P

SN	
1	To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3 & 4 inputs using gates with 2, 3, & 4 inputs).
2	To verify the truth table of OR, AND, NOR, Ex-OR. Ex-NOR realized using NAND & NOR gates.
3	To realize an SOP and POS expression.
4	To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables.
5	To realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor & basic Full Adder/ Subtractor.
6	To verify the truth table of 4-to-1 multiplexer and 1-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and 1-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer.
7	Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -3 I 2 seven-segment display.
8	Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table.
9	Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.
10	Perform input/output operations on parallel in/parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer.

**Note:** As far as possible, the experiments shall be performed on bread board. However experiment Nos. 1-4 are to be performed on bread board only

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## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI4-22: FLUID MECHANICS LAB

**Credit:1.5**

**Max. Marks: 100 (IA:60, ETE:40)**

**0L+0T+3P**

SN	
1	Determination of Meta-centric height of a given body.
2	Determination of Cd, Cv & Cc for given orifice.
3	Calibration of contracted Rectangular Notch and / Triangular Notch and determination of flow rate.
4	Determination of velocity of water by Pitot tube.
5	Verification of Bernoulli's theorem.
6	Calibration and flow rate determination using Venturimeter & Orifice meter and Nozzlemeter
7	Determination of head loss in given length of pipe.
8	Determination of the Reynold's number for laminar, turbulent and transient flow in pipe.
9	Determination of Coefficient for minor losses in pipes.
10	To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
11	To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
12	Conducting experiments and drawing the characteristic curves of centrifugal pump/submergible pump.
13	Conducting experiments and drawing the characteristic curves of reciprocating pump.
14	Conducting experiments and drawing the characteristic curves of Pelton wheel.
15	Conducting experiments and drawing the characteristics curves of Francis turbine.
16	Conducting experiments and drawing the characteristic curves of Kaplan turbine.

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## Syllabus

2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI4-23: PRODUCTION PRACTICE - II

**Credit:1.5**

**Max. Marks: 100 (IA:60, ETE:40)**

**0L+0T+3P**

SN	
1	To study of single point cutting tool geometry and to grind the tool as per given tool geometry.
2	To study the milling machine, milling cutters, indexing heads and indexing methods and to prepare a gear on milling machine.
3	To machine a hexagonal / octagonal nut using indexing head on milling machine
4	To cut BSW/Metric internal threads on lathe machine.
5	To cut multi-start Square/Metric threads on lathe machine.
6	Boring using a boring bar in a centre lathe.
7	Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
8	Demonstration on milling machine for generation of plane surfaces and use of endmilling cutters.
9	Grinding of milling cutters and drills.
10	Exercise on cylindrical and surface grinders to machine surfaces as per drawing.
11	Cylindrical grinding using grinding attachment in a centre lathe

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2<sup>nd</sup> Year - IV Semester: B.Tech. : P&I Engineering

### 4PI4-24: THEORY OF MACHINES LAB

**Credit:1.5**

**Max. Marks: 100 (IA:60, ETE:40)**

**0L+0T+3P**

SN	
1	To study inversions of four bar chain and slider crank mechanism and their practical applications.
2	To study Steering Mechanisms: Davis and Ackerman.
3	Study of quick return mechanism and its practical applications.
4	Study of inversion of Double slider chain: Oldham Coupling, Scotch Yoke and Elliptical Trammel.
5	Study of various cam-follower arrangements. To plot displacement v/s angle of rotation curve for various cams
6	To determine co-efficient of friction using two roller oscillating arrangement.
7	Study of various types of dynamometers, Brakes and Clutches.
8	Study of differential gear box.
9	To verify the torque relation for gyroscope.
10	To perform wheel balancing. To perform static and dynamic balancing on balancing set up.
11	Study of a lathe gear box, sliding mesh automobile gear box, planetary gear box.

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