Table 6.1: Seat Matrix for M.Tech. Programmes

Sr. No.	Name of the Department	Name of M.Tech. Programme	Total Seats
1.	Mechanical Engineering	M.Tech. in Manufacturing Systems Engineering **(PG-MSE)**	25
2.	Mechanical Engineering	M.Tech. in Welding and Fabrication **(PG-WLF)**	15
3.	Food Engineering & Technology	M. Tech. in Food Engineering & Technology **(PG-FET)**	23
4.	Computer Science and Engineering	M.Tech. in Computer Science and Engineering **(PG-CSE)**	23
5.	Electrical & Instrumentation Engineering	M.Tech. in Instrumentation and Control Engineering **(PG-ICE)**	15
6.	Chemical Engineering	M.Tech. in Chemical Engineering **(PG-CE)**	15
7.	Electronics & Comm. Engg.	M.Tech. in Electronics & Communication Engineering **(PG-ECE)**	22
Total			138

d) Admission Procedure:

(i) Admission to M.Tech. will be through Centralized Counseling for M. Tech. (CCMT-2021). Candidates interested in M.Tech. admission at SLIET should visit CCMT-2021 website.

- ***In case, the seats remain vacant, the candidates who have qualified valid GATE/SET VII-2021 and registered on our admission portal with registration fee paid on or before 15.07.2021 will be considered for admission.***
- ***Preference will be given to the candidates having valid GATE score.***
- ***In case, seats still remain vacant, the candidates appeared in the SET VII will be considered in order of merit.***

(e) Fee Structure for M.Tech. Programmes (Detailed fee structure is given in Section 2.11) :

- Note 1 : Admission on the basis of GATE does not guarantee the GATE Scholarship. However, scholarship shall be offered assanctioned by AICTE, New Delhi.

-Note 2 : The scholarship to the admitted students (with GATE) shall be disbursed by AICTE, New Delhi through DBT scheme as per policy of Govt. of India.

- **Reservation of seats will be as per Govt. of India rules.** (Refer section 2.9)
- **There shall be a minimum number of students required to run the course as approved by the senate.**

SYLLABUS OF SLIET ENTRANCE TEST (SET-VII)

For admission to M.Tech. Programme-2021(Vacant Seats)

Pattern of SET-VII

SLIET Entrance Test (SET-VII) for admission to M.Tech. Programme will consist of one paper of one hour and forty minutes duration. This paper will have 100 objective type questions of 100 marks.

Note: Answers of the objective type questions are to be filled in the OMR answer sheet given separately during the examination.

There will be 25% negative marking for wrong answers.

Marks: 100 (100 Questions)

Time: 1 Hour 40 Minutes

COMMON FOR ALL M.TECH. PROGRAMMES
ENGINEERING MATHEMATICS

Marks: 15 (15 Questions)

Linear Algebra: Matrix Algebra, Systems of linear equations, Eigen values and eigen vectors.

Calculus: Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series. Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

Differential equations: First order equation (linear only), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Legendre's equations, Initial and boundary value problems, Partial Differential Equations, linear and non-linear equations of first order only.

Complex variables: Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent' series, Residue theorem, evaluation of real integrals.

Probability and Statistics: Mean, median, mode and standard deviation, Probability (simple problems) Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Correlation and regression analysis.

Numerical Methods: Solutions of non-linear algebraic equations, single and multi-step methods for differential equations.

Transform Theory: Fourier transform, Laplace transform, Z-transform.

COMMUNICATION SKILL/MENTAL APTITUDE

Marks: 15 (15 Questions)

a) Language and Communication Skills

b) Arithmetic and Quantitative Skills

c) Critical Reasoning & General Intelligence

d) General Awareness

MANUFACTURING SYSTEMS ENGINEERING / MECHANICAL ENGINEERING (WELDING AND FABRICATION)

Marks:70 (70 Questions)

Engineering Mathematics: Laplace transformation & Fourier series, partial differential equations, vector calculus, curve fitting, regression analysis & linear correlation.

Engineering Mechanics: Statics Laws of equilibrium, centroids & centre of gravity, friction, moment of inertia, virtual work. Dynamics**:** Kinematics of particle, Newton's second Law of motion, work & energy, impulse & momentum, force & acceleration.

TOM & SOM: Simple mechanisms, velocity & acceleration in mechanisms, cams, balancing & vibrations, stress and strains, Mohr's circle, complex stresses, bending & deflection of beams, curved beams, shear centre, unsymmetrical bending, Castigliano's Theorem, pressures vessel, rotating rings.

Fluid Mechanics & Machines: Introduction, static pressure, gauges, flow of liquids through orifices & pipes, working principles of hydraulic machines & pumps.

Material Science: Bonding in solids & crystals, structure of material, imperfection in solids, heat treatment, magnetic materials, dielectric and other materials.

Thermal Science: Basics I.C. Engines, steam nozzles, steam turbines, compressors & gas turbines, different modes of heat transfer.

Operation Research:- Linear programming, network models, queuing theory, PERT,CPM

Metal Cutting & Forming: Tool nomenclature, orthogonal & oblique cutting, chip formation and types of chips, force system in turning, milling, tool wear, tool life and machinability. Fundamentals of dynamometry, temperature measurement in machining, types & application of different cutting fluids, plasticity, theories of failure, rolling, forging, extrusion and drawing processes.

Measurement & Quality Control: Standards of measurements, measurement of displacement, speed, stress strain, force,

torque, spur gears etc., introduction of quality control, control charts, OC curve, acceptance sampling, TQM, reliability.

Work Study & Ergonomic: Productivity, methods study, time study, work sampling, ergonomics.

Manufacturing Processes: Metal casting & fabrication; types of molding sand, solidification of metals, design of Risers, various molding & casting processes. Arc welding process, TIG, MIG, CO_2, Plasma, resistance welding, welding defects, powder metallurgy.

Non-Conventional Machining Processes: EDM, ECM, CHM, USM, AJM, WJM, EBM, IBM, LBM and PAM.

Industrial Automation: Introduction, pneumatics, pneumatic actuators & valves, basic pneumatic circuits, fluidics & fluid logic, pneumatic sensors, programmable logic controllers, encoders.

CAD/CAM: Fundamentals of CAD,NC Machine tools, group technology, components of CIM, computer aided part programming, adaptive control system.

FOOD ENGINEERING & TECHNOLOGY

Marks: 70 (70 Questions)

Technology of Fruit and Vegetable Processing: Extraction and preservation of fruit juices, jam, jelly and marmalades, Intermediate moisture products, Canning of fruits and vegetables, Drying and Dehydration of fruits & vegetables, Freezing, Chutney, Pickles and tomato products, Utilization of byproducts.

Dairy Engineering: Cleaning and sanitation in dairy industries, Homogenization, Pasteurization, Sterilization, Evaporation and Drying of milk, Utilization of byproducts.

Food Chemistry: Physico-chemical characteristics of food constituents, Changes in food constituents during processing and their determination methods, Enzymes and their applications in food processing.

Heat and Mass Transfer in Food Processing: Modes of heat transfer-Principles and practices in food engineering, Heat exchangers and their application in food processing, Mass transfer-Fick's law of diffusion of mass transfer, natural and forced convective mass transfer.

Food Packaging and Storage Engineering: Properties of packaging materials, Packaging equipment and machinery, Food packaging systems, Packaging standards and Role of packing in environmental pollution, Storage requirements and structures, Handling equipments, Management Practices.

Biotechnology: Principles of biochemistry, Microbial products, Techniques of genetic engineering, Enzyme technology, Tissue culture technology, Environmental biotechnology.

Animal Products Technology: Meat processing and preservation, Sausage, Meat Plant sanitation and safety, Fish processing and preservation, Fish products, Utilization of by-products.

Food Biochemistry: Cell biochemistry, Metabolism of carbohydrates, lipids and proteins.

Food Analysis and Quality Control: Quality attributes and measurements, Consistency and viscosity, Modern techniques of food analysis, Measurements of various properties, sensory quality and analysis, Food laws and regulations.

Technology of Cereals and Pulses: Structure and composition, Wheat milling technology, Rice Milling, Milling of pulses, Cereal based extruded products, Utilization of by-products.

Industrial Microbiology: Techniques of strain development, Microbial growth, Food spoilage, Microbial products. **Biochemical Engineering**: Media sterilization, Air Sterilization, Enzyme Kinetics, Bioreactor fermenter, Aeration and Agitation.

Food Processing Plant Layout and Design: Network analysis of processes, Evaluation of layouts, Plant Buildings, Cost analysis, Plant layout of different industries.

Beverage Technology: Non-alcoholic beverages, Alcoholic beverages, Instrumentation and process control in beverage industry.

Food Engineering: Material and energy balance, Flow of fluids, Thermal processing, Freezing, Fluidization, Refrigeration and air conditioning, Leaching & Extraction.

INSTRUMENTATION AND CONTROL ENGINEERING

Marks: 70(70 Questions)

Electrical Circuits & Networks: Voltage and current sources; independent, dependent, ideal, and practical; v-I relationships of resistor, inductor, mutual inductor, and capacitor; transient analysis of RLC circuits with dc excitation. Kirchoff's laws, mesh and nodal analysis, superposition, Thevenin, Norton, maximum power transfer and reciprocity theorems. Tellegen's Theorem, star-delta transformation.

Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance,

Magnetic circuits, Self and Mutual inductance of simple configurations. Peak-, average- and rms values of ac quantities; apparent-, active- and reactive powers, phasor analysis, Time domain and frequency domain analysis, impedance, and admittance, series and parallel resonance, locus diagrams, realization of basis filters with R, L and C elements.

One-port and two-port networks, driving point impedance with admittance, open-, and short circuit parameters.

Analog and Digital Electronics: Characteristics and applications of diode, Zener diode, BJT, JFET, UJT, MOSFT; Rectifiers small signal analysis of transistor circuits, feedback amplifiers. Characteristics of operational amplifiers; applications of op-amps; difference amplifier, adder, subtractor, integrator, differentiator, instrumentation amplifiber, precision rectifier, active filters, and other circuits, Oscillators, signal generators, voltage-controlled oscillators, and phase locked loop. Combinational logic circuits minimization of Boolean functions. IC families: TTL and CMOS. Arithmetic circuits, comparators, Schmitt trigger, multi-vibrators, sequential circuits, flipflops, shift registers, timers and counters, sample-and-hold circuit, multiplexer, analog to digital and digital to analog converters, characteristics of ADC and DAC, 8085Microprocessor: Architecture, Programming and Interfacing and basic supporting chips, Introduction to 8086 microprocessors and 8051 microcontroller.

Electrical and Electronic Measurements: SI units, systematic and random errors in measurement, expression of uncertainty – accuracy and precision index, propagation of errors. PMMC, MI and dynamometer type instruments; dc potentiometer; DC & AC bridges, Q-meter. Measurement of voltage, current and power in single and three phase circuits; ac and dc current probes; true rms meters, voltage and current scaling, instrument transformers, timer/counter, time phase, and frequency measurements, digital multimeter, oscilloscope, shielding and grounding.

Power Electronics: Characteristics of semiconductor power devices: Diode, Thyristor, Traic, GTO, MOSFET, IGBT, DC to DC conversion, Buck Boost and Buck-Boost converters, Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor-based converters, Bidirectional ac to dc voltage source converters, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters, Single phase and three phase inverters, Sinusoidal pulse width modulation.

Signals and Systems: Representation of continuous and discrete-time signals, Laplace, Fourier, and z-transforms, transfer function, frequency response of first and second order linear time invariant systems, impulse response of systems; convolution, correlation. Discrete time system: impulse response, frequency response, pulse transfer function, DFT and FET, basics of IIR and FIR filters.

Control Systems: Control system components, block diagrams, open loop and closed loop systems, mathematical modeling, signal flow graphs, transient response, steady-state-errors, Bode plot, phase and gain margins, Routh and Nyquist criteria, root loci, on-off, P,P-I, P-I-D design of lead, lag and lead-lag compensators, state-space representation of systems; state transition matrix, state equation decomposition, direct cascade and parallel solution of state equations, Calay Hamilton method, diagonalisation method and Sylvester method, time-delay systems.

Sensors and Industrial Instrumentation: Resistive, capacitive, inductive, piezoelectric-, Hall effect sensors and associated signal conditioning circuits; transducers for industrial instrumentation; displacement (linear and angular), velocity, acceleration, force, torque, vibration, shock, pressure (including low pressure), flow (differential pressure, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters)temperature (thermocouple, bolometer, RTD and its types, thermistor, pyrometer and semiconductor), liquid level, pH, conductivity and viscosity measurement.

Communication and Optical Instrumentation: Amplitude- and frequency modulation and demodulation; Shannon's sampling theorem, pulse code modulation; frequency and time division multiplexing, amplitude-, phase-, frequency-, pulse shift keying for

digital modulation; optical sources and detectors: LED, laser photodiode, light dependent resistor, and their characteristics; interferometer: applications in metrology; basics of fiber-optic sensing.

CHEMICAL ENGINEERING

Marks:70(70 Questions)

Section 1: Process Calculations and Thermodynamics

Steady and unsteady state mass and energy balances including multiphase, multi-component, reacting and non-reacting systems. Use of tie components; recycle, bypass and purge calculations; Gibb's phase rule and degree of freedom analysis. First and Second laws of thermodynamics. Applications of first law to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: Equation of State and residual properties.

Section 2: Fluid Mechanics and Mechanical Operations

Fluid statics, Newtonian and non-Newtonian fluids, shell-balances including differential form of Bernoulli equation and energy balance, Macroscopic friction factors, dimensional analysis and similitude, flow through pipeline systems, flowmeters, pumps and compressors, elementary boundary layer theory, flow past immersed bodies including packed and fluidized beds. Particle size and shape, particle size distribution, size reduction and classification of solid particles; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, agitation and mixing; conveying of solids.

Section 3: Heat Transfer

Steady and unsteady heat conduction, convection and radiation, thermal boundary layer and heat transfer coefficients, boiling, condensation and evaporation; types of heat exchangers and evaporators and their process calculations. Design of double pipe, shell and tube heat exchangers, and single and multiple effect evaporators.

Section 4: Mass Transfer

Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage-wise and continuous contacting and stage efficiencies; HTU & NTU concepts; design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, drying, humidification, dehumidification and adsorption.

Section 5: Chemical Reaction Engineering

Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors.

Section 6: Instrumentation and Process Control

Measurement of process variables; sensors, transducers and their dynamics, process modeling and linearization, transfer functions and dynamic responses of various systems, systems with inverse response, process reaction curve, controller modes (P,PI, and PID); control valves; analysis of closed loop systems including stability, frequency response, controller tuning, cascade and feed forward control.

Section7: Plant Design and Economics

Principles of process economics and cost estimation including depreciation and total annualized cost, cost indices, rate of return, payback period, discounted cash flow, optimization in process design and sizing of chemical engineering equipments such as compressors, heat exchangers.

Section 8: Chemical Technology

Inorganic chemical industries (sulfuric acid, phosphoric acid, chlor-alkali industry), fertilizers (Ammonia, Urea, SSP and TSP); natural products industries (Pulp and Paper, Sugar, Oil, and Fats); petroleum refining and petrochemicals; polymerization industries (polyethylene, polypropylene, PVC and polyester synthetic fibers).

ELECTRONICS & COMMUNICATION ENGINEERING

Marks:70(70 Questions)

Networks: A.C. and D.C. fundamentals, nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks.

Electronic Devices: Semiconductor physics, diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-i- n and avalanche photo diode, Basics of LASERs. Device technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography.

Analog Circuits: Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers. Power supplies.

Digital Circuits: Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift-registers. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor (8085): architecture, programming, memory and I/O interfacing.

Signals and Systems: Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FET, z-transform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems.

Control Systems: Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

Communications: Random signals and noise: probability, random variables, probability density function, Auto-correlation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, super heterodyne receivers; elements of hardware, realizations of analog communication systems; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM), digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM. Basic of optical fiber; total internal reflection, acceptance angl, numerical aperture, step index and graded index fiber, single mode and multi-mode fibers.

Electromagnetics: Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth. Transmission lines: characteristics impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Basics of Antennas: Dipole antennas; radiation pattern; antenna gain. Basics of Antennas; Dipoleantennas; radiation pattern;; antenna gain. Basics of propagation in dielectric waveguide.

COMPUTER SCIENCE AND ENGINEERING

Marks:70(70 Questions)

Digital Logic: Boolean algebra, Combinational and sequential circuits, Minimization, Number representations and computer arithmetic (fixed and floating point).

Computer Organization and Architecture: Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining, Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA Mode).

Programming and Data Structures: Programming in C, Recursion, Arrays, Stacks, Queues, linked lists, trees, binary search trees, binary heaps, graphs.

Algorithms: Searching, sorting, hashing, Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph search, minimum spanning trees, shortest paths.

Theory of Computation: Regular expression and finite automata. Context-free grammars and push-down automata. Regular and contex-free languages, pumping lemma. Turing machines and undecidability.

Compiler Design: Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.

Operating System: Processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory Management and virtual memory. File systems.

Databases: ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, Indexing (e.g., B and B+ trees). Transactions and concurrency control.

Computer Networks: Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching, IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi, Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.

Information Systems and Software Engineering: Information gathering, requirement and feasibility analysis, data flow diagram, process specifications, input/output design, process life cycle, planning and managing the project, design, coding and testing, implementation and maintenance.

Emerging Technologies: Clustering, Cloud computing, Edge computing, Fog computing, IOT, Block Chain Technology, Artificial Intelligence.