

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

**Description of the post:**

Service: Teaching	Group: Mechanical Engineering
Post: Lecturer, Mechanical 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 2080/05/10

**Subject: Mechanical 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
<b>Total</b>		<b>50</b>		<b>50</b>

**(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"> <li>• Demonstration method</li> <li>• Problem solving method</li> <li>• Discovery method</li> <li>• Project method</li> <li>• Practical /Experimental method</li> <li>• Field work method</li> </ul>

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

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

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

(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"> <li>• नेपालको संविधानमा शिक्षा संबन्धी प्रावधानहरु:</li> <li>• नेपालको शिक्षा प्रणाली: शिक्षाको संरचना, औपचारिक र अनौपचारिक प्रणाली ।</li> <li>• उच्च शिक्षामा प्राविधिक विषयको आवश्यकता</li> <li>• विश्वविद्यालय अनुदान आयोगका प्रमुख कार्यहरु तथा यसबाट विश्व विद्यालयहरुलाई दिइने अनुदानका प्रकार ।</li> <li>• उच्च शिक्षा नीति ।</li> </ul>

(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: Mechanical 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?
- A. It supplements formal education
  - B. It reduces the cost of education
  - C. It replaces the formal education
  - D. 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?
- A. Representative of the industrial institute
  - B. Teacher representative of MTU
  - C. Member of the service commission of MTU**
  - D. Representative from the subject specialist
9. In which of the following case salary is discontinued to a teacher if he/she should be punished?
- A. If he/she frequently denied the code of conduct of teacher
  - B. If he/she disclosed the secrecy of the university
  - C. If he/she has not got clearance of his/her advance amount taken from the MTU
  - D. If he/she frequently denied and neglected the appeals of stakeholders**
10. Which one of the following statements is true?
- a. Curriculum and syllabus are equivalent components.
  - b. Syllabus has a wide scope than curriculum.
  - c. Curriculum is a broad term and syllabus is a part of curriculum.**
  - d. Syllabus includes many activities as compare to the curriculum

**Subject: Mechanical 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. Heat transfer takes place as per...
  - A. Zeroth law of thermodynamics
  - B. Second law of thermodynamics**
  - C. First law of thermodynamics
  - D. Kirchhoff's law
  
2. The processes involved in a carnot cycle are...
  - A. Two adiabatic processes and two constant volume processes
  - B. Two isothermal and two constant pressure processes
  - C. Two adiabatic processes and two isothermal processes**
  - D. Two constant pressure and two constant volume processes
  
3. What are the forces that influence the problem of fluid statics?
  - A. Gravity and viscous forces
  - B. Gravity and pressure forces**
  - C. Viscous and surface tension forces
  - D. Gravity and surface tension forces
  
4. Turbulence flow implies ...
  - A. Random component of velocity superimposed on mean flow**
  - B. Nonuniformity of flow
  - C. Transmission from laminar to turbulent flow
  - D. Unsteadiness of flow

**Subject: Mechanical 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 included from the types 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. Engineering Thermodynamics and Heat Transfer: (10)**
- 1.1 Basics of Thermodynamics: systems and surroundings, temperature, thermodynamics properties, state and path functions, thermodynamics equilibrium, Zeroth law
  - 1.2 Properties of Substances: ideal gas and its equation, universal gas constant and characteristic gas constant, state postulate, specific volume & quality, two-phase system, two-phase mixture, development of data, internal energy, enthalpy and specific heat
  - 1.3 Laws of Thermodynamics: laws of thermodynamics and applications, conservation of mass and energy, entropy and entropy relations, isentropic process, heat engine, heat pumps, refrigerator, Kelvin-Planck and Clausius statements, thermal efficiency, coefficient of performance, Carnot cycle and its efficiency
  - 1.4 Thermal Processes and Thermodynamic Cycles: isothermal process, isobaric process, isochoric process, adiabatic process; reversible and irreversible process, examples of thermodynamic cycles such as vapor compression refrigeration cycle, Rankine cycle, Brayton cycle, Otto cycle, Diesel cycle and their efficiency and COP
  - 1.5 Internal Combustion Engines: working of spark ignition engines and compression ignition engines, major components and their functions, cycle of operation in four-stroke and two-stroke engines
  - 1.6 Applied Thermodynamics: HVAC system, boilers, compressors, refrigeration system using vapor compressor and vapor absorption, refrigerants and their properties, psychometric
  - 1.7 Heat Transfer: conduction, convection and radiation processes, heat transfer in plane wall, tubes & sphere, Stefan's Boltzmann law, reflectivity, transmissivity & absorptivity, overall heat transfer coefficient



1.8 Application of Heat Transfer: free and forced convection, fins, heat exchanger types, and effectiveness

**2. Fluid Mechanics and Machines: (5)**

2.1 Fluid Properties and Statics: fluid and solid, continuum, no-slip condition, Lagrangian and Eulerian approach, control volume, viscosity, Newtonian and non-Newtonian fluids, surface tension, pressure, pressure measurement, force on a plane

2.2 Kinematics: types of fluid flow, steady flow, uniform flow, compressible flow, rotational flow, laminar and turbulent flow, stream function, potential function, vorticity, circulation

2.3 Fluid Flow Equation: continuity equation, Euler equation, Bernoulli's equation, application of Bernoulli's equation, momentum equation, Navier-Stokes equation

2.4 Laminar Flow: laminar flow in a pipe, laminar flow between parallel plates, major losses, minor losses, boundary layer, boundary layer thickness, laminar and turbulent boundary layer flow, flow separation

2.5 Turbines: classification of turbines, comparison between turbines, merits and demerits of each type of turbine, Francis turbine, Pelton turbine, Kaplan turbine, Cross Flow turbine, low-head turbines, selection of turbines, cavitation and erosion

2.6 Pumps: classification, working principles and advantages of pumps, criteria for pump selection, pump characteristics (head, efficiency, power), priming

**3. Engineering Mechanics and Strength of Materials: (5)**

3.1 Applied Mechanics: concept in statics and static equilibrium, forces acting on the particle and rigid body, mass moment of inertia, laws of friction, types, coefficient and application of friction

3.2 Theory of Elasticity: stress, strain, Hook's law, modulus of elasticity, thermal stress, longitudinal strain, lateral strain, Poisson's ratio, volumetric strain, bulk modulus, strain energy, and impact loading

3.3 Strength of Materials: centre of gravity, centroid, moment of inertia, polar moment of inertia, shear force and bending moment, deflection of beam and torsion of shaft

3.4 Theory of Machines: degree of freedom, linkage mechanism (4R, 3R-1P, 2R-2P), kinematics of motion, kinetics of motion, velocity in mechanism, acceleration in mechanism, force in mechanism, mechanisms with lower pairs

3.5 Mechanism: SHM, cycloidal motion, gyroscopic couple and precessional motion, governor, flywheel, balancing of mass, cam and follower mechanism, belt, rope and chain drives, gear trains

3.6 Mechanics of Solid: deformable body, stress on the deformable body, general Hooke's law, torsion, determinate and indeterminate structures, thick wall and thin wall cylinder

**4. Manufacturing Technology: (10)**

4.1 Casting: sand casting, investment casting, permanent mould casting and pressure die casting processes

4.2 Heat Treatment: annealing, normalizing, hardening, tempering, surface modification processes (carburizing, cyaniding and nitriding)

4.3 Hot and Cold working: advantages, types of hot working (rolling, forging, extrusion), benefits, cold rolling, drawing, squeezing, bending, shearing, shot peening

4.4 Calculations of forces and powers on rolling, forging, extrusion and drawing

4.5 Cutting Tool Materials and Cutting Fluids: types and their applications

4.6 Fundamentals Machining: mechanics of cutting, cutting forces (force relationship in orthogonal cutting, Merchant's circle diagram) and power, tool life, wear and failure of cutting tools

4.7 Machine Tools: classification, construction and application of lathe, milling machine, drilling machine, boring machine, shapers, sawing, broaching and grinding machines

4.8 Welding and Brazing: fundamentals of arc welding, types of welded joints, welding equipment, welding processes and applications of arc welding, gas welding, spot welding; types of brazing and their applications

4.9 Nontraditional Machining: working principle, advantages and disadvantages of ultrasonic machining (USM), electrical discharge machining (EDM), laser beam machining (LBM), electrochemical machining (ECM), abrasive water jet machining (AWJM) and electro-chemical grinding (ECG)

4.10 CAD/ CAM (Computer-aided manufacturing): Additive manufacturing, principle and benefits of CAD/CAM, rapid prototyping, flexible manufacturing system, CNC in manufacturing

4.11 Industrial Robots: introduction , types basic components and applications

4.12 Production of screw threads and gears by matching, rolling and grinding

**5. Mechanical Design: (5)**

5.1 Design Classification: design requirements, design considerations, needs and benefits of codes and standards, mechanical engineering standards, ISO series

5.2 Machine Elements: gears, belts & pulleys, couplings, bearings, bolts, springs and dampers, screws, brakes, clutches and keys

5.3 Static analysis of systems, design for static strength, transmission components, design of fasteners and connections, design of load-carrying members

5.4 Mechanical Vibrations: degree of freedom of system (DoF), natural frequency and resonance, damped and un-damped vibration, free and forced vibration of single and 2 DoF only

**6. Industrial Engineering and Management: (5)**

6.1 Design of Production Systems: plant location and layout, material handling, production planning and control

6.2 Inventory Control: economic order quantity, safety stock, reorder quantity, lead time, ABC analysis

6.3 Forecasting Techniques

6.4 Project scheduling (CPM, PERT)

6.5 Material requirement planning (MRP I), manufacturing resource planning (MRP II) and just in time manufacturing (JIT)

6.6 Quality Management: dimensions of quality and total quality management

6.7 Plant Maintenance: preventive maintenance, scheduled maintenance, break down maintenance and total productive maintenance(TPM)

**7. Metrology: (5)**

7.1 Introduction to metrology, methods of measurements, general metrological terms

7.2 Errors in measurement

7.3 Linear, angular and surface measuring instruments

7.4 Gear measurement and screw thread measurements

7.5 Needs of inspection, roles and responsibilities of institution concerning metrology, calibration of measurements

7.6 Surface roughness

7.7 Limits fits and tolerances

7.8 Gauge design

7.9 Alignment and acceptance test on machine tools

**8. Energy Resources (5)**

8.1 Conventional and Non-conventional Energy Resources: classification, properties of coal, oil, and natural gas, solar, bio, wind, micro and small hydro, harnessing technologies, nuclear energy, fuel cells, and hydrogen fuel system uses and their impacts on the environment

8.2 Combustion and Combustion Products: combustion process, the condition necessary for combustion, phases of combustion, methods of controlling fire, harmful effects of combustion products and their controls, engine emissions

8.3 Engine Fuels: chemical structure of petroleum, rating of engine fuels, fuel supply system, fuel injection system, lubrication system, grading of lubrications, specific fuel consumption, conversion

- 9. Material Science: (10)**
- 9.1 Deformation of Metals: deformation, slip, twinning, imperfections (defects) in crystals
- 9.2 Heat Treatment: definition, objectives constituents of iron and steel, iron-carbon equilibrium diagram, TTT diagram, annealing, normalizing, hardening and tempering
- 9.3 Mechanical Properties and Testing of Materials: elastic and plastic behavior of solids, nondestructive tests and destructive tests (mechanical tests: tensile test, hardness test, impact test, fatigue test and creep test)
- 9.4 Deformation Process of Materials: cold work and hot work
- 9.5 Types of steels and cast iron
- 9.6 Non-ferrous Alloys: properties and applications of aluminum alloys, magnesium alloys, copper alloys, nickel alloys, cobalt alloys, titanium alloys, refractory alloys

**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: Mechanical Engineering**  
**Paper: Second (Subjective)**  
**Sample Questions: (short and long 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 working of four stroke engine with neat sketch. Derive an expression for pressure ratio, temperature ratio and efficiency for Otto cycle. (4+6)
2. Draw the Iron Carbide equilibrium diagram with detailed explanation of various phase transformation. (10)
3. Explain briefly the electrical discharge machining with the help of a diagram. Give the advantages, limitations and applications of EDM. (4+6)

**Short answer type questions**

**6×5=30**

4. Explain the types of flames used in oxy-acetylene gas welding in detail. (5)
5. State the Newton's Law of Viscosity. What are Newtonian and non-Newtonian fluids? (2+3)
6. Explain the General Considerations in Machine Design. (5)
7. Determine the limits of dimensions and type for the designed by H8/c11 for the basic size of 50mm, assuming fundamental deviation for H and c respectively as  $0 \mu\text{m}$  above the basic size line and  $125 \mu\text{m}$  below the basic size line and international tolerance grades for 8 and 11 as  $39 \mu\text{m}$  and  $110 \mu\text{m}$ . (5)
8. Draw a neat sketch of Merchant's circle diagram and show different forces acting on orthogonal cutting. (5)
9. A short question. (5)

**Group: B (2×10=20)**

10. Why the failure rate of students is increasing day by day in Bachelor Engineering programs? How the failure rate can be improved? Mention some measures. (5+5)
11. Describe briefly the steps of research methodology. (10)

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

12. What are the strong and weak points of the curriculum of Bachelor Level Mechanical Engineering of MTU? How do you suggest to make it better? (5+5)
13. What is Practical method of teaching? How can it be introduced in teaching Mechanical Engineering in Bachelor Level? (2+3)
14. What qualities are required to be a good teacher of higher level? And also explain individual qualities in brief. (2+3)