

Manmohan Technical University
 Service Commission
 Curriculum of Open Competitive Examination
 For the Post of Lecturer in **Electrical Engineering**

Description of the post:

Service: Teaching	Group: Electrical Engineering
Post: Lecturer, Electrical Engineering	Level: Lecturer

Framework of the Curriculum:

The examinations are conducted in two phases as mentioned below:

First Phase: Written Exam Full Marks: 150
 Second Phase: (a) Qualification, Publications and Teaching Experience: Full Marks: 50
 (b) Interview & Presentation: Full Marks: 50

Table No: 1

First Phase: Written Exam Full Marks: 150

Paper	Subject	Full Marks	Pass Marks	Examination System	Number of Questions	Time
First	Teaching, Research and General Knowledge	50	25	MCQs	20	50 Minutes
	Subject Related Contents			MCQs	30	
Second	Subject, Research and Teaching Related Contents	100	50	Subjective Questions (short & long answer type)	14	3 Hours

Table No: 2

Second Phase: Interview Full Marks: 100

Subject	Full Marks	Examination System	Remarks
Interview and Presentation	50	Oral and Very Short Presentation	
Evaluation of Documents	50	Observation and Marking	
Total	100		

Note:

1. This curriculum framework is divided into two phases.
2. Open/internal competitive examination will be held as mentioned above.
3. The medium of language in written exam will be Nepali or English or both Nepali+ English only.
4. Examinees are prohibited to take mobile phone, programmable calculator, smart watch or other similar electronics devices in the examination hall.
5. The marks of academic qualification, publications and teaching experiences in the concerned field will be evaluated before the time of interview. All the publications and related documents are to be submitted before the last date of application submission.
6. The marks are allotted for these documents as given below:

S. No	Documents	Full Marks
1	Academic qualification	30
2	Research publication	10
3	Teaching experience	10
Total		50

7. The final result will be published on the basis of total marks of written exam, interview/ presentation, evaluation of academic qualification, research publications and teaching experiences.
8. In a subjective question, one or more than one questions can be included within the allotted marks area.
9. The full marks and weightage of questions are based on the given curriculum.
10. Research and problem solving types of questions will be selected from the related field.
11. This curriculum will be effective from the date of 2080/05/13

Subject: Electrical Engineering
Paper: First (Objective)
Objective (Multiple Choice) Questions

Full Marks: 50
Pass Marks: 25
Time: 50 Minutes

Part	Subject Matter	Number of Questions	Marks per Question	Total Marks
First Part	Teaching, Research and General Knowledge	20	1	20
Second Part	Subject Related Contents	30	1	30
Total		50		50

(Extention of the Curriculum) पाठ्यक्रमको विस्तृतीकरण

First Part: (Teaching, Research and General Knowledge)

20×1=20

क) शिक्षण सीप, विधि र विद्यार्थी मुल्याङ्कन (Teaching Skill, Methods and Evaluation): (5)

विस्तृतीकरण	उच्च शिक्षा शिक्षणका लागि आवश्यक गुण, संचार सीप, शिक्षण विधि र विद्यार्थी मुल्याङ्कन सम्बन्धी प्रश्नहरू ।
शीर्षक	थप विस्तृतीकरण
उच्च शिक्षा शिक्षणका लागि आवश्यक गुणहरू Required qualities for teaching in higher education:	उच्चशिक्षामा शिक्षणको लागि आवश्यक व्यक्तिगत, सामाजिक तथा पेशागत गुणहरू: (Required qualities for teaching in higher education: Individual, social and occupational/professional)
कक्षामा सञ्चार सीप (Communication Skill in the classroom)	सिकाइमा उत्प्रेरणा जगाउने तरिका र कक्षामा विषयवस्तुको प्रस्तुतीकरण सीप: (Motivational and presentation skills of subject matter in the classroom): भाषाको प्रयोग, विषयवस्तुको क्रमवद्धता, सिकारुमैत्री वातावरण निर्माण ।
शिक्षण विधि (Teaching methods)	शिक्षण विधिका अवधारणा र प्रयोग: (Concept and uses of teaching methods): <ul style="list-style-type: none"> • Demonstration method • Problem solving method • Discovery method • Project method • Practical /Experimental method • Field work method

विद्यार्थी मूल्याङ्कन (Student evaluation and assessment)	<ul style="list-style-type: none"> • सुधारात्मक, निर्णयात्मक तथा निदानात्मक मूल्याङ्कन (Formative, summative and diagnostic evaluation). • मूल्याङ्कनबाट प्राप्त जानकारीको प्रयोग (Using assessment information): निर्णय गर्नका लागि (For Decision making), सुधारका लागि पृष्ठपोषण (Feedback for improvement) ।
--	---

(ख) Research Aptitude, Publication Ethics and Data Interpretation: (5)

Extention	<ul style="list-style-type: none"> • Meaning of research and its objectives, types and methods, • Research & publication ethics, • Types of data sources, access to data, availability of data and data presentation • Research based article, • Quality of journal • Dissertation/thesis framework
-----------	---

(ग) उच्च शिक्षा प्रणाली (Higher Education System) (5)

विस्तृतिकरण	नेपालको संविधानमा शिक्षा संबन्धी प्रावधानहरु, नेपालको शिक्षा प्रणाली, नेपालमा उच्च शिक्षाको वर्तमान अवस्था, उच्च शिक्षा नीति ।
नेपालको संविधानमा शिक्षा संबन्धी प्रावधानहरु, नेपालको शिक्षा प्रणाली, नेपालमा उच्च शिक्षाको वर्तमान अवस्था, उच्च शिक्षा नीति ।	<ul style="list-style-type: none"> • नेपालको संविधानमा शिक्षा संबन्धी प्रावधानहरु: • नेपालको शिक्षा प्रणाली: शिक्षाको संरचना, औपचारिक र अनौपचारिक प्रणाली । • उच्च शिक्षामा प्राविधिक विषयको आवश्यकता • विश्वविद्यालय अनुदान आयोगका प्रमुख कार्यहरु तथा यसबाट विश्व विद्यालयहरुलाई दिइने अनुदानका प्रकार । • उच्च शिक्षा नीति ।

(घ) मनमोहन प्राविधिक विश्वविद्यालय र नेपाल इन्जिनियरिङ परिषद सम्बन्धी जानकारी (Information on Manmohan Technical University and Nepal Engineering Council) (5)

विस्तृतिकरण	म. प्रा. वि. ऐन, नियम तथा सांगठनिक स्वरुप सम्बन्धी प्रश्नहरु ।
४.१ मनमोहन प्राविधिक विश्वविद्यालय ऐन, २०७६	
४.२ मनमोहन प्राविधिक विश्वविद्यालय शिक्षक तथा कर्मचारीको सेवाका सर्त र सुविधासम्बन्धी नियमावली, २०७८	
४.३ मनमोहन प्राविधिक विश्वविद्यालय शैक्षिक प्रशासन नियमावली, २०७८	
४.४ मनमोहन प्राविधिक विश्वविद्यालय सेवा आयोग सम्बन्धी नियमावली, २०७८	
४.५ नेपाल इन्जिनियरिङ परिषद ऐन २०५५ र नियमावली २०५७ (संशोधन सहित)	

Subject: Electrical Engineering
Paper: First
First Part: Teaching, Research and General Knowledge

Sample Questions (MCQs)

20×1=20

(20 MCQs are asked from the contents of First Part. Each question carries one mark.)

Tick the best answer for the following questions from the given alternatives:

1. In the context of higher education, which of the followings is the most important role of a good teacher?
 - A) An evaluator of students in the class
 - B) A guide liner, analyzer and synthesizer of related information effectively
 - C) Innovator and Creator
 - D) **Effective communicator**
2. Which of the following assessment techniques is used to evaluate a student's progress and give feedback?
 - a) Summative
 - b) **Formative**
 - c) Decisive
 - d) Diagnostic
3. Which one is not a part of research proposal?
 - a) Methodology
 - b) Objectives
 - c) **Recommendations**
 - d) References
4. Which one is not a tool of data collection in engineering education?
 - A) Campaigning**
 - B) Questionnaire
 - C) Focus group discussion
 - D) Participatory rural appraisal
5. The main mandate of the University Grants Commission (UGC) Nepal includes:
 - A) **Disbursing grants to universities and colleges**
 - B) Recognizing and monitoring technical institutions
 - C) Funding research centers in universities
 - D) Managing various scholarship programs
6. The main present structure of education in Nepal is:
 - a. Primary, secondary and higher level
 - b. Pre-primary, Primary, basic, secondary, Higher and Research level
 - c. Primary, Secondary, Higher and Research level
 - d. **Basic, secondary and Higher level**

7. Which of the following statements is the most appropriate in terms of online education?
- It supplements formal education
 - It reduces the cost of education
 - It replaces the formal education
 - It enhances access to education in low cost and short time.**
8. Which of the following officials is not a member of the academic council of MTU?
- Representative of the industrial institute
 - Teacher representative of MTU
 - Member of the service commission of MTU**
 - Representative from the subject specialist
9. In which of the following case salary is discontinued to a teacher if he/she should be punished?
- If he/she frequently denied the code of conduct of teacher
 - If he/she disclosed the secrecy of the university
 - If he/she has not got clearance of his/her advance amount taken from the MTU
 - If he/she frequently denied and neglected the appeals of stakeholders**
10. Which one of the following statements is true?
- Curriculum and syllabus are equivalent components.
 - Syllabus has a wide scope than curriculum.
 - Curriculum is a broad term and syllabus is a part of curriculum.**
 - Syllabus includes many activities as compare to the curriculum

Subject: Electrical Engineering
Paper: First
Second Part: Subject Related Contents

30×1=30

Sample Questions (MCQs)

(30 MCQs are asked from the Contents of Group A of the Second Paper.
Each question carries one mark.)

Tick the best answer for the following questions from the given alternatives:

1. A network contains linear resistors and ideal voltage sources. If the values of all the resistors are doubled, then the voltage across each resistor is.....
 - a. Halved
 - b. Doubled
 - c. Increased by four times
 - d. Not changed**
2. Which of this power semiconductor device is not a current triggered device?
 - a. Thyristor
 - b. GTO
 - c. Triac
 - d. MOSFET**
3. A 300 kVA transformer has 95% efficiency at full load 0.8 pf lagging and 96% efficiency at half load unity power factor. The iron loss and copper loss in kW under full load operation are respectively
 - a. 4.12, 8.51**
 - b. 6.59, 9.21
 - c. 8.51, 4.12
 - d. 12.72, 3.07
4. A Buchholz relay is used for.....
 - a. Protection of a transformer against all internal faults**
 - b. Protection of transformer against external faults
 - c. Both a and b
 - d. Detection of fault in transmission line
5. If δ is the loss angle of the cable, its power factor is.....
 - a. $\sin \delta$**
 - b. $\cos \delta$
 - c. Independent of δ
 - d. depends on δ but not as per (a) and (b)
6. In power plant, a reserve generating capacity which is in operation but not in service is called the.....
 - a. cold reserve
 - b. hot reserve**
 - c. spinning reserve

- d. firm reserve
7. If a system is marginally stable, the roots of the characteristic equation can be.....
- a. $-j, j, -1, 1$
 - b. $-3, -2, 0$**
 - c. $-2+3j, -2-3j, -3$
 - d. $-3, -2, 1$
8. Three-point starters are not suitable for applications where speed variation by flux control is required because the motor may
- a. not start
 - b. run away
 - c. stop at very high speed**
 - d. stop at very low speed
9. Water hammer is developed in.....
- a. surge tank
 - b. water turbine
 - c. penstock**
 - d. draft tube
10. For an open circuited transmission line, the reflection coefficient is.....
- a. 1
 - b. -1
 - c. 0**
 - d. 0.5

Subject: Electrical Engineering
Paper: Second (Subjective)

Full Marks: 100
Pass Marks: 50
Time: 3 Hours

Group: A
Knowledge of the Subject Matter and Its Analysis: 60

Questions on this part are asked from each section as given below:

Question Types	Number of Questions	Per Question Marks	Total Marks
Long Questions	3	10	30
Short Questions	6	5	30
Total	9		60

- 1. Electric Circuit & Network: (5)**
 - 1.1 Electric Circuit: Ohm's Law; Voltage and Current sources; Source Conversion; Resistance, Inductance, Capacitance
 - 1.2 Network Solution Methods: Kirchhoff's laws; Nodal and Mesh analysis; Star/delta transformation; Thevenin's, Norton's, Superposition, Maximum power transfer, Reciprocity theorem
 - 1.3 AC fundamentals: Ac voltage and current; Generation of single-phase ac voltage; Average and RMS value, Form Factor, Crest Factor; Analysis of different combinations of R, L and C element in ac circuit, Power and Power Factor, Phasor diagram
 - 1.4 Three phase system: Introduction; Advantages; Generation; Analysis of balanced and unbalanced star and delta connected loads; Power in three phase ac circuits
 - 1.5 Network Analysis: Transient and steady state analysis of RLC circuits; Synthesis of RL, RC, LC and RLC network functions; Two port network parameters

- 2. Analog and Digital Electronics, Signals and Systems: (5)**
 - 2.1 Electronic Device and Circuits: PN junction diode and its VI characteristics; clippers, clampers and rectifiers; BJT configuration, Input and output characteristics of CB, CE and CC; Construction of JFET and MOSFET; Op amp in inverting and non-inverting configuration; Op amp as adder, subtractor, differentiator and integrator
 - 2.2 Digital Electronics: Binary systems, Boolean Algebra and logic gates, Combinational logic circuits, Sequential logic circuits
 - 2.3 Signals and Systems: Representation of continuous and discrete-time signals, Shifting and Scaling operations, Linear, time-invariant and causal

systems, Fourier series representation of continuous periodic signals, Fourier, Laplace and Z transforms

3. Measurement, Control and Instrumentation: (10)

- 3.1 Measurement System and Electrical Measuring Equipment: Significance of measurement; Methods of measurements; Classification of instruments; Types of instrumentation system; Elements of generalized measurement system; Input output configuration of measuring instrument and measurement system; Wattmeter: Working principle; Digital & Induction type; Energy meter: Working Principle; Frequency meter: Working Principle, Digital & Electrodynamometer type frequency meter
- 3.2 Control System: Mathematical modeling and representation of systems, Feedback principle, Transfer Function, Block diagrams and Signal Flow Graphs; Transient and Steady-state analysis of linear time invariant systems; Stability analysis: Routh-Hurwitz criterion, Nyquist criteria Bode plots, Root locus; Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model; Solution of state equations of LTI systems
- 3.3 Instrumentation: Medium resistance measurement (Ammeter, substitution and Wheatstone bridge); Low resistance measurement using Kelvin bridge; Measurement of insulation resistance; Measurement of earth resistance; General equation for ac bridge balance; Maxwell inductance and capacitance bridge; Schering bridge; Wein's bridge; Sensing element; Electrical transducer and classification; Characteristics and choice of transducer; Resistive transducer; Variable inductance transducer; Capacitive transducer; Piezo electric transducer; Analog / Digital conversion (Resolution, Quantization, aperture time, and sampling); Analog to Digital converter (SAR & Dual slope); Digital to Analog converter (Binary weighted and R2R ladder network)

4. Electrical Machine: (10)

- 4.1 Single phase transformer: Construction; Working principle; Types; Equivalent circuit, Phasor diagram; Tests; Regulation and Efficiency
- 4.2 Three phase transformers: Connections, Parallel operation
- 4.3 DC Generators: Construction; Types; Working principle; Characteristics; Applications; Parallel operation; Armature reaction and Commutation
- 4.4 DC Motors: Operating principle; Back emf and its role; Types; Characteristics; Applications; Starting and Speed control
- 4.5 Three phase induction motors: Construction; Working principle; Types; Rotating magnetic field; Torque-slip characteristic; Starting and Speed control; Losses and efficiency
- 4.6 Single phase induction motors: Double revolving field theory; Types and operating principle

- 4.7 Three phase synchronous generator: Construction; Types; Parallel operation and synchronization; Power angle characteristic
- 4.8 Three phase synchronous motor: Operating principle; Starting methods; Effect of excitation; V curves and inverted V curves

5. Power Electronics and Utilization of Electrical Energy: (5)

- 5.1 Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs : static characteristics and principles of operation
- 5.2 Power Electronics Converters: DC-DC Converter (Principle of operation of step-down and step-up chopper; AC -DC Converter (controlled and uncontrolled half wave and full wave rectification); DC-AC Converter (principle of inverters, PWM inverters); AC- AC converter (Principle of operation of ac voltage controller and cycloconverter)
- 5.3 Utilization of Electrical Energy: Basic principles of lighting, lighting calculations, types of lamps; Electric heating: resistive, arc, dielectric, induction, infrared, microwave heating; Electric drives and motor selection; Energy conservation and management: basic principles, energy auditing, and energy management techniques; Electric traction: systems of traction, dc and ac motors application for traction, starting method and speed control of electric motors, electric braking, speed-time curves

6. Power Plant, Switchgear and Protection: (5)

- 6.1 Power Plant: Hydroelectric power plant (classifications and respective layouts, selection of sites, types of water turbines, their working principles and applications, governing of water turbines, Hydro- plant auxiliaries); Non-conventional power generation (solar power generation, wind power generation); Energy Storages (pumped storage plants, battery energy storage, compressed air storage and flywheel storage); Excitation systems (dc excitation system, ac excitation system, static excitation system, brushless excitation system); Automatic voltage regulator
- 6.2 Switchgear and Protection: Substations classification; General layout of substation, Working principle ,construction and application of air, vacuum, oil and gas filled circuit breakers; Specification, rating, testing and selection of circuit breakers; Fuse, MCB and MCCB protection; Over current, earth fault and under voltage relays, isolators and contactors, Overload and short circuit protection, earth fault protection, differential protection, distance protection; Lightning phenomenon, types and functions of lightning arrestor, overhead earth wire; Tap changing in transformer, booster transformer, synchronous condenser and static compensator; System and Equipment Earthing

- 7. Power System Analysis, Transmission and Distribution: (5)**
- 7.1 Power System Analysis: Basic power generation concepts; Transmission line models and performance; Corona and radio interference; Distribution systems; Per-unit quantities; Bus impedance and admittance matrices; Load flow; Voltage control; Economic operation; Symmetrical components; Fault analysis; System stability concepts, swing curves and equal area criterion; Voltage control and VAR compensation.
- 7.2 Transmission and Distribution: Overhead transmission line and underground cabling; Necessity of high voltage transmission, choice of voltage level, conductor spacing, insulating materials and their classification, voltage regulation and efficiency of transmission lines, sag, tension and clearances, supports and cross arms, conducting materials, types of Insulators, String Efficiency, jumpers and vibrations dampers in transmission lines; Electrical loads (types, characteristic and load forecast); Primary distribution system(radial system, ring main system and interconnected network system); Secondary distribution system (three phase four wire distribution, single phase two wire distribution, selection of supports and conductors in secondary distribution system)
- 8. Optimization Techniques and Reliability Engineering: (5)**
- 8.1 Optimization Techniques: Linear Programming (simplex method and extensions); Network models (shortest path, maximum flow and minimum cost problems); Dynamic programming (resource allocation, production scheduling and equipment replacement problem); Non-linear programming (selected unconstrained and constrained non-linear programming algorithms like quasi-Newton, reduced gradient and gradient projection methods); Penalty function methods; Quadratic programming.
- 8.2 Reliability Engineering: Review of probability theory; Binomial distribution and its applications; Network modeling and calculations for simple and complex systems; Probability distribution in reliability evaluation; System reliability evaluation using probability distribution; Discrete Markov chains; Continuous Markov processes; Frequency and duration techniques for reliability evaluation
- 9. Advanced Power System Operation and Control: (10)**
- 9.1 Introduction: Modern Power System; Structure of a bulk power system network; concept of synchronous grid; interconnected power system and its elements; Concept of reliability, Operational Objectives of a Power System; Hierarchical Control in power systems, ownership and co-ordination, definition of various operating states, nature of various control actions and their significance
- 9.2 Equipment and Stability Constraint in System Operation: Nature of constraints faced in power system operation, equipment constraints,

- Generator Constraints, Transmission Line Constraints; Stability Problems in Power Systems, Numerical Solution of Differential Equations; Large disturbance Angle stability, Feedback control systems; Voltage instability
- 9.3 Frequency Control in Power System: Definition of frequency, load frequency variation, Load characteristics, Solution of non-linear algebraic equations, Calculation of system frequency, Frequency Control, Speed Governor, Automatic Generation Control (AGC)
 - 9.4 Voltage and Power Flow Control: Reactive Power and Voltage Control; Reactive Power Characteristics of special devices; HVDC Converter; Power Flow Control; Controllable Devices
 - 9.5 Real and Reactive Power Scheduling: Scheduling, control variables and constraints; Real Power Scheduling, Optimization; Real and Reactive Power Scheduling
 - 9.6 Preventive, Emergency and Restorative Control: Control actions, power system state estimation; Normal and alert state in a power system; Emergency control, blackout, power system restoration
 - 9.7 Power System Structures: Utility Integration; Deregulation

Group: B

Subject Related Research and Problem Solving: 20

Questions on this part are included from the types as given below:

Question Types	Number of Questions	Per Question Marks	Total Marks
Long Questions	2	10	20
Total	2		20

- 1. Research Aptitude, Publication Ethics and Data Interpretation: (10)**
Meaning of research and its objectives, types and methods, Research publication ethics, Process of data collection, availability of data and its presentation, Research based articles, Process of preparation and publication of qualitative journal and its framework, Dissertation/thesis framework, Analyze the existing problems and suggest solutions
- 2. Problems and Solutions in Related Field: (10)**
Identify problems, issues and challenges in related field, Latest trends, issues and challenges in the field of related Engineering and suggest appropriate means and ways of solutions to overcome these issues

Group: C

Teaching Related Contents: 20

Questions on this part are included from the types as given below:

Question Types	Number of Questions	Per Question Marks	Total Marks
Long Questions	1	10	10
Short Questions	2	5	10
Total	3		20

- 1. Curriculum and Teaching Plans: (10)**
General knowledge on curriculum, Analysis and preparation of Bachelor level curriculum of MTU in related subject and its frame work. General information, importance, preparation and implementation of instructional plan, unit plan and daily lesson plan
- 2. Teaching Skill, Methods and Evaluation: (10)**
Required qualities for teaching in higher level: Individual, social and occupational/ professional, Communication Skill: motivation and presentation of subject matter in the classroom, Teaching methods: Demonstration method, Problem solving method, Discovery method, Project method, Practical/ Experimental method, Field work method, Student Evaluation and Assessment: Formative, summative and diagnostic evaluation, Using assessment information for decision making and feedback for improvement

Subject: Electrical Engineering
Paper: Second (Subjective)
Sample Questions: (long and short answer types)

Full Marks: 100
Pass Marks: 50
Time: 3 Hours

Attempt all questions
Group: A (30+30=60)

Long answer type questions: **3×10=30**

1. Explain deregulated models of power systems based on energy trading. (10)
2. Explain double revolving field theory and justify that a single-phase induction motor is unable to produce starting torque. (10)
3. Draw the root locus for the system whose open loop transfer function is $G(s) = \frac{K}{s(s+6)(s^2+4s+13)}$ (10)

Short answer type questions: **6×5=30**

4. Why are transformers connected in parallel? Explain the conditions necessary for operating transformers in parallel. (1+4)
5. While solving linear programming problem, how would you select a basic variable that should become non basic variable? Explain. (5)
6. Explain the principle of operation of step-up chopper and also derive the expression for average output voltage in terms of input voltage and duty cycle (5)
7. For satisfying the technical requirement in a transmission line design, it's more effective to increase the number of circuits rather than increasing voltage level. Justify. (5)
8. Define half-sub tractor with truth table and logic diagram. (5)
9. Explain the operation of pumped storage type hydro power plant with neat diagram. (5)

Group: B (2×10=20)

10. Even though Electric vehicles are being commercially manufactured, the majority of consumers are still opting non-EVs as their first choice. What may be the probable reasons behind it? Identify the research area that needs to be explored in order to improve design and performance of Electric Vehicles. (10)
11. On a certain day, the operator operating a dc shunt generator finds that the generator is not able to conduct load at its rated voltage. What might be the probable causes for this and suggest suitable solutions to rectify this issue. (5+5)

Group: C (10+5+5) =20

12. Highlight the distinctive features of the course 'Power system protection' of Bachelor of Electrical and Electronics Engineering of MTU with its course structure. Explain any one of the distinctive features of this course. (6+4)
13. Prepare a lesson plan for one period on any topic from the course 'Control System Engineering' in the present curriculum of Bachelor of Electrical and Electronics Engineering of MTU. (5)
14. What is discovery method of teaching? How can it be introduced in teaching BE level students of Electrical Engineering? (2+3)