

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)
December 2017 End Semester Examinations
M.Tech. (Marine Engineering & Management)
First Semester

Marine Machinery and Plant Design (PG13T1102)

Date: 05.12.2017

Maximum Marks: 100

Time: 3 Hrs

Pass Marks : 50

Note: Answer any five questions. All questions carry equal marks.

(5 x 20 Marks = 100 Marks)

1. A marine diesel engine has a transfer function of $1/\{s(s+5)\}$ at 100 rpm, where the input is fuel flow rate and the output is rotational speed. The fuel valve is controlled by an electric motor of transfer function $1/(s+1)$, whose input is the voltage and the output is fuel flow rate. A PI controller is implemented for the motor with gains of K_p and K_i respectively. A tachometer in the feedback loop measures the rotational speed and feeds back with a gain of 5.
 - a) Draw the system block diagram and derive the closed loop transfer function (in standard form)
 - b) At the lower speed of 70 rpm the engine transfer function is $1/\{s(s+2)\}$. Calculate the total system transfer function if the engine runs at 70 rpm. [12+08=20]
2. Ships emissions may be transported hundreds of kilometers, median transport velocity of SO_x and NO_x is about 400 km per day and the mean residence times of 1 to 3 days, indicating mean transport distances of 400 to 1200km. In this context, discuss
 - a) Hazardous Effects of Emissions of SO_x and NO_x emission measurements
 - b) MARPOL Legislation / Major regulations
 - c) SO_x and NO_x emission reduction[07+06+07=20]
3. Make a modeling of Cylinders in a Large Marine Turbo charged Two-stroke Diesel Engine with direct injection, uniflow scavenging and variable valve timing with a maximum rated power 7080 kW at 123 rpm. [20]

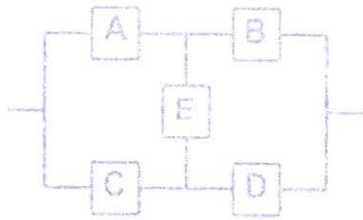
4. (a) Describe Process of condition monitoring by a flow chart, advantages of condition monitoring and types of sensor used, measurement process of metal temperature in condition monitoring.

(b) Describe the measurement process of metal temperature, piston ring measurement and fuel injection pressures

[10+10=20]

5. (a) Factors affecting performance hydraulic and pneumatic systems

(b) What is the reliability of the system?



[Where component reliabilities are A= 0.80 B= 0.95 C= 0.82 D= 0.85 & E = 0.75]

[10+10=20]

6. Write short notes on any four of the following:

- Hertz stress and its characteristics
- Factors affecting performance hydraulic and pneumatic systems
- Fault Tree Analysis
- Life cycle weight factors
- Propulsion transmission system Integration
- Reliability, Availability & Maintainability

[4X5=20]

7. Estimate the maximum pressure, size of the contact area and maximum shear stress when a 10 mm dia sphere in contact vertically with a 20 mm dia sphere with 100 N loading [take E_1 and E_2 are each 70 GPa , ν_1 and ν_2 are each 0.35]

[6+6+8=20]

8. (a) Make the mathematical modeling of the following pneumatic system



(b) List five advantages and five disadvantages of Pneumatic system

[14+6=20]