FNU FIJI NATIONAL UNIVERSITY

College of Engineering, Science & Technology (CEST)

SCHOOL OF MECHANICAL ENGINEERING

TRADE DIPLOMA IN MECHANICAL ENGINEERING

MEC 567 POWER PLANT

TRIMESTER 3 – 2015

DATE: TIME:

DURATION: 3 HOURS

INSTRUCTIONS:

1. You are allowed 10 minutes extra reading time.

2. Begin each answer on a Fresh Page and use both sides of the sheet

3. Do not write your name on any answer sheet – only write your examination number

4. Insert all written sheets, graph paper, drawing paper, etc. in their correct sequence and secure with string

5. For all sheets of paper of which rough/draft work has been done, cross it through and you MUST ATTACH to your answer scripts

6. Write clearly the number(s) of the question(s) attempted on the top of each sheet

7. Attempt ALL Questions in the Answer sheet provided

Number of Pages: 6

Question 1 Fundamentals of Power Plant (20 marks)

I. A power plant is assembly of systems or subsystems to generate electricity, i.e., power with economy and requirements. The power plant itself must be useful economically and environmental friendly to the society. Non-conventional power generating systems are preferred to as they are pollution free. Name and describe any four (4) types of non-convectional power plant. (4 marks)

II. Describe thermal power plant and give examples and give four examples. (3 marks)

III. Energy is the capacity for doing work, generating heat, and emitting light. Explain these types of energy that are used to provide mechanical energy:

a. Kinetic energy.
b. Radiant energy
c. Nuclear energy (3 marks)

IV. Explain what a Carnot cycle is and show it on a PV diagram. (3 marks)

V. In designing a power plant there are some factors that always affect these designs. Some examples of these factors are the location of power plant, the availability of water in power plant and the low operating cost. Name 5 more. (5 marks)

VI. Define these terms: (2marks)

a. Dump power
b. Firm power
c. Prime mover
d. Load curve

Question 2 Diesel Power Plants (20 marks)

I. Describe briefly the purpose of these parts in a diesel power plant:
   a. Cylinder
   b. Piston connecting rod
   c. Connected load
   d. Suitable Valves

(2 marks)

II. Explain and draw diagrams to illustrate the operation of a four stroke internal combustion engine. (4 marks)

III. A diesel engine requires five supporting systems in order to operate. Explain these systems. (5 marks)

IV. Briefly describe the purpose and operation of the governing system in an engine

(2 marks)

V. List down 5 advantages and disadvantages of diesel power plant. (5 marks)

VI. Explain the functions of :

   a. Turbocharger
   b. Supercharger (2 marks)

QUESTION 3 STEAM POWER PLANT (20 marks)

I. Listed below are some major components of a boiler. Explain them and their functions in the boiler system: (4 marks)

a. Economizer
b. Air preheater
c. Soot blower
d. Condenser
e. Cooling tower
f. Super-heater
g. Re-heater
h. High pressure heater

II. Sketch and explain the operation and state the advantages and disadvantages of :

a. Chain grate stoker (6 marks)
b. Spreader stoker
c. Multi retort stoker

III. Figure 1 (a) and (b) are different types of steam turbine. Name them and briefly describe their operations. (6 marks)

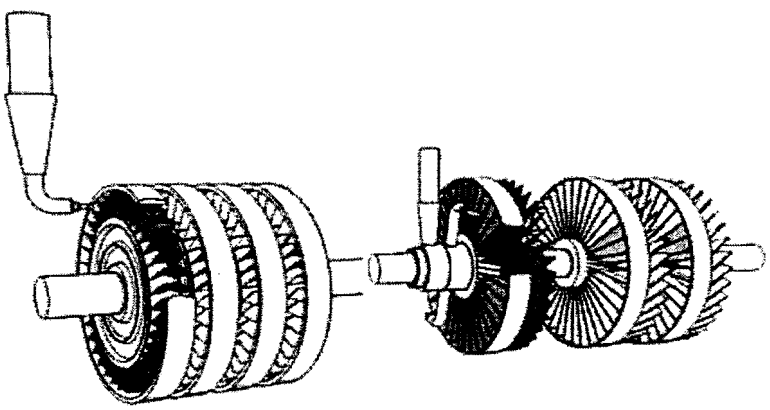

Figure 1: Steam turbines

(a) (b)

VII. What is the meaning of governing of steam turbine? Name three methods of governing.

(4 marks)

QUESTION 4 HYDRO ELECTRIC POWER PLANT (20 marks)

I. A hydro power station uses potential energy of water at high level for generating electrical energy. Briefly describe its operation and the amount of power produced until it reaches our homes. (5 marks)

II. The hydro-plants cannot be classified directly on the basis of head alone as there is no clear line of demarcation between the heads. Sketch and explain these three types of head (6 marks)

III. Figure 2 below shows the pelton wheel turbine in operation. Briefly explain the arrangement of the jets and the nozzles and the principle operation of the spear. (6 marks)

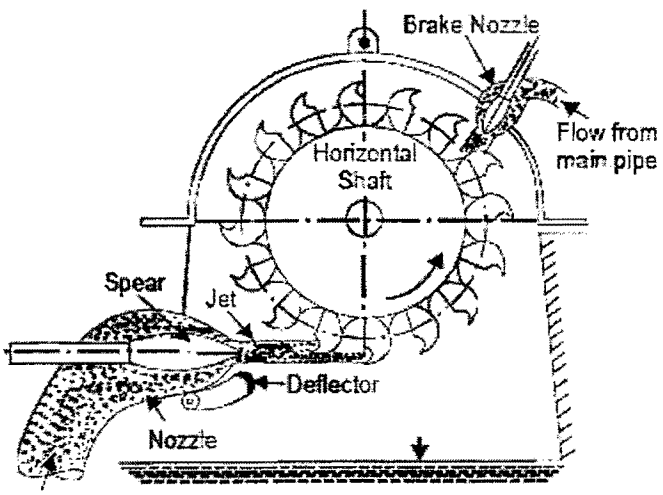

Figure 2: Pelton wheel

IV. Define cavitation and list down 3 techniques to avoid it in water pipes. (3 marks)

QUESTION 5 ELECTRICAL SYSTEMS (20 marks)

I. Explain the transformer and state the types and their applications. (3 marks)

II. The cooling of transformers differs from that of rotary machinery in that there is no inherent relative rotation to assist in the circulation of ventilating air. List any four (4) methods of cooling transformers (4 marks)

III. Explain in detail the process of transforming power shown in figure 3 below.

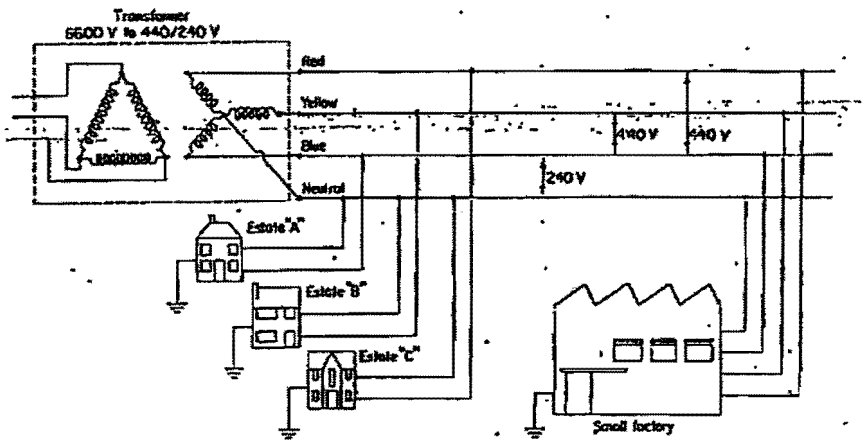

Figure 3: Transforming system

IV. Sketch and explain the single bus bar system and its operation (4 marks)

V. Name and explain the operation of the bus bar system shown in figure 3 (5 marks)

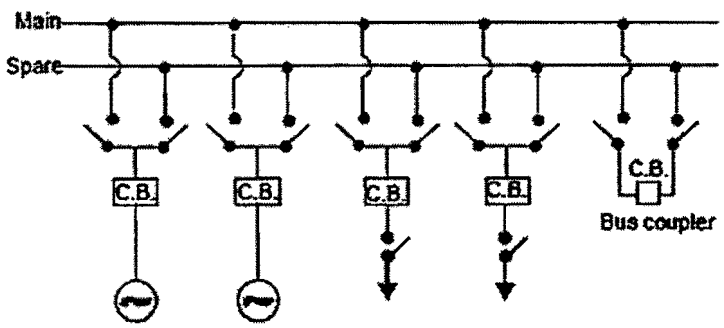

Figure 4: Bus bar system.

END OF EXAMINATION