

Scholarship Examinations 2024/25

Engineering with Management

PAPER 1 – XSCH3206 ENGINEERING SCIENCE I: GENERAL MATHEMATICS, MANAGEMENT AND COMPUTER SCIENCE

6 QUESTIONS DO 4, at least 2 from mathematics section

1 Question – Introduction to Computing:

- Control Structures
- Data types
- Importing and exporting data
- Machine number representation
- Writing functions in Matlab
- Programming of simple engineering tasks

2 Questions – Introduction to Management Science:

- Linear programming: problem, graphical solution, possible solution outcomes.
- Basic probability: conditional probability, laws of probability, the partition law, Bay's law, expected value.
- Decision analysis: components of a decision, decision tables and trees, decision criteria, decision making under uncertainty, value of information: perfect and imperfect information, the utility of money (risk averseness and decreasing marginal worth) and required data structure & algorithm to implement.
- Time value of money: interest, net present value, annuities, amortised loans, futures.
- Networks: spanning tree, shortest path, critical path analysis, maximum flow algorithm.
- Inventory control: the classic model, constant receipt, shortages.
- Time series: properties of time series, moving averages, exponential smoothing.
- Transportation problem: definition, balanced problems, algorithm, initial solutions.

3 Questions – Engineering Mathematics I, II and III:

- Chapters 6, 7, 8, 9 of the book Calculus by Anton, Bivens and Davis (10th ed) (the text for the course) and Chapter 1 of Elementary Linear Algebra – Applications Version, Anton and Rorres
- Chapters 3 - 6 of Anton-Rorres' book "Elementary Linear Algebra (with applications)"

PAPER 2 - XSCH3207 ENGINEERING SCIENCE II: GENERAL MECHANICS AND MATERIALS

Exactly As for General Engineering Paper Engineering Science II, namely

7 QUESTIONS DO 4

Principles of statics and dynamics, Forces and moments, Structural analysis, Hydrostatics, Friction, Newton's laws, General motion and coordinate systems, Relative motion, Energy and momentum methods, 2D rigid body dynamics, Harmonic motion, Thermal Systems, Thermodynamics and kinetics of chemical reactions, Optics, Atomic structure, Phase diagrams, Properties of Materials, Compound stress and strain, Virtual work, Failure criteria, Beam analysis, Design and analysis of pin jointed structures, Dynamics of machines..

These topics roughly follow the courses and labs associated with 1E4; 1E5; 1E7; 1E12; 2E4.

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PAPER 3 – XSCH3104 ENGINEERING SCIENCE III: GENERAL MANUFACTURING AND ELECTRICITY

5 QUESTIONS DO 4

1 Questions – Introduction to Manufacturing

Introduction to Turning, Milling and Drilling

Principal features of these machining operations, material removal rate, cutting force, torque, power, specific energy, cutting time.

2 Questions – Electrical Engineering

Resistance; capacitance; electrostatics; dc circuit analysis; Kirchhoff's laws; network theorems; analysis of RC circuit transients; number representation and binary arithmetic; signed numbers; Boolean algebra and standard forms; Karnaugh map minimisation; combinational design and standard combinational elements.

2 Questions – Electronics

Analysis and classification of analogue electrical signals; introduction to classification and analysis of analogue electrical systems; linear amplifiers; operational amplifiers (op-amps) and their applications; ac network analysis; transient analysis; ac power; frequency response and filters.