

MIZORAM PUBLIC SERVICE COMMISSION
DEPARTMENTAL EXAMINATION FOR JUNIOR GRADE OF M.E.S. (AE/SDO)
UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT,
GOVERNMENT OF MIZORAM, DECEMBER, 2024.

ENGINEERING PAPER – II
MECHANICAL ENGINEER

Time Allowed : 3 hours

FM : 100 PM : 40

Marks for each question is indicated against it.

PART 'A' (50 Marks)

1. State whether the following are **true** or **false**: **(10×1=10)**
 - (a) Weight is the amount of matter contained in a given body and does not vary with the change in its position on the earth's surface.
 - (b) Moment of force is the turning effect produced by a force on the body on which it acts.
 - (c) The motion of a piston in the cylinder of steam is an example of completely constrained motion.
 - (d) The force of friction is directly proportional to the normal load between the surfaces.
 - (e) A rigid link is one which is partly deformed in a manner not to affect the transmission of motion.
 - (f) The calorific value of gasoline is about 45 MJ/Kg.
 - (g) Cetane number in the case of diesel fuel is the percent of cetane in a mixture of cetane and a methylnaphthalene.
 - (h) Maximum Oil Pressure in lubrication system is controlled by pressure relief valve.
 - (i) Steel is an alloy of iron and carbon.
 - (j) The unit of mass moment of inertia in SI unit is Kg-m².
2. Answer **any 4 (four)** of the following question: **(4×5=20)**
 - (a) What is the purpose of operation research in water supply plant maintenance?
 - (b) What is oxygen cutting process?
 - (c) Describe the process of galvanised iron?
 - (d) Define soldering of metal?
 - (e) Define ERW pipes and state its uses?
 - (f) Define Viscosity and its role in lubrication system?
 - (g) State the principal of conservation of energy.
3. Answer **any 2 (two)** of the following questions:
 - (a) Describe Newton's law of motion? **(10)**
 - (b) Define IC & CI engine. Compare IC & CI engine? **(4+6=10)**
 - (c) Define friction. State and explain different types of friction? **(4+6=10)**
 - (d) What is Network Analysis in Operation Research? How can you improve Operation Research by using Network Analysis? State the uses in different in different situations? **(4+3+3=10)**
 - (e) Describe briefly different types of welding process with respect to water supply works? **(10)**

PART 'B' (50 Marks)

4. State whether the following statements are true or false: (10×1=10)

- (a) Centrifugal pumps are the most commonly used pump types due to its simplicity, efficiency and variability.
- (b) A water pump typically convert electrical energy into hydraulic energy.
- (c) The recommended oil change interval for DG set is usually every 1000 hours of operation.
- (d) An electrical motor converts electrical energy into hydraulic energy.
- (e) Population of forecasting using arithmetic increase method is suitable for large, old cities and considerably develop.
- (f) Duty point of a pump is the point where a pump's performance curve intersect with system characteristic curve.
- (g) Boring is the process of enlarging a hole that has already been drilled by means of single point cutting tool.
- (h) Pumping mains are pipelines in which the flow is maintained by gravity.
- (i) Design of a pump for power includes the pump's parts, the required flow rate and the total head.
- (j) The general rule of thumb is to maintain a velocity below 1.5 m/s for a water flowing through pipes.

5. Answer any 4 (four) of the following question:

- (a) What are the testing procedure of water pumps? (5)
- (b) Describe operation and maintenance of Electric Motor? (5)
- (c) Define grinding machine and its application. (3+2=5)
- (d) What is Lathe Machine? Describe its application. (3+2=5)
- (e) Calculate the daily water demand of urban areas having a population of 20000 souls at water supply level of 135 lpcd? (5)
- (f) Calculate the discharge (m^3/sec) of water flowing through a circular pipe having radius 25mm at a velocity of $1.3 \text{ m}^3/\text{sec}$. (5)
- (g) What is DG Set? Mention its application? (3+2=5)

6. Answer any 2 (two) of the following questions

- (a) What are the different types of pumps and describe the criteria of selection of pumps? (5+5=10)
- (b) Describe the operation and maintenance of Diesel Engine driven pump set? (10)
- (c) What is the function of water distribution system and discuss the merit and demerit of various types of water distribution system. (10)
- (d) What is population forecasting? Describe 3 (three) methods for population forecasting? (4+6=10)
- (e) Define working principle of air compression and its uses? (5+5=10)

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