Indian Maritime University

(A Central University, Govt of India)

Supplementary Examinations – September/October 2024

Programme Name: B Tech (ME)

Semester: SIXTH

Subject Code: UG11T4602

Subject Name: MARINE MACHINERY SYSTEMS AND DESIGN

Date: 25.10.2024	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1.According to Indian standard the total number of tolerance grades are
a) 10 b) 20 c)18 d) 8

2.In clearance fit
a) Tolerance zone of hole and shaft overlap
b) Tolerance zone of hole is completely below that of shaft
c) Tolerance zone of hole is entirely above that of shaft
d) None of the above

3.The type of springs used in valve mechanism is
a) helical compression spring b) multi-leaf spring c) spiral spring
d) helical torsion spring

4.In thrust bearings, the load acts
a) along the axis of rotation b) Perpendicular to the axis of rotation
c)parallel to the axis of rotation d) both a & c
5. In case of full journal bearing the angle of contact of the bushing with the journal is

a) 60^0 b)90^0 c) 180^0 d) 360^0

6.In most of the internal combustion engines the crankshaft bearing is
a) Hydrodynamic journal bearing b) Hydrostatic journal bearing
c)ball bearings d) Roller bearings

7. The spokes of the flywheel are subjected to
a) direct shear stress b) torsional shear stress
c) tensile stress d) Compressive stress

8. The tail shaft is usually supported by the _____.
a) spring bearings b) tail bearings c) stern tube bearings d) propeller bearings

9. Which of the listed fire extinguishing agents would be suitable for use on an oil fire, but dangerous on an electrical fire?

a) CO_2 b) Water fog c) Halon d) Dry chemical

10. A disadvantage of using CO_2 for firefighting is that
a) the CO_2 does not cool the fire b) the cylinders are regulated pressure vessels
c) they are not effective on class "B" fires d) they are not effective on class "C" fires

Section B

Five Questions of 02 Marks each

11. Why single cylinder engines and power presses uses larger flywheels?

12.What arrangements are provided to keep the rudder stationary and shock relieving during heavy seas

13. How is the thrust bearing clearance adjusted.

14. At what position of piston in the cylinder is the starting air introduced?

15. Why are lignum vitae strips dove tailed?

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. A helical compression spring is made of music wire. The spring has to support a load of 150 N. Due to space limitations, the outer diameter of the spring should not exceed 25 mm, the solid length should not to exceed 40 mm, and the free length of the spring is not to exceed 100 mm. Allowable shear stress for music wire is 800 MPa and G = 81000 N/mm^2. (10M)

17. The connecting rod for an I.C. engine running at 1800 r.p.m. and develops a maximum pressure of 3.15 N/mm^2. The diameter of the piston is 100 mm; mass of the reciprocating Parts per cylinder 2.25 kg; length of connecting rod 380 mm; stroke of piston 190 mm and compression ratio 6 : 1. Take a factor of safety of 6 for the design. Take length to diameter ratio for bearing as 1.3 and small end bearing as 2 and the corresponding bearing pressures as 10N/mm^2 and 15 N/mm^2. The density of material of the rod may be taken as 8000 kg/m^3 and the allowable stress in the bolts as 60 N/mm^2 and in cap as 80 N/mm^2. The rod is to be of I-section for which you can choose your own proportions. Use Rankin formula for which the numerator constant may be taken as 320 N/mm^2 and the denominator constant 1 / 7500. Design i) Dimensions of the I-section of the connecting rod, ii) Dimensions of the bigger end bearing and small end bearing. (10M)

18. Following data is given for a full hydrodynamic bearing:
Radial load = 22 kN
Journal speed = 960 rpm
Unit pressure in bearing = 2.4 MPa
l/ d = 1:1
Viscosity of lubricant = 20 cp
Ratio of h_0/c =0.2 -Minimum oil thickness / Radial clearance
Determine: (*a*) dimensions of the bearing, (*b*) minimum film thickness, (*c*) requirements of oil flow. (10M)

19a) What are the operational difficulties of emergency fire pump and suggest suitable remedies and repairs to keep in operation. (7M)

b) List out the safety requirements of steering gear according to SOLAS (3M)

20a) Draw the schematic circuit diagram of Air starting system of marine diesel engine. (7M)

b) List out the advantages of intercoolers and aftercoolers of air starting system (3M)

21. A six-cylinder single acting 4 stroke non supercharged diesel engine is required to develop 650kW brake power. It is required to design a suitable fuel pump with the help of data given below. The pump plunger has a helical groove and it is actuated by a tangent flat cam and roller carrier.

1. Bore /stroke ratio of the engine	1/1.5
2. Mean pressure from indicator card	7.86bar
3. R.P.M	600
4. Mechanical efficiency	86.64%
5. Maximum Pressure in the cylinder	69bar
6. Injector set pressure	350 bar
7. Density of fuel at working temperature	850 kg/m^3
8. Fuel pump plunger die/stroke ratio	1/1.25

9. Desired specific fuel oil consumption — 240 gms/kWh

FUEL PUMP CAM

a. Base circle die — 100 mm
b. Half angle of action — 55°
c. Roller Follower — 60 mm
d. Mass of the plunger, roller and carrier — 0.66 kg
e. Distance between centers — 80 mm

FUEL PUMP SPRING

a. Mean dia — 66 mm
b. Pre compression load at zero lift — 40 N
c. Allowable shear stress — 200 MN/m^2
d. G for spring material — 90 GN/m^2

Determine:

1. Engine bore and stroke
2. Fuel consumed per day.
3. The diameter and the stroke of the fuel pump plunger. [Note: Approximately half of actual stroke volume of pump barrel is utilized for required fuel injection.]
4. The minimum well thickness of the pump barrel considering the thick cylinder theory, given that the Ultimate Tensile Stress of the material is 1000 MPa and factor of safety is 12.

(10M)

22. Find the displacement and stress & strain of composite bar shown in the figure using Finite element method analysis (FEM)

A1 = 200 mm^2, A2 = 100 mm^2,

l1 = l2 = 100 mm

P3 = 1000 N.

E1 = E2 = E = 2 x 106 N/mm^2 (10M)

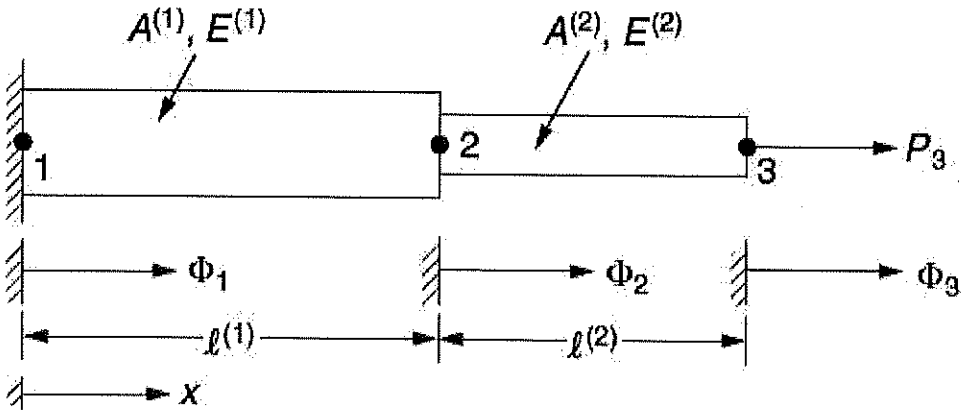

Fig.