# Indian Maritime University

( A Central University, Govt of India)

May-June 2018 End Semester Examinations

**B. Tech (Marine Engineering)**

Semester-II

**Seamanship, Elementary navigation & Survival at Sea**
**(UG11T3201)**

Date: 09.06.2018 — Max Marks:100 Marks
Time: 3 Hrs — Pass Marks: 50 Marks

**Part- A**

**(All questions are Compulsory)**

1. a. What are the Pyrotechnics carried on Navigation Bridge? **Marks 3 x 10 = 30**

b. What is SOPEP ?

c. Name Types of splices done on a rope.

d. Describe MUSTER STATION.

e. What are the different types of anchors used on merchant ships?

f. What is Rat Guard, where is it used? What is the use of it?

g. Name the MARPOL annexes that are in force.

h. describe briefly about Free-fall lifeboat.

i. What is bitter-end of Anchor cable? Explain.

j. Describe briefly SART & EPIRB.

**Part-B**

**( Answer any 5 of the following Questions)** **Marks: 5 x 14 = 70**

2. Explain in detail the ship's organizational structure. (14)

3. Why do ships carry Anchors? Draw a Stockless anchor & label its parts.(14)

4. Name any five Navigational Equipment inside Navigation Bridge & briefly describe their purpose. (14)

5. Draw a profile view (neatly) of a cargo ship & label various compartment on it. (14)

6. How do you Care & Maintenance of
(i) Natural fibre rope (ii) Steel wire rope. (7+7)

7. Describe following navigation lights w.r.t. their position on board, colour, & arc of visibility;

(i) Mast headlight (ii) portside light (iii) starboard side light (iv)Stern light

(v) All-round Light (14)

8. Describe various security levels as per ISPS code. Describe Role of Ship Security Officer. (14)

---

# INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

MAY/JUNE 2018 END SEMESTER EXAMINATION

**B. Tech (Marine Engineering)**

**Semester: II**

**Mathematics-II (UG11T3202)**

---

Date : 12-06-2018 | Maximum Marks: 100

Time: 3 Hrs | Pass Marks: 50

---

PART –A | Marks: 10 x 3=30

(All Questions are compulsory)

1. (a) For any function $f(x)$ defined with in [-L,L], write down the explicit expressions of the Fourier coefficients $a_n$ and $b_n$. In case of $f(x)$ being an odd function, which of these coefficients will be zero and why?

(b) If $f(t)=\sin t$ and $g(t)=\cos t$, calculate the convolution $f(t)*g(t)$.

(c) Compute L($\cos^2$t) and L($\sin^2$t) using the relation cos2t=1-2$\sin^2$t=2$\cos^2$t-1

(d) Calculate the inverse Laplace transform $L^{-1}\left\{\frac{5s}{s^2+2s+17}\right\}$

(e) Solve the non-exact equation $y^2dx+x(x-y)dy=0$

(f) Find the particular integral (PI) for the differential equation

$$(D^2+3D+2)y=e^{2x}\sin x$$

(g) Derive the orthogonal trajectory corresponding to the curve $xy=C$.

(h) A bag contains five white, seven black and eight red balls. A ball is drawn at random. What is the probability that it is red ball or a white ball ?

(i) Out of 800 families with five children each, how many families would be expected to have at the most two girls ?

(j) Write down the Pearson's constants $\beta_1,\beta_2,\gamma_1,\gamma_2$ for Binomial distribution in terms of $n,p,q$.

PART – B

(Answer any five questions) 5 x 14=70 Marks

2 (a) Expand $f(x) = x - x^2$ , $-\pi < x < \pi$ in Fourier series and show that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} \cdots\cdots = \frac{\pi^2}{12}$$

(b) Find the Fourier series of the triangle wave

$$f(x) = \begin{cases} \frac{\pi}{2} + x, -\pi \le x \le 0 \\ \frac{\pi}{2} - x, 0 < x \le \pi \end{cases}$$

defined on the interval $[-\pi, \pi]$.

7+7

3 (a) Find the inverse Laplace transform of $F(s) = \log\left\{\frac{s^2+4}{s^2+9}\right\}$.

(b) Use Laplace transform to solve the differential equation

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = e^{-x}\sin x, \quad y(0) = 0, \; y'(0) = 1$$

6+8

4 Solve the following differential equations:

(a) $y(xy + 2x^2y^2)dx + x(xy - x^2y^2)dy = 0$

(b) $(D^2 - 4)y = e^x + \sin 2x$

(c) $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = \log x$ 5+4+5

5 (a) Two fair dices are thrown simultaneously. Find the probability of getting doubles (two dices showing the same numbers) or a multiple of 3 as the sum when the sample space is assumed to be 36.

(b) An item is manufactured by three factories $F_1$, $F_2$, and $F_3$. The number of such items produces by the three factories are 2x, x, and x respectively. It is known that 2% of the items produced by $F_1$ and $F_2$ are defective while 4% of the items produced by $F_3$ are defective. All these units are put together in one stockpile and one unit is chosen at random from this stockpile. It is found that the item is defective. Calculate the probabilities of this defective unit came from $F_1$, $F_2$, or $F_3$. 6+8

6 (a) A discrete random variable X has the probability density function $p(x) = \frac{1}{2^x}, x = 1,2,3.....$ Find its (i) moment generating function (m.g.f), (ii) mean (μ) and (iii) variance ($\sigma^2$).

(b) A continuous normal distribution function is given by

$$f(x) = \begin{cases} ax(2-x), 0 \le x \le 2 \\ 0, elsewhere \end{cases}$$

Calculate the constant 'a' and show that the mean, mode and median of this distribution coincides to unity. 7+7

7 (a) Solve by the method of variation of parameters

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x \log x$$

(b) Use unit step functions and second shifting property to calculate Laplace

transform of $f(t) = \begin{cases} t^2, 0 < t < 2 \\ t-1, 2 < t < 3 \\ 7, t > 3 \end{cases}$ 8+6

8 (a) Calculate the Laplace transform for the periodic function (with period '2a')

$$f(t) = \begin{cases} t, 0 \le t < a \\ 2a - t, a \le t \le 2a \end{cases}$$

(b) When a resistance R ohms is connected in series with an inductance L henries and an e.m.f. of E volts the current i(t) is given by $L\frac{di}{dt} + Ri = E$.
Calculate the current i(t) when E=10 sin(t) and the initial condition is i(0)=0.

7+7

---

# INDIAN MARITIME UNIVERSITY

(A Central Univesity, Government of India)

May/June 2018-End Semester Examination

**B.Tech(Marine Engineering)**

Semester II

**Applied Thermodynamics I (UG11T3203)**

Date: 14-06-2018 Maximum Marks:100

Time: 3 Hrs Pass Mark : 50

**PART-A** **(Marks: 10 x 3=30)**

**(All Questions are compulsory)**

1. a) What are the basic considerations in ideal gas cycles?
   b) Draw P-v and T-s diagram of Dual cycle
   c) Draw the block diagram of Binary vapour cycle
   d) What is Turbine and Pump efficiency with regard to Rankine cycle?
   e) Define molar mass and write its SI unit
   f) What is Gravimetric and Volumetric analysis of a gas mixture?
   g) Define volumetric efficiency of a reciprocating compressor
   h) Draw p-V diagram of two stage reciprocating compressor with clearance and show the effect of intercooling on compression work.
   i) Why pre whirl is required in centrifugal compressor?
   j) What is slip and slip factor?

**PART- B** **(Marks: 5x14 = 70)**

**(Answer any 5 of the following 7 Questions)**

2.a) Explain Diesel cycle with the help of P-v and r-S diagram (7)

b) In a dual combustion cycle the maximum temperature is 2000°C and the maximum pressure is 70 bar. Calculate the temperatures at all cardinal points when the pressure and temperature at the start of compression are 1 bar and 17°C respectively. The compression ratio is 18: 1 and Y= 1.4 (7)

3.a) Derive the expression for the air standard efficiency of Otto cycle. (7)

b) A four stroke single cylinder diesel engine has a cylinder bore of 150 and a stroke of 250 mm. The crankshaft speed is 300 rpm and fuel consumption is 1.2 kg/h, having a calorific value 39900 kJ/kg. The indicated mean effective pressure is 5.5 bar. If the compression ratio is 15 and cut-off ratio is 1.8, calculate the relative efficiency, taking Y= 1.4 (7)

4. a) Explain the effect of increasing the boiler pressure and decreasing the condenser pressure in Rankine cycle with the help of T-s diagram. (7)

b) Explain combined gas-vapour power cycle with block diagram and T-s curve. (7)

5. a) State and explain Dalton's law of partial pressure (7)

b) A vessel of 1.5 $m^3$ capacity contains oxygen at 7 bar and 40°C. The vessel is connected to another vessel of 3 rrr' capacity containing carbon monoxide at 1 bar and 15°C. A connecting valve is opened and the gases mix adiabatically. Calculate the final temperature of the mixture. (For oxygen, $C_v$=21.07 kJ/kmol K; For carbon monoxide, Cv= 20.86 kJ/ kmol K). (7)

6. a) Derive the expression for the work done in single stage reciprocating compressor without clearance. (7)

b) A single stage reciprocating compressor takes 1 $m^3$ of air per minute at 1.013 bar and 15°C and delivers at 7 bar. Assuming the law of compression to be pV1.35=C and negligible clearance; calculate the indicated power. (7)

7. a) Sketch and briefly explain the working principle of Inline Reciprocating Compressor? (7)

b) In a single acting, two stage reciprocating air compressor 4.5 kg of air per minute is compressed from 1.013 bar and 15°C through pressure ratio of 9 to 1. Both stages have the same pressure ratio, and the law of compression and expansion in both stages is pV1.3 =constant. If intercooling is perfectly done, calculate the indicated power and mass induced per cycle if compressor runs at 300 rpm. (7)

8. a) Explain in short the working of centrifugal compressor with the help of pressure velocity variation diagram. (7)

b) Draw the inlet and outlet velocity triangles of centrifugal compressor and write the meaning of terms involved in it. (7)

***********

# Indian Maritime University

( A Central University, Govt of India)

May-June 2018 End Semester Examinations

**B. Tech (Marine Engineering)**

Semester-II

**STRENGTH OF MATERIALS-I (UG11T3204)**

Date: 17.06.2018 Max Marks:100 Marks

Time: 3 Hrs Pass Marks: 50 Marks

**PART-A** Marks:10X3 =30

(All questions are Compulsory)

**1.**

(a) Define Thermal stress? Mention the examples of deformation induced by thermal stress.

(b) A load of 5 KN is to be raised with the help of a steel wire. Find the diameter of steel wire, if the maximum stress is not to exceed 100 $MNm^2$.

(c) Write the equation of Strain Energy stored in the bar and name the terms used in it?

(d) Define shear force and Bending Moment.

(e) What is section modulus? Write the formula of section modulus for rectangular section?

(f) Define the term circumferential stress & longitudinal stress.

(g) Derive the equation of hoop stress for Spherical shell.

(h) What are the advantages of welded joints?

(i) Define the term torsion. List few examples of torsion in engineering practice.

(j) Define Torsional Stiffness and Torsional flexibility.

**PART-B** Marks: 5X14=70

(Answer any 5 of the Following)

**2.** A mild steel bar 250 mm long and 100 mm X 100 mm in cross-section is subjected to longitudinal axial compressive force of 1000 KN. Determine the values of lateral forces necessary to prevent any transverse strain. Also find change in length and volume.
Assume E =200 GPa and $\mu$= 0.3. (14 marks)

3. **a)** A composite bar shown in Figure 1 is rigidly fixed at the two ends. There is no stress in the bar at a temperature of 20°C. If the temperature of the bar is raised to 40°C, find the forces applied by the rigid wall on the bar.

Take: $E = 200\ GN/m^2$ for both and $\alpha = 11.7 \times 10^{-6}/^0C$ for both.

(06 marks)

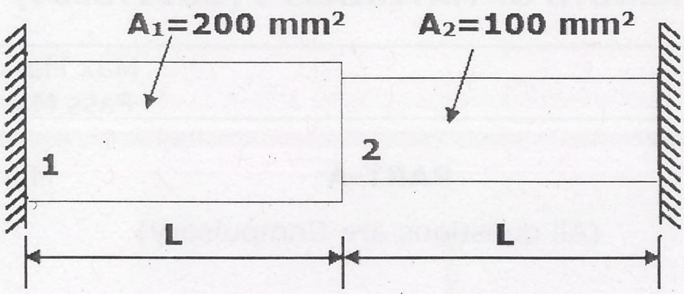



**Figure: 1**

**b)** Draw a stress strain diagram for a ductile material and show the elastic limit, yield point and ultimate strength. Explain any one of these three.

(08 marks)

4. **a)** A vertically suspended steel bar, circular cross-section, is subjected to a load of 5 KN which falls by 20 mm on rigid collar provided at lower end of bar. If maximum allowable strain for bar is 1/1250, find suitable diameter of the rod. Assume E=200GPa and length of bar=2 m.

(07 Marks)

**b)** A plate 10 cm wide and 1.20 cm thick is joined with another plate by a single fillet lap weld and a double parallel fillet weld as shown in figure 2.The maximum tensile and shear stresses are 75 $N/mm^2$ and 55 $N/mm^2$ respectively. Find the length of each parallel fillet, if the joint is subjected to a total load of 90KN. (07 Marks)

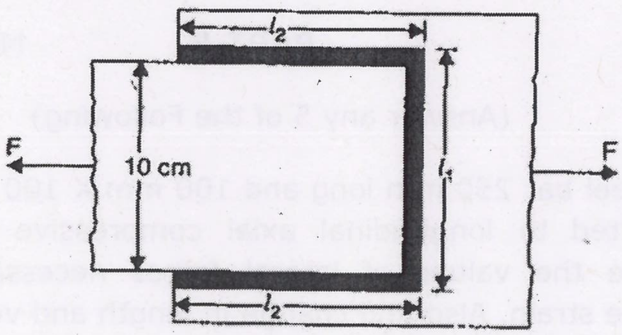



**Figure: 2**

**5.** The beam is supported & loaded as shown in figure 3. Draw Shear Force & Bending Moment diagrams indicating all important values.

(14 Marks)

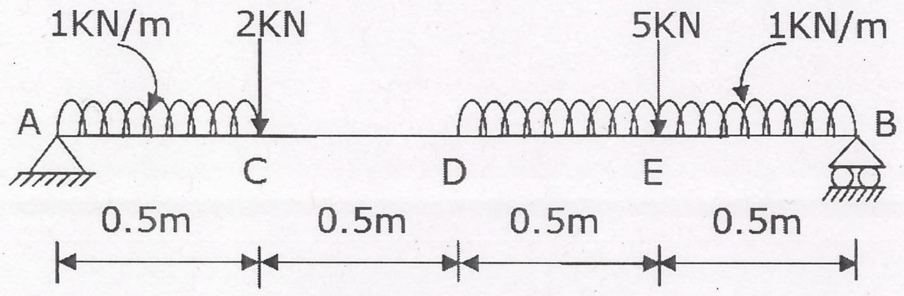



**Figure: 3**

**6.** A cylindrical shell 3 m long which is closed at the ends has internal diameter of 1m and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also the change in the dimensions (ie. δd, δL and δv) of the shell, if it is subjected to an internal pressure of 1.5 $MN/m^2$ Take E = 200 $GN/m^2$ and poison's ratio =0.3. (14 Marks)

**7.** Two wooden planks 150mm X 50 mm each are connected to form a 'T' section of a beam. If a moment of 3.4 KN-m is applied around the horizontal neutral axis, including tension below the neutral axis, find the stresses at the extreme fibres of the cross-section. Also calculate the total tensile force on the cross section. (14 Marks)

**8. a)** Drive the relation for a circular shaft when subjected to torsion as given below: $T/J = \tau/R = G\,\theta/L$

(8 Marks)

**b)** A closed helical spring is made out of 10 mm diameter steel rod. The coil consist of 10 complete turns with a mean diameter of 120 mm. The spring carries an axial pull of 200 N. Find the maximum shear stress induced in the section of the rod. If G= 80 $GN/m^2$, find the deflection in the spring ,stiffness and maximum shear stress. (6 Marks)

# Indian Maritime University

( A Central University, Govt of India)

May-June 2018 End Semester Examinations

**B. Tech (Marine Engineering)**

Semester-II

**COMPUTER SCIENCE (UG11T3205)**

Date: 19.06.2018 Max Marks:100 Marks

Time: 3 Hrs Pass Marks: 50 Marks

**Part –A (10 x 3 = 30)**

**(All questions are Compulsory)**

1)

a) Discuss the characteristics of computer

b) Covert the $(516)_8$ and $(9A5)_{16}$ to binary form

c) Explain the process of booting

d) Define Phishing, URL

e) Write a Pseudocode to find Area of Circle ($\pi r$ 2 )

f) Write a program to find the total amount when there are 5 notes of Rs.100, 3 notes of Rs.50 and 20 notes of Rs.20

g) What is loop? Why it is necessary in the program?

h) List any three library function and illustrate them with example

i) What is a union in C? How data is stored using union?

j) What is TCP/IP? Explain

**Part – B (5 x 14 = 70)**

**(Answer any 5 of the following 7 Questions)**

2)

a) Explain the basic computer organization with neat diagram (7)

b) What is a software? Discuss the types of it (7)

3)

a) Convert the following to its decimal equivalent (7)

i) $(2E5)_{16}$

ii) $(531)_8$

iii) $(1101010)_2$

b) Write short notes on Internet Security (7)

4)

a) Explain the difference between router, switch and gateway (7)

b) Define a flowchart. Draw a flowchart to log in to your email account (7)

5)

a) What is Computer Network? Explain the various types of computer network. (7)

b) State the order of evaluation of the operations in each of the following C statements and implement them to show the value of x after each statement. (7)

i) x = 7 + 3 * 6 / 2 – 1;

ii) x = 2 % 2 + 2 * 2 – 2 / 2;

iii) x = ( 3 * 9 * ( 3 + ( 9 * 3 / (3) ) ) );

6)

a) Write a program to check whether a character is vowel or not using switch case (7)

b) Explain the while loop with an example (7)

7)

a) Write a program in C to read n number of values in an array and display it in reverse order (7)

b) Explain with example different ways of reading string from terminal. (7)

8)

a) Write a program in C to find the square of any number using the function. (7)

b) Define pointer Discuss on pointer arithmetic? (7)

# Indian Maritime University

( A Central University, Govt of India)

May-June 2018 End Semester Examinations

**B. Tech (Marine Engineering)**

Semester-II

**STRENGTH OF MATERIALS-I (UG11T2204/1204)**

| | |
|---|---|
| Date: 17.06.2018 | Max Marks: 100 Marks |
| Time: 3 Hrs | Pass Marks: 50 Marks |

**PART-A (3x10=30 MARKS)**

**(COMPULSORY QUESTIONS)**

1. a) Explain briefly the term “Factor of Safety”.

   b) Explain briefly the term “Poisson’s Ratio”.

   c) Write any two relations between E, G, K, m.

   d) Explain the term the “Point of Contraflexure”.

   e) Explain the terms “Resilience” and “Proof Resilience”.

   f) State three assumptions made in the “Theory of Bending”.

   g) Define a thin cylindrical shell. Write formulae for the Circumferential stress & the Longitudinal Stress.

   h) Explain the term “Torsional Rigidity” or “Torsional Stiffness”.

   i) State three assumptions made in the derivation of the “Torsion Equation”.

   j) Explain briefly by a sketch the “Sign Conventions” used for drawing the Shear Force Diagram & the Bending Moment Diagram.

**PART -B (5x14=70 Marks)**

**(ANSWER ANY 5 QUESTION)**

2. A copper rod 36 mm diameter is encased inside a steel tube. It is rigidly attached to the steel tube which has 50 mm external diameter, thickness of metal being 5 mm. The composite section is then subjected to an axial pull of 100 KN. Calculate each of the following: (a) the stress in the copper rod, (b) the stress in steel tube, (c) the extension on the length of 1.5 m.

   Take : $E_s = 200$ GN /$m^2$ , $E_c = 110$ GN/$m^2$. (5+5+4)

3. (a) An unknown weight falls through a height of 22 mm on to a collar rigidly attached to the lower end of a vertical bar 3.0 m long fixed at the top end. The bar is 500 $mm^2$ in cross section. If the maximum instantaneous extension of the bar is not to exceed 2.5 mm, find the corresponding stress and the magnitude of the falling weight.

Take E =200 $GN/m^2$. (8)

(b) Obtain an expression for the stress induced $\sigma$ ($N/m^2$) in a vertical rod of cross sectional area A ($m^2$), length L (m), modulus of elasticity E ($N/m^2$), due to a falling load W (N) through a height h (m). Assume any additional data if necessary. (6)

4. A simply supported beam carries a concentrated load of 20 KN at mid span & an uniformly distributed load of 8 KN/m spread over its entire length. The beam has a rectangular cross section with a width of 200 mm & a depth of 300 mm. Calculate the length of the beam between the supports if the maximum stress induced in the beam is not to exceed 16.667 $N/m^2$ . (14)

5. A cylindrical thin shell one metre internal diameter and 3 m long has a metal thickness of 10 mm. If it is subjected to an internal pressure of 3 $N/mm^2$, determine change in length, change in diameter, change in volume. Take E = 210 $GN/m^2$, Poisson's Ratio 1/m = 0.3. (14)

6. a) State the two types of the weld, the two advantages & the two disadvantages of the welded joint over a riveted joint. (6)

b) A tie member 120 mm width x 20 mm thick is welded on to an another plate. The tie member is welded only along the length of the member by a fillet weld of size 8 mm. The tensile stress in the tie member is limited to 140 $N/mm^2$ & the shear stress in the weld is limited to 100 $N/mm^2$. Calculate the minimum length of the weld required. (8)

7. A thin rod is bent in the form of arc of circle without exceeding the elastic limit. The radius of the arc of circle formed by the bent rod is 1.4 m. The stress at the elastic limit is 250 $MN/m^2$. The modulus of elasticity of the material of the rod is 200 $GN/m^2$. Calculate each of the following, (a) the depth of the cross section of the rod, (b) the moment of the resistance for a square cross section, (c) the moment of the resistance for a circular cross section. (6+4+4)

8. An intermediate shaft with the flange coupling on either ends transmit 16 MW power at 100 rpm. The flange coupling has 12 bolts on the pitch circle diameter . The pitch circle diameter is 1.6 times the shaft diameter. The allowable shear stress in the shaft material is 80 $MN/m^2$. The allowable shear stress in the bolt material is 90 $MN/m^2$. Calculate each of the following, (a) the diameter of the shaft, (b) the diameter of the bolt. (7+7)

# INDIAN MARITIME UNIVERSITY

(A Central Univesity, Government of India)

May/June 2018-End Semester Examination

**B.Tech(Marine Engineering)**

Semester II

**COMPUTER SCIENCE (UG11T2205/1205)**

---

Date: 19-06-2018 Maximum Marks:100

Time: 3 Hrs Pass Mark : 50

---

**Part –A**

**(All questions are Compulsory)**

10 x 3 = 30

1)

a) Discuss the characteristics of computer
b) Covert the $(653)_8$ and $(9E5)_{16}$ to binary form
c) What does an operating system do for hardware and user?
d) Write short notes URL, TCP/IP
e) Write a Pseudocode to find Area of Circle ($\pi r^2$ )
f) What is MsExcel? What are its applications?
g) Write a C++ program to find the area and volume of sphere. Formulas are: Area = 4*PI*R*R Volume = 4/3*PI*R*R*R.
h) What is loop? Why it is necessary in the program?
i) List any three library function and illustrate them with example
j) What is a union in C? How data is stored using union?

**Part – B**

**(Answer any 5 of the following 7 Questions)**

**5x14=70**

2)

a) Explain the basic computer organization with neat diagram (7)
b) How are computers classified? Explain briefly (7)

3)

a) Define software. Discuss various types of software (7)
b) Write short notes on Firewall and router (7)

4)

a) What is an algorithm? Discuss its uses (7)
b) Define a flowchart. Draw a flowchart to log in to your email account (7)

5)

a) What is preincrement and post increment operator? Explain with example(7)
b) Explain if statement with example (7)

6)

a) Explain the use of 2D array with example (7)

b) Write a C++ program to find the sum of first 100 natural nos. (7)

7)

a) Write a program in C to find the square of any number using the function.(7)

b) Write short notes on pointers, structures (7)

8)

a) List the different input devices and explain any three of them (7)

b) What is Computer Memory? Explain various types of it (7)

**********

b.

# INDIAN MARITIME UNIVERSITY

(A Central Univesity, Government of India)

May/June 2018-End Semester Examination

**B.Tech(Marine Engineering)**

Semester II

**Seamanship, Elementary Navigation & Survival at Sea**
**(UG11T2201/1201)**

---

Date: 09-06-2018 Maximum Marks:100
Time: 3 Hrs Pass Mark : 50

---

## Section- A
**(All questions are Compulsory) Marks: 10 x 3 = 30**

a) What are the alarms mentioned in Muster List?
b) Describe Immersion Suit & TPA.
c) Describe Pyrotechnics carried in lifeboat.
d) Briefly Explain different types of anchors & their uses.
e) Describe different ways Lifeboats are launched.
f) What is HRU? Where is it connected with?
g) Describe briefly Role of safety officer on board.
h) Name Annexes of MARPOL (in force), name them
i) Name different types of Ropes used on board ships.
j) Write short notes on ill effects of cargo on human and environment.

## Section-B
**( Answer any 5 of the following Questions) Marks: 5 x 14 = 70**

2. Describe the Crew structure(Organization chart) on a Merchant vessel. Describe the Role of Master briefly. (14)

3. Describe with a simple sketch the various parts of a seagoing vessel. (14)

4. Explain the purpose of following Conventions. (14)
(i) SOLAS (ii) MARPOL (iii) STCW (iv) ISPS

5. Describe the Contents of a Muster list. (14)

6. Name any five Navigational Equipment inside Navigation Bridge & briefly describe their purpose. (14)

7. Mention Care & Maintenance of (7+7)
(i) Natural fibre rope (ii) Steel wire rope.

8. Describe briefly survival duties (after Abandonment) when taken shelter in a survival craft. (14)

***********

**Indian Maritime University**
( A Central University, Govt of India)
May-June 2018 End Semester Examinations
**B. Tech (Marine Engineering)**
Semester-II
**Mathematics II(UG11T2202 /T1202)**

Date: 12.06.2018 Max Marks:100 Marks
Time: 3 Hrs Pass Marks: 50 Marks

**PART-A** **Marks: 10 x 3 =30**

**(All Questions are compulsory)**

1. a. Find $a_0$ in the Fourier series for the fuction $f(x) = e^{-x}$ in the interval $0 < x < 2\pi$

b. Find the Laplace transform of $f(t) = 4$ for $0 \leq t \leq 1$
$= 3$ for $t > 1$

c. Find the Laplace transform of the function
$f(x) = |t-1| + |t+1|, t \geq 0$

d. Find the Inverse Laplace transform of $\frac{S^2 - 3S+4}{S3}$

e. Solve $ydx - x\,dy + \log x\,dx = 0$

f. Find the integration factor of the differential equation
$\frac{dx}{dy} + \frac{3x}{y} = \frac{1}{y^2}$

g. Find the Particular Integral of $\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4$

h. A speaks the truth in 75% cases and B in 80% cases. In what percentage of cases are they likely to contradict each other in stating the same fact.

i. A variate $X$ has the probability distributions

| x | : | -3 | 6 | 9 |
|---|---|---|---|---|
| P (X=x) | : | $\frac{1}{6}$ | $\frac{1}{2}$ | $\frac{1}{3}$ |

Find $E(2x+1)^2$

j. Determine the binomial distribution for which mean = 2 (variance) and mean + variance = 3.

**PART-B** **Marks: 5 x 14 =70**

**(Answer any 5 of the following 7 questions)**

2. a. Obtain the Fourier series for the functions

$$f(x) = \pi x \quad 0 \leq 1$$
$$= \pi(2-x) \quad 1 \leq x \leq 2$$

Deduce that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2} \ldots\ldots \infty = \frac{\pi^2}{8}$

b. Expand $f(x) = \frac{1}{4} - x$ for $0 < x < \frac{1}{2}$

$$= x - \frac{3}{4} \text{ for } \frac{1}{2} < x < 1$$

as the Fourier Series of Sine terms

(6 + 8 marks)

3. a. Evaluate

$$\int_{t=0}^{\infty}\int_{u=0}^{t} \frac{e^{-t}\sin u}{u}\, du\, dt$$

b. Given

$$L\left(Sin\sqrt{t}\right) = \frac{\sqrt{\pi}}{2S^{3/2}}\, e^{\frac{-1}{4\pi}}$$

prove that

$$L\left(\frac{\cos\sqrt{t}}{\sqrt{t}}\right) = \sqrt{\frac{\pi}{S}}\, e^{\frac{-1}{4\pi}}$$

(7 + 7 marks)

4. a. Solve $x^4\frac{dy}{dx} + x^3y + cosec\,(xy) = 0$

b. Find the curve for which the tangent at any point p on it bisects the angle between the ordinate at P and the line joining P to the origin. (6 + 8 marks)

5. a. Solve $(D-2)^2 = 8\,(e^{2x} + Sin\,2x + x^2)$

b. Solve by the method of variation of parameters

$y" - 2y' + y = e^x\ \log\ x$

(7 + 7 marks)

6. a. The contents of 3 urns are

1 white, 2 red, 3 green balls

2 white, 1 red, 1 green balls

4 white, 5 red, 3 green balls

Two balls are drawn from an urn chosen at random. There are found to be one white and one green. Find the probability that the balls so drawn came fom the third urn.

b. A function is defined as follows.

$$f\,(x) = 0 \qquad x < 2$$

$$= \frac{1}{18}\,(2x+3) \quad 2 \le x \le 4$$

$$= 0 \qquad x > 4$$

Show that it is a density function. Find the probability that a variate having this density will fall in the interval $2 \le x \le 3$

(7 + 7 marks)

7. a. Find the Fourier Series for

$$f(x) = -1 \qquad -\pi \le x < -\pi/2$$
$$= 0 \qquad -\pi/2 \le x < \pi/2$$
$$= 1 \qquad \pi/2 \le x < \pi$$

b. Solve $2ydx + x(2\log x - y)dy = 0$

(7 + 7 marks)

8. a. Use Laplace transform method to solve

$(D^3 - 3D^2 + 3D - 1)y = t^2e^t$ given

$y(o) = 1; y'(o) = 0; y''(o) = -2$

b. X is a Poisson variable and it is found that the probability that $X = 2$ is two thirds of the probability that $X = 1$. Find the probability that $X = 0$ and the probability that $X = 3$. What is the probability that $X$ exceeds 3.

(7 + 7 marks)

-------

# INDIAN MARITIME UNIVERSITY

(A Central Univesity, Government of India)

May/June 2018-End Semester Examination

**B.Tech(Marine Engineering)**

Semester II

**Applied Thermodynamics I (UG11T2203/1203)**

---

Date: 14-06-2018 Maximum Marks:100

Time: 3 Hrs Pass Mark : 50

---

**PART-A**

**(All questions are compulsory)**

(10 × 3=30)

1.a)State clausius statement of second law of thermodynamics.

b)Define entropy and change in entropy.

c)Mention the improvements made to increase the ideal efficiency of rankine cycle.

d)What are the effects of condenser pressure on the rankine cycle.

e)Define Specific steam consumption of an ideal rankine cycle.

f)What are the factors that affect the volumetic efficiency of a reciprocating compressor.

g) What is compression ratio.

h) What is meant by free air delivered.

i)What is the difference between air conditioning and refrigeration.

j)State Amagat's law of partial volume.

PART-B

ANSWER ANY 5 FROM THE FOLLOWING 7 QUESTIONS

(5×14=70)

2.a)1 Kg of steam at 7 bar, entropy 6.5 Kj/Kg K ,is heated reversibly at constant pressure until the temperature is 250$^0$C.Calculate the heat supplied.

(8)

b)A rigid cylinder of volume 0.025 $m^3$ contains steam at 80 bar and 350$^0$C. The cylinder is cooled until the pressure is 50 bar. Calculate the state of the steam after cooling and the amount of heat rejected by the steam. (6)

3.a)A mass of 5 kg air is compressed from 0.9 bar, 32°C to 6 bar in a polytropic process $PV^{1.3}$ = constant. Find the change in entropy. (6)

b)Establish the general expression for the change in entropy of an ideal gas from the first law of thermodynamics.i)in terms of volume and absolute temperature ii)in terms of pressure and volume. (8)

4. Determine the rankine cycle efficiency working between 6 bar and 0.4 bar when supplied with dry saturated steam. By what percentage is the efficiency increased by supplying superheated steam of 300°C. (14)

5.Define the following terms as applied to steam engines:

i)Mean effective pressure

ii)Diagram factor

iii)Missing quantity. (14)

6.a)Explain Multi stage air compression in compressors. (6)

b) A single acting air compressor, the clearance volume is 5% of stroke volume. Air is drawn in a constant pressure of 1 bar at a temperature of 37$^0$C. Compression follows the law $PV^{1.2}$ =constant and the pressure is 7 bar. The compressor delivers 15 kg of air/min. Find the volumetric efficiency and the power required to drive the compressor. (8)

7.a)Derive an expression for volumetric efficiency in compressors . (7)

b) A single cylinder single acting reciprocating compressor is required to compress 0.83$m^3$ of air From 1.05 bar and 20$^0$c to 8 bar and

# Indian Maritime University

( A Central University, Govt of India)

May-June 2018 End Semester Examinations

**B. Tech (Marine Engineering)**

Semester-III

**Strength of Materials- II (UG11T2304/T1304)**

| | |
|---|---|
| Date: 09.07.2018 | Max Marks:100 Marks |
| Time: 3 Hrs | Pass Marks: 50 Marks |

**PART-A** Marks:10X3 =30

(All questions are Compulsory)

**1.**

(a) Name the types of Principal theories of failures.

(b) What is the use of Mohr's circle?

(c) What are the methods of determining slope and deflection at a section in a loaded beam?

(d) Define Over hanging beam.

(e) Define compound cylinder.

(f) Define built-in and continuous beam

(g) What is Claperyon's Three moment theorem

(h) State Castigliano's Theorem

(i) What are the assumptions in Euler's theory for long column.

(j) Write the equation of Rankine –Gordon formula and name the terms used in it?

**PART B**

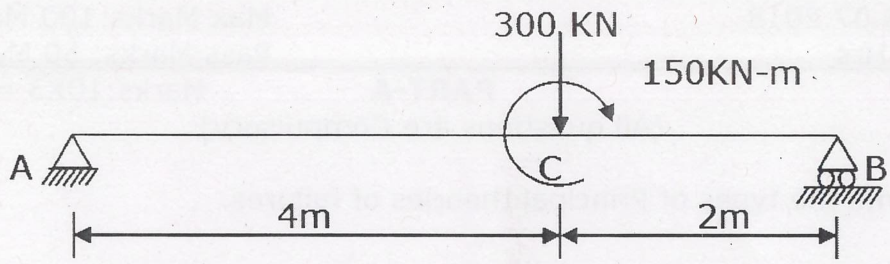
**Answer any Five of the Following**

2. The stresses at a point in a bar are 200 N/mm$^2$ (tensile) and 100 N/mm$^2$ (compressive).Determine the resultant stress in magnitude and direction on a plane inclined at $60^0$ to the axis of the major stress. Also determine the maximum intensity of shear stress in the material at the point. (14 Marks)

3. A cantilever 2.5 m long is carrying a load of 25 KN at free end and 35 KN at a distance of 1.3 m from the end. Find the slope and deflection at the free end. Take $E = 2.0 \times 10^8$ KN/m$^2$, $I = 1.5 \times 10^{-4}$ m$^4$

(14 Marks)

4. A beam of 6 metres long is loaded as shown in figure. If the flexural rigidity (EI) of the beam is $8 \times 10^4$ KNm$^2$, find the deflection at point 'C'




(14 Marks)

5. Using moment area method, find maximum deflection of a simply supported beam of length 'L' subjected with a concentrated load 'W' acting at the centre. (14 Marks)

6 A continuous beam ABC covers two consecutive span AB and BC of lengths 4 m and 6 m, carrying uniformly distributed loads of 6 KN/m and 10 KN/m respectively. If the ends A and C are simply supported, find the support moments at A,B and C. Draw also bending moment.

(14 Marks)

7. Derive Lame's equations involved for the stresses in thick cylindrical shell. Also sketch the radial pressure distribution & circumferential stress distribution across the section. (14 Marks)

8. a) Derive the relation of Euler's buckling load for column whose both ends are pinned. (7 Marks)

b) Calculate the safe compressive load on a hollow cast iron column with one end rigidly fixed and the other hinged, of 150 mm external diameter, 100 mm internal diameter and 10 m length. Use Euler's formula with factor of safety of 5 , and $E = 95$ GN/m$^2$

(7 Marks)

** **

**INDIAN MARITIME UNIVERSITY**

**(A Central University, Govt. of India)**

**B.TECH (MARINE ENGINEERING)**

**END SEMESTER EXAMINATION – DECEMBER 2017**

Sub Code: UG11T1201/T2201 Date : 02.1.2018

Sub Name: Seamanship, Elementary Navigation &Survival at sea. Max Marks: 100

Semester: II Pass Marks: 50

---

**Part A** ( $3\times10=30$ )

**Compulsory Question**

1) (a) How look out is maintained? Discuss with watch schedule?

(b)What are the alarms mentioned in the muster list?

(c) What all the methods are there for Launching of inflatable life raft?

(d) What are Fore-mast, Main-mast , Mizzen-mast ?

(e) What all departments are there on board of a sailing ship?

(f)What is Monkey Island?

(i) What led to the development of the ISPS Code?

(j)What are Meaning of flag represented:-E,Q,S&W

(k)What is cable stopper?

(l)What is the use of canvas on board?

**Part B** ( $5\times14=70$ )

**Answer Any Five of the following**

2) (a) Discuss the Maintenance and care of steel weir rope.
(b)What is heaving line and mooring line?
(c) What is the function of Rat guard? 8+4+2

3) a) Describe various routine safety drill and exercise carried out on board of a merchant ship?
b) How HRU functions in a life raft? 10+4

4) (a) Briefly discuss the convention MARPOL and SOLAS . 14

5) a)What all life saving equipments are there in a life boat ?
b) What all pyro-techniques are carried in a life raft?
c) What is immersion suit ? 9+3+2

6) (a) Briefly discuss the function of a marine sextant with sketch?

(b)What do you understand by true course and true bearing while measuring by a marine compass? 10+4

7) (a)Sketch and describe a Patent Stockless anchor?

(b)What is lugless shackle used for joining cable?

(c ) What do you understand by term “ bitter end “ and “ hose pipe” in relation to anchoring process ? 9+3+2

8) (a) Define the term celestial sphere, celestial pole, celestial equator, celestial meridian, ecliptic.

(b)What are star charts? How it is used?

(c) Write short note on Polaris. 7+4+3

******

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Applied Thermodynamics – I (UG11T1203/ UG11T2203)**

Date : 15.06.2017 | Maximum Marks: 100
Time: 3 Hrs | Pass Marks : 50

**Part – A** **(10 x 3=30 Marks)**
**(All questions are compulsory)**

1.(a) Explain Carnot's principle.

(b) What are four basic components of a steam power plant?

(c) Compare the Rankine cycle with Carnot cycle in terms of efficiency and work ratio.

(d) Write equation of mean effective pressure.

(e) Explain the term diagram factor as applied to steam engine.

(f) What is free air delivered for compressors? Explain.

(g) What is compressor performance? What are the parameters which affects the compressor performance ?

(h) Explain with neat sketch multistage compression.

(i) State Amagat's law of partial volume and Gibbs Dalton law

(j) Define a) Relative humidity b) Dew point temperature

**Part – B** **(5 x 14=70 Marks)**
**(Answer any 5 of the following)**

2. (a)Establish the general expression for the change in entropy of an ideal gas from the first law of thermodynamics (i) in terms of volume and absolute temperature (ii) in terms of pressure and volume (6 Marks)

2. (b) A rigid cylinder containing 0.004 $m^3$ of nitrogen at 1 bar and 300 K is heated reversibly until temperature becomes 400 K. Determine : (i) The heat supplied. (ii) The entropy change. Assume nitrogen to be perfect gas having molecular mass = 28 Kg/Kmol and take $\gamma$ = 1.4 (8 Marks)

3. (a) Explain the effect of operating conditions on Rankine cycle(6 Marks)

   (b) In a reheat Rankine cycle steam enters the high pressure turbine at 40 bar and 500° C, and is condensed in the condenser at a pressure of 0.035 bar. Assume that the steam is just dry saturated on leaving the high pressure turbine, and is reheated to its initial temperature before it enters the low pressure turbine. Determine the thermal efficiency of the cycle and the specific steam consumption. (8 Marks)

4. (a) Explain the following efficiencies as applied to steam engines.

   (i) mechanical efficiency (ii) thermal efficiency
   (iii) relative efficiency (iv) overall efficiency (8 Marks)

   (b) A double acting single cylinder steam engine runs at 250 r.p.m. and develops 30 kW. The pressure limits of operation are 10 bar and 1 bar. The cut-off is at 40% of the stroke. The stroke/bore ratio is 1.25 and the diagram factor is 0.75. Assume no clearance and hyperbolic expansion and determine the (i) mean effective pressure (ii) length of stroke (iii) diameter of bore (6 Marks)

5. (a) Derive an expression for roots efficiency for roots blower. (6 Marks)

   (b) A single stage single acting reciprocating air compressor intakes 1.4 kg air per min and compresses it to 6 bar according to the law $pV^{1.35}$= constant. The pressure and temperature at intake are 1bar and20° C. Calculate temperature at discharge and the power input to the compressor. (8 Marks)

6. A two stage single acting reciprocating compressor takes in air at the rate of 0.2 $m^3/s$. The inlet pressure and temperature of air are 0.1 MPa and 16°C. The air is compressed to a final pressure of 0.7MPa. The intermediate pressure is ideal and the intercooling is perfect. The

compression index in both the stages is 1.25 and compressor runs at 600 rpm.

Determine the following neglecting clearance.(i) the intermediate pressure (ii) total volume of each cylinder (iii) power required to drive the compressor (iv)heat rejected in an intercooler (14 Marks)

7. A mixture consisting of 6 kg of $O_2$ and 9 kg of $N_2$ has a pressure of 3 bar and temperature of 20°C. For the mixture determine the following: (i) the mole fraction of each component (ii) the average molecular weight (iii) the specific gas constant (iv) the volume and density (v) the partial pressures and partial volumes. (14 Marks)

8. (a) The atmospheric conditions are 20°C and specific humidity of 0.0095kg/kg of dry air. The barometric pressure of air is 101 $kN/m^2$ .Calculate the following:

i) partial pressure of vapour

ii) relative humidity

iii) dew point temperature (10 Marks)

(b) Explain about psychrometric chart. (4 Marks)

****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Fluid Mechanics- I (UG11T1405/ UG11T2405)**

Date : 20.06.2017 — Maximum Marks: 100
Time: 3 Hrs — Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. a) Define mass density, specific gravity and viscosity of a fluid.
   b) State Newton's law of viscosity. What are Newtonion and Ideal Fluids?
   c) Define hydrostatics, total pressure and centre of pressure.
   d) What is stable, unstable and neutral equilibrium?
   e) State continuity equation and derive it for incompressible fluids.
   f) Name three types of heads of flowing liquid, state Bernoulli's equation and write its expression.
   g) Give use of venturimeter, orificemeter and pitot tube.
   h) Define vortex motion, forced vortex flow and free vortex flow.
   i) Define Reynolds number, Froude's number and Euler's number.
   j) What is geometric similarity, kinematic similarity and dynamic similarity in model analysis?

**PART – B** **(5 x 14 = 70 marks)**
**(Answer any 5 of the following)**

2. A fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. the maximum shear stress at the pipe wall is 210 N/m$^2$. Find (i) pressure gradient (ii) centre line velocity (iii) average velocity (iv) Reynolds Number (v) friction coefficient of the pipe. (14 marks)

3. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m length from the tank the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm for the remaining length. The height of

water level in the tank is 8 m above the pipe. Take friction coefficient (f) = 0.01 for both sections of the pipe.

If 'V1' is the velocity in first section (150 mm diameter) and 'V2' is velocity in second section (300 mm diameter), calculate (i) all losses occurring in the flow in terms of kinetic head in section 2 ($V_2^2/2g$) (ii) velocity in section 2 ($V_2$) (14 marks)

4. Using Buckingham's pi-theorem show that velocity (V) through circular orifice is given by

$$V = \sqrt{2gH}\ \phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$$

Where, H = head causing the flow, D= Diameter of the orifice, μ = Co-efficient of viscosity, ρ = Mass density and g= acceleration due to gravity (14 marks)

5. Derive expression for rate of flow for venturimeter fitted in a horizontal pipe (14 marks)

6. A cylindrical vessel closed at the top and bottom is 0.24 m in diameter, 1.44 m high and contains water up to a height of 0.96 m.

   (i) find the height of the paraboloid formed if it is rotated at 480 rpm about its vertical axis. (7 marks)
   (ii) Find speed of rotation of the vessel when axial depth of water is zero. (7 marks)

7. Each gate of lock is 6 m high and 5 m wide, supported on one side by two hinges, each 0.5 m from top and from bottom. The angle between the gates in closed position is 120 degrees. If the water levels are 5 m and 1.25 m on the upstream and downstream side respectively, find
   (i) magnitude of resultant water pressure (3 marks)
   (ii) position of resultant water pressure from bottom of the gate (4 marks)
   (iii) reaction at top hinge (3 marks)
   (iv) reaction at bottom hinge. Assume reaction between the gates is in same horizontal plane as that of resultant water pressure. (4 marks)

8. a. A nozzle of 60 mm diameter delivers a stream of water at 24 m/s perpendicular to the plate that moves away from the jet at 6 m/s. Find (i) the force on the plate (ii) the work done (iii) efficiency of the jet. (7 marks)

b. A 400 mm diameter shaft is rotating at 200 rpm in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is 0.7 N-s/m$^2$, determine torque required to overcome friction in the bearing. (7 marks)

*****

6.002826.

L $a_1 + b_1 - c_1 = 0.$

M $c_1 = 0.$

T $-b_1 - c_1 = 0.$

$b_1 = 0.$

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Fluid Mechanics- I (UG11T1405/ UG11T2405)**

Date : 20.06.2017 Maximum Marks: 100
Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. a) Define mass density, specific gravity and viscosity of a fluid.
   b) State Newton's law of viscosity. What are Newtonion and Ideal Fluids?
   c) Define hydrostatics, total pressure and centre of pressure.
   d) What is stable, unstable and neutral equilibrium?
   e) State continuity equation and derive it for incompressible fluids.
   f) Name three types of heads of flowing liquid, state Bernoulli's equation and write its expression.
   g) Give use of venturimeter, orificemeter and pitot tube.
   h) Define vortex motion, forced vortex flow and free vortex flow.
   i) Define Reynolds number, Froude's number and Euler's number.
   j) What is geometric similarity, kinematic similarity and dynamic similarity in model analysis?

**PART – B** **(5 x 14 = 70 marks)**
**(Answer any 5 of the following)**

2. A fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. the maximum shear stress at the pipe wall is 210 N/m$^2$. Find (i) pressure gradient (ii) centre line velocity (iii) average velocity (iv) Reynolds Number (v) friction coefficient of the pipe. (14 marks)

3. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m length from the tank the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm for the remaining length. The height of

water level in the tank is 8 m above the pipe. Take friction coefficient (f) = 0.01 for both sections of the pipe.

If 'V1' is the velocity in first section (150 mm diameter) and 'V2' is velocity in second section (300 mm diameter), calculate (i) all losses occurring in the flow in terms of kinetic head in section 2 ($V_2^2/2g$) (ii) velocity in section 2 ($V_2$) (14 marks)

4. Using Buckingham's pi-theorem show that velocity (V) through circular orifice is given by

$$V = \sqrt{2gH}\ \phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$$

Where, H = head causing the flow, D= Diameter of the orifice, μ = Co-efficient of viscosity, ρ = Mass density and g= acceleration due to gravity (14 marks)

5. Derive expression for rate of flow for venturimeter fitted in a horizontal pipe (14 marks)

6. A cylindrical vessel closed at the top and bottom is 0.24 m in diameter, 1.44 m high and contains water up to a height of 0.96 m.

(i) find the height of the paraboloid formed if it is rotated at 480 rpm about its vertical axis. (7 marks)

(ii) Find speed of rotation of the vessel when axial depth of water is zero. (7 marks)

7. Each gate of lock is 6 m high and 5 m wide, supported on one side by two hinges, each 0.5 m from top and from bottom. The angle between the gates in closed position is 120 degrees. If the water levels are 5 m and 1.25 m on the upstream and downstream side respectively, find

(i) magnitude of resultant water pressure (3 marks)

(ii) position of resultant water pressure from bottom of the gate (4 marks)

(iii) reaction at top hinge (3 marks)

(iv) reaction at bottom hinge. Assume reaction between the gates is in same horizontal plane as that of resultant water pressure. (4 marks)

8. a. A nozzle of 60 mm diameter delivers a stream of water at 24 m/s perpendicular to the plate that moves away from the jet at 6 m/s. Find (i) the force on the plate (ii) the work done (iii) efficiency of the jet. (7 marks)

b. A 400 mm diameter shaft is rotating at 200 rpm in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is 0.7 N-s/$m^2$, determine torque required to overcome friction in the bearing. (7 marks)

*****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

# Fluid Mechanics- I (UG11T1405/ UG11T2405)

Date : 20.06.2017 Maximum Marks: 100
Time: 3 Hrs Pass Marks : 50

## Part – A (10 x 3=30 marks)
**(All questions are compulsory)**

1. a) Define mass density, specific gravity and viscosity of a fluid.
   b) State Newton's law of viscosity. What are Newtonion and Ideal Fluids?
   c) Define hydrostatics, total pressure and centre of pressure.
   d) What is stable, unstable and neutral equilibrium?
   e) State continuity equation and derive it for incompressible fluids.
   f) Name three types of heads of flowing liquid, state Bernoulli's equation and write its expression.
   g) Give use of venturimeter, orificemeter and pitot tube.
   h) Define vortex motion, forced vortex flow and free vortex flow.
   i) Define Reynolds number, Froude's number and Euler's number.
   j) What is geometric similarity, kinematic similarity and dynamic similarity in model analysis?

## PART – B (5 x 14 = 70 marks)
**(Answer any 5 of the following)**

2. A fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. the maximum shear stress at the pipe wall is 210 $N/m^2$. Find (i) pressure gradient (ii) centre line velocity (iii) average velocity (iv) Reynolds Number (v) friction coefficient of the pipe. (14 marks)

3. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m length from the tank the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm for the remaining length. The height of

water level in the tank is 8 m above the pipe. Take friction coefficient (f) = 0.01 for both sections of the pipe.

If 'V1' is the velocity in first section (150 mm diameter) and 'V2' is velocity in second section (300 mm diameter), calculate (i) all losses occurring in the flow in terms of kinetic head in section 2 ($V_2^2/2g$) (ii) velocity in section 2 ($V_2$) (14 marks)

4. Using Buckingham's pi-theorem show that velocity (V) through circular orifice is given by

$$V = \sqrt{2gH}\ \phi\left[\frac{D}{H}, \frac{\mu}{\rho V H}\right]$$

Where, H = head causing the flow, D= Diameter of the orifice, μ = Co-efficient of viscosity, ρ = Mass density and g= acceleration due to gravity (14 marks)

5. Derive expression for rate of flow for venturimeter fitted in a horizontal pipe (14 marks)

6. A cylindrical vessel closed at the top and bottom is 0.24 m in diameter, 1.44 m high and contains water up to a height of 0.96 m.

   (i) find the height of the paraboloid formed if it is rotated at 480 rpm about its vertical axis. (7 marks)

   (ii) Find speed of rotation of the vessel when axial depth of water is zero. (7 marks)

7. Each gate of lock is 6 m high and 5 m wide, supported on one side by two hinges, each 0.5 m from top and from bottom. The angle between the gates in closed position is 120 degrees. If the water levels are 5 m and 1.25 m on the upstream and downstream side respectively, find

   (i) magnitude of resultant water pressure (3 marks)

   (ii) position of resultant water pressure from bottom of the gate (4 marks)

   (iii) reaction at top hinge (3 marks)

   (iv) reaction at bottom hinge. Assume reaction between the gates is in same horizontal plane as that of resultant water pressure. (4 marks)

8. a. A nozzle of 60 mm diameter delivers a stream of water at 24 m/s perpendicular to the plate that moves away from the jet at 6 m/s. Find (i) the force on the plate (ii) the work done (iii) efficiency of the jet. (7 marks)

b. A 400 mm diameter shaft is rotating at 200 rpm in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is 0.7 N-s/$m^2$, determine torque required to overcome friction in the bearing. (7 marks)

*****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Fluid Mechanics- I (UG11T1405/ UG11T2405)**

Date : 20.06.2017 Maximum Marks: 100
Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. a) Define mass density, specific gravity and viscosity of a fluid.
   b) State Newton's law of viscosity. What are Newtonion and Ideal Fluids?
   c) Define hydrostatics, total pressure and centre of pressure.
   d) What is stable, unstable and neutral equilibrium?
   e) State continuity equation and derive it for incompressible fluids.
   f) Name three types of heads of flowing liquid, state Bernoulli's equation and write its expression.
   g) Give use of venturimeter, orificemeter and pitot tube.
   h) Define vortex motion, forced vortex flow and free vortex flow.
   i) Define Reynolds number, Froude's number and Euler's number.
   j) What is geometric similarity, kinematic similarity and dynamic similarity in model analysis?

**PART – B** **(5 x 14 = 70 marks)**
**(Answer any 5 of the following)**

2. A fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. the maximum shear stress at the pipe wall is 210 N/m$^2$. Find (i) pressure gradient (ii) centre line velocity (iii) average velocity (iv) Reynolds Number (v) friction coefficient of the pipe. (14 marks)

3. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m length from the tank the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm for the remaining length. The height of

water level in the tank is 8 m above the pipe. Take friction coefficient (f) = 0.01 for both sections of the pipe.

If 'V1' is the velocity in first section (150 mm diameter) and 'V2' is velocity in second section (300 mm diameter), calculate (i) all losses occurring in the flow in terms of kinetic head in section 2 ($V_2^2/2g$) (ii) velocity in section 2 ($V_2$) (14 marks)

4. Using Buckingham's pi-theorem show that velocity (V) through circular orifice is given by

$$V = \sqrt{2gH}\ \phi\left[\frac{D}{H}, \frac{\mu}{\rho V H}\right]$$

Where, H = head causing the flow, D= Diameter of the orifice, μ = Co-efficient of viscosity, ρ = Mass density and g= acceleration due to gravity (14 marks)

5. Derive expression for rate of flow for venturimeter fitted in a horizontal pipe (14 marks)

6. A cylindrical vessel closed at the top and bottom is 0.24 m in diameter, 1.44 m high and contains water up to a height of 0.96 m.

   (i) find the height of the paraboloid formed if it is rotated at 480 rpm about its vertical axis. (7 marks)

   (ii) Find speed of rotation of the vessel when axial depth of water is zero. (7 marks)

7. Each gate of lock is 6 m high and 5 m wide, supported on one side by two hinges, each 0.5 m from top and from bottom. The angle between the gates in closed position is 120 degrees. If the water levels are 5 m and 1.25 m on the upstream and downstream side respectively, find

   (i) magnitude of resultant water pressure (3 marks)

   (ii) position of resultant water pressure from bottom of the gate (4 marks)

   (iii) reaction at top hinge (3 marks)

   (iv) reaction at bottom hinge. Assume reaction between the gates is in same horizontal plane as that of resultant water pressure. (4 marks)

8. a. A nozzle of 60 mm diameter delivers a stream of water at 24 m/s perpendicular to the plate that moves away from the jet at 6 m/s. Find (i) the force on the plate (ii) the work done (iii) efficiency of the jet. (7 marks)

b. A 400 mm diameter shaft is rotating at 200 rpm in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is 0.7 N-s/$m^2$, determine torque required to overcome friction in the bearing. (7 marks)

*****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Seamanship, Elementary Navigation & Survival at Sea**
**(UG11T1201/ UG11T2201)**

Date : 10.06.2017 | Maximum Marks: 100
Time: 3 Hrs | Pass Marks : 50

**PART – A** **Marks: (10x3=30)**
**(Question number 1 is compulsory)**

1. Explain the following Terms:
   (a) Poop deck
   (b) Look out
   (c) Knot
   (d) GPS
   (e) Nautical mile
   (f) Flags used onboard ships
   (g) Keel
   (h) Rescue boat
   (i) Freeboard
   (j) Pyrotechnics

**PART – B** **Marks: (5X14 marks = 70)**
**(Answer any FIVE of the following)**

2. With a simple sketch briefly describe various parts of a ship.

3. What do you understand by Navigation Bridge? Describe any two Nautical instruments fitted in the bridge.

4. What are the types of ropes used on board ships and describe how we can avoid damage to mooring ropes during mooring operations.

5. What is MARPOL? What are its various annexures and its purpose?

6. Sketch and describe an "Anchor" briefly.

7. What is a speed log? Explain clearly any one type.

8. Explain the working principle of a marine sextant with a neat diagram.

****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Strength of Materials – I (UG11T1204/ UG11T2204)**

Date : 17.06.2017 | Maximum Marks: 100
Time: 3 Hrs | Pass Marks : 50

---

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. a) Define True stress & True strain
   b) An alloy specimen has a modulus of elasticity of 120 GPa and modulus of rigidity of 45 GPa. Determine the Poisson's ratio of the material.
   c) Explain the term Strain Energy.
   d) Define point of inflexion.
   e) Write the Bending stress equation and name the terms used in it?
   f) Find the expressions for the modulus of section for Rectangular section
   g) Define the term circumferential stress & longitudinal stress.
   h) Find the expressions for the Torsional section modulus for solid circular shaft.
   i) A close-coiled helical spring is required to carry a load of 150 N. If the mean coil diameter is to be 8 times that of wire, calculate these diameters. Take maximum shear stress as 100 MPa
   j) What are the advantages of welded joints?

**Part-B** **(5x 14=70 marks)**
**(Answer any 5 of the Following)**

2. (a) A brass bar having cross-sectional area of 1000 $mm^2$ is subjected to axial forces shown in the figure 1. Find the total elongation of the bar.

   Take E for brass=100 $GN/m^2$ (8 marks)

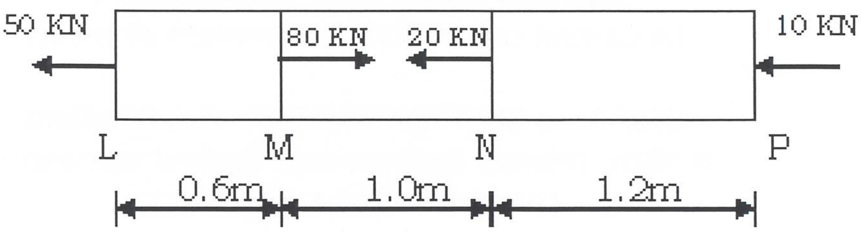



**Fig. 1**

(b) Draw a stress strain diagram for a ductile material and show all the points on them. Explain any one of these. (6 marks)

3. A steel bar 3 m long and 2500 $mm^2$ in area hangs vertically, which is securely fixed on a collar at its lower end. If a weight of 15 KN falls on the collar from a height of 10 mm, determine the stress developed in the bar. What will be the strain energy stored in the bar? Take E= 200 GPa. (14 marks)

4. The beam is supported & loaded as shown in figure 2. Draw Shear Force & Bending Moment diagrams indicating all important values. (14 marks)

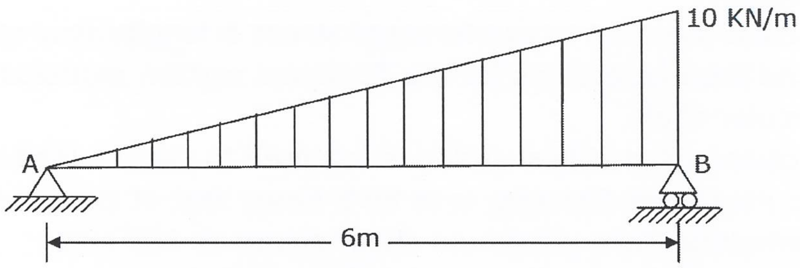



**Fig.2**

5. A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 3mm thick. The internal length & diameter of vessel are 50cm and 25cm respectively. Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 3 $MN/m^2$ .Also calculate increase in length, diameter and volume of the vessel. Take: E=200 $GN/m^2$, and μ= 0.3. (14 marks)

6. a) State the assumptions made in the theory of simple bending. (4 marks)

   b) Derive the expression for the bending stress and the radius of curvature for a straight beam subjected to pure bending. (10 marks)

7. A solid circular shaft transmit 75 KW power at 200 rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed $1^0$ in 2 meters length of shaft, shear stress is limited to 50 $MN/m^2$. Calculate the maximum external diameter satisfying these conditions. Take G= 100 $GN/m^2$. (14 marks)

8. a) Find the expression for strain energy stored in a body due to torsion. (6 marks)

   b) Derive an expression for closely-coiled helical springs subjected to an axial load. (8 marks)

****

# INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

**December 2016 End Semester Examinations**
**B.Tech. (Marine Engineering) Second Semester**

**Strength of Materials – I (UG11T1204/ UG11T2204)**

**Date : 06.01.2017** | **Maximum Marks: 100**
**Time: 3 Hrs** | **Pass Marks : 50**

---

## Part-A (3x10=30 Marks)

**Compulsory Questions**

1. a) State the principle of superposition.

   b) Define the term modulus of resilience.

   c) State Hooke's Law clearly.

   d) What is statistically indeterminate structure? Explain with diagram.

   e) Write down the relation between Young's modulus, Bulk modulus and Poisson's ratio.

   f) Define Poisson's ratio. What is the range of the value of Poisson's ration.

   g) What do you understand by the term, 'point of contraflexture'?

   h) Define Neutral axis is a beam.

   i) Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.

   j) Define "Shear Stress".

## Part-B (5x14=70Marks)

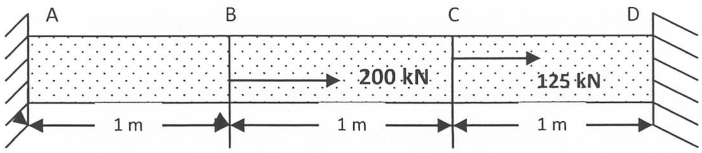
**Answer any five of the followings.**

2. a) Define modulus of elasticity.

   b) Find the expression of deformation of a body to self weight.

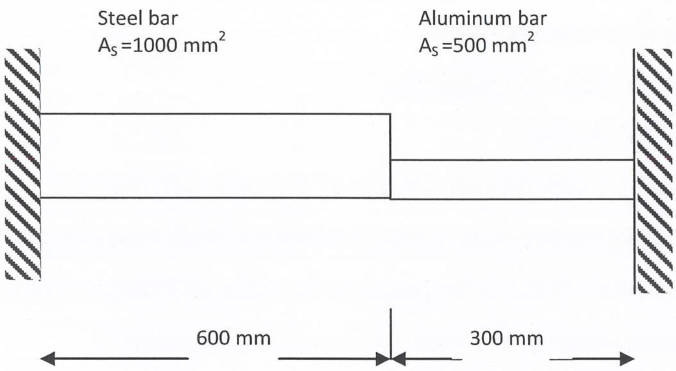
   c) A load 0f 5kN is to be raised with the help of a steel wire. Find the minimum diametre of the steel wire, if the stress is not to exceed 100 Mpa. (2+6+6 = 14)

3. An aluminum bar 3m long and 2500 $mm^2$ in cross-section is rigidly fixed at A and D as shown in Figure.




Determine the loads sheared and stresses in each portion and the distances through which the points B and C will move. Take E for aluminum as 80 GPa. (14)

4. A composite bar made up of aluminum and steel, is held between two supports as shown




The bars are stress free at a temperature of 38° C. What will be the stress in the two bars, when the temperature is 21°C, if (a) the supports are unyielding; (b) the supports come nearer to each other by 0.1 mm? (Assume the change of temperature is uniform all along the length of bar)

Take E for steel as 200 GPa; E for aluminum as 75 Gpa and coefficient of expansion for steel as $11.7 \times 10^{-6}$ per °C and coefficient of expansion for aluminum as $23.4 \times 10^{-6}$ per °C.

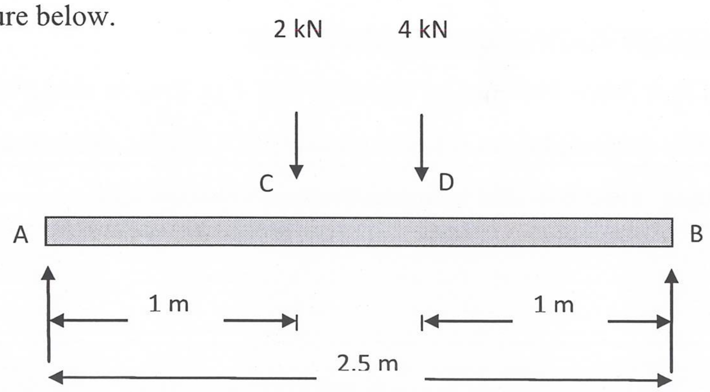
(14)

5. a) Deduce the relation between Modulus of Elasticity and Modulus of Rigidity.

b) A solid steel shaft has to transmit 100 kW at 600 r.p.m. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20 %. (7+7=14)

6. a)Draw the S.D.F (shear force diagram) and B.M.D (bending moment diagram) for a cantiliver beam with uniformly distributed load.

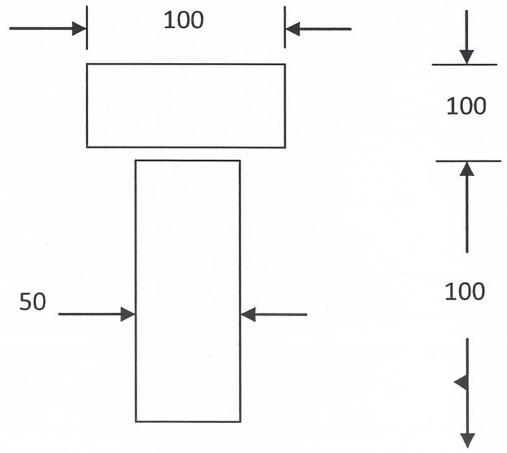
   b) A simply supported beam AB of span 2.5 m is carrying two point loads as shown in the figure below.

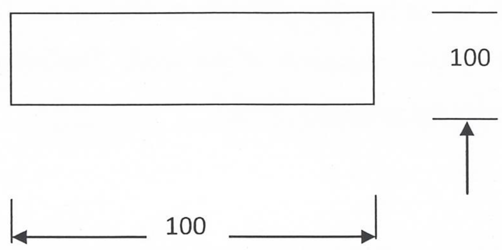



Draw the shear force and bending moment diagram for the beam. (7+7=14)

7. a) Prove that $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ (all the expressions are as per convention)

   b) Figure shows a rolled steel beam of an unsymmetrical I-section.






If the maximum bending stress in the beam section is not to exceed 40 MPa, find the moment, which the beam can resist. (7+7=14)

8. a) Write advantage and disadvantages of welded joints.

   b) A cylindrical thin drum 800 mm in diameter and 4 m long is made of 10 mm thick plate. If the drum is subjected to an internal pressure of 2.5 MPa, determine its changes in diameter and length. Take E as 200 GPa and Poisson's ratio as 0.25. (7+7=14)

**INDIAN MARITIME UNIVERSITY**

(A Central University, Government of India)

May/ June 2017 End Semester Examinations

B.Tech. (Marine Engineering) Second Semester

**(AY 2009-2014 batches)**

**Electrical Machines - II (UG11T1404/ UG11T2404)**

Date : 17.06.2017 Maximum Marks: 100

Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**

**(All questions are compulsory)**

1. (a) What is the difference between a squirrel-cage-type rotor and phase-wound rotor?

   (b) Why is it not possible to run an induction motor on synchronous speed?

   (c) What do you mean by breakdown torque of an induction motor?

   (d) What is the effect of variation of supply frequency in an induction motor?

   (e) What do you mean by the Crawling of induction motor?

   (f) What is synchronous reactance for synchronous machine?

   (g) Mention in brief starting methods of synchronous motor?

   (h) Why damper windings are used in a synchronous machine?

   (i) What is V-curve for 3-phase Alternator?

   (j) How can you protect the motor against single phasing?

**Part – B** **(5 x 14=70 Marks)**

**(Answer any 5 of the following)**

2. (a) Show that in an induction motor, "Rotor input : power developed : rotor copper losses :: 1 : (1-S) : S", where S is the fractional slip. (7 marks)

   (b) A 40 kW, 6-pole, 3-phase star-connected induction motor delivers full-load output at 950 rpm and with 0.85 pf when connected to a supply of 500 V (line value), 50-Hz. Friction and windage losses equal 1.5 kW and stator losses are 1.8 kW. Determine for this load (i) rotor copper loss (ii) efficiency and (iii) line current. (7 marks)

3. (a) If stator impedance of an induction motor is neglected, then show that $\frac{T_e}{T_{max}} = \frac{2}{\frac{S_{mt}}{s} + \frac{s}{S_{mt}}}$. Where, $T_{max}$ is maximum torque and $S_{mt}$ is the slip at maximum torque. (7 marks)

(b) A 3-phase star-connected 6.6-kV, 20-pole, 50-Hz induction motor has rotor resistance of 0.12 ohm and stand still reactance of 1.12 ohm. The motor has speed of 291 rpm at full load. Calculate slip at maximum torque and ratio of maximum torque to full load torque. Assume that stator resistance is neglected. (7 marks)

4. (a) Show that an induction motor with star-delta starter behaves as if it is started by an auto-transformer starter with 58% tapping. (7 marks)

(b) Design the 6-sections of a 7-stud rotor starter for a 3-phase wound induction motor. The slip at full load current is 2% and the maximum starting currents is 1.5 times full-load current. The resistance of rotor is 0.02 ohm per phase. (7 marks)

5.(a) Describe the production of Rotating Magnetic Field for 50-Hz two-pole 3-phase Y-connected synchronous generator using 3-phase currents diagram into a cross-section of the machine. (7 marks)

(b) A 3-phase, 4-pole winding of the double-layer type is to be installed on a 48-lot stator. The pitch of the stator windings is 5/6, and there are 10 turns per coil in the windings. All coils in each phase are connected in series, and the three phases are connected in Δ-delta. The flux per pole in the machine is 0.054 Wb, and the speed of rotation of the magnetic field is 1800 r/min.

(i) What is the pitch factor of this winding? (ii) What is the distribution factor of this winding? (iii) What are the frequency and terminal voltages produced in this winding? (7 marks)

6. (a) Derive the formula for distribution factor or winding factor or breadth factor or spread factor in windings used in a synchronous machine? (7 marks)

(b) A 480V, 200-kVA 0.8 pf lagging 50-Hz two-pole, Y-connected synchronous generator has a synchronous reactance of 0.25Ω and an armature resistance of 0.03Ω. At 50 Hz, its friction and windage losses are 6 kW, and its core losses are 4 kW. The field circuit has a DC voltage of 200V, and the maximum field current is 10-A. Assume that the field current of the generator is adjusted to achieve rated voltage (480 V) at full load conditions in each of the questions below:

(i) What is the efficiency of the generator at rated load?

(ii) What is the voltage regulation of the generator if it is loaded to rated kilo-voltamperes (kVA) with 0.8-pf lagging loads? Draw the Phasor.

(7 marks)

7.(a) Explain armature reaction of an alternator and its effect on main flux at zero power-factor-leading load. (7 marks)

(b) A 208V Star-connected synchronous motor is drawing 50-A at unity power factor from a 208-V power system. The field current flowing under these conditions is 2.7-A. Its synchronous reactance is 0.8Ω. Assume a linear open-circuit characteristic. (i) Find the torque angle. (ii) How much field current would be required to make the motor operate at 0.78 PF (power factor) leading? Also draw the phasors. (7 marks)

8.(a) Classify the single-phase induction motors. Write down the working principle of a single phase motor. (3+4 = 7 marks)

(b) Explain the double revolving field theory. (7 marks)

****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

June 2017 End Semester Examinations
B. Tech (Marine Engineering – First Semester)

**Workshop Technology – UG11T 2106/UG11T 1106**

| | |
|---|---|
| Date: 08.07.2017 | Maximum Marks : 100 |
| Time: 3 Hrs | Pass Marks : 50 |

**PART – A** 10X3=30 Marks

(All questions are compulsory)

1. (a) Draw a Try square and an Internal calliper.

(b) Explain the term Reaming.

(c) What is the use of a Turret.

(d) List the functions of Cutting Fluid.

(e) Write down the properties of material for cutting tool and give one example for such material.

(f) Explain the term Tolerance with respect to precision measurements in manufacturing machine parts.

(g) Mention the importance of Marking of engine parts for fitting. Mention one example for such marking.

(h) According to factories Act define the meaning for Hazardous process.

(i) Explain the process of Soldering.

(j) Mention the Safety precautions to be carried out before doing welding operations.

**PART – B** 5X14=70 Marks

(Answer any 5 of the following)

2. (a) Draw a Drill Bit and label the different parts and cutting angles. (8 Marks)

   (b) Draw a Bench vice and label the parts. (6 Marks)

3. (a) Draw a lathe Machine and label the parts. (8 Marks)

   (b) List the safeties provided and safety precautions to be taken while working on a lathe machine. (6 Marks)

4. (a) Draw a single point cutting tool and mark the different angles and terminologies of it. (8 Marks)

   (b) With a sketch explain the different wears that occur in a cutting tool. (6 Marks)

5. (a) Draw a neat sketch with labels of various parts of Micrometer and explain how to use it. (8 Marks)

   (b) Draw and show the various measuring edges of Vernier calliper and its uses. (6 Marks)

6. (a) Draw a sectional view of a globe valve showing the gland box and its tightening arrangements. (8 Marks)

   (b) List the procedure to be followed before overhauling an engine. (6 Marks)

7. (a) Mention the General Duties of an occupier as per factories act. (8 Marks)

   (b) Explain the precautions to be carried out in case of a fire, according to factories act. (6 Marks)

8. (a) Draw and explain the process of Electric Arc Welding. (8 Marks)

   (b) Explain in detail about the defects in Welding. (6 Marks)

***************

(2) increased funding for research on amorphous materials
(3) further study of the history of silicon crystals
(4) increased reliance on solar energy

v) Which of the following has been mentioned as an advantage of amorphous materials over silicon crystals for solar cells?
(1) The relative thinness of amorphous materials
(2) The cost of amorphous materials
(3) The size of solar cells which can be made of amorphous materials
(4) All of the above

vi) The tone of the passage can best be described as
(1) analytical and optimistic
(2) biased and unprofessional
(3) critical and discouraged
(4) tentative and inconclusive

vii) The word 'terrestrial' as used in the passage means
(1) on the surface of the earth
(2) territory
(3) to be used on roof tops or terraces
(4) without wire connectivity

(c) Write a summary for the above passage. (6 marks)

7. (a) What are the salient features of the Minimum Wages Act, 1948?

(b) What are the powers of Inspectors as stated in Chapter II of Factories Act, 1948?

8. Explain 'social stratification' and 'gender discrimination' in India.

*****************

and moving blades at this stage, have inlet angle of $30^0$ and exit angle $20^0$ . Determine

a) Draw Velocity Diagram (4)
b) Determine blade height at this stage , If the blade height is 1/10 of mean blade diameter and steam flow is 10 Kg/s (4)
c) Power developed by a pair of fixed and moving blade rings at this stage (3)
d) The heat drop required by the pair if the steam expand with an efficiency of 85% (3)

7. Room air at 20°C Dry bulb temperature & 60% RH is mixed with outdoor air at 40°C Dry bulb temperature & 40% RH in the ratio of 4:1. The mixture is passed through a cooling coil whose temperature is maintained at 9°C & whose bypass factor is 0.25.Find

(a) Condition of air at inlet of coil. (5)

(b) Condition of air leaving the coil (5)

(c ) If $250 m^3$/min of air is supplied to the room, what is the refrigeration load in tons. (4)

8. A food storage plant requires 10 kW for operating the refrigerating system with Ammonia as refrigerant. The evaporator temperature is (-) 10°C , the condenser temp is 25°C & the refrigerant is sub cooled by +6°C before it is throttled .The quality of vapor leaving the evaporator is 0.98 dry. Determine

(a) The condition of vapor entering the condenser & evaporator (4)

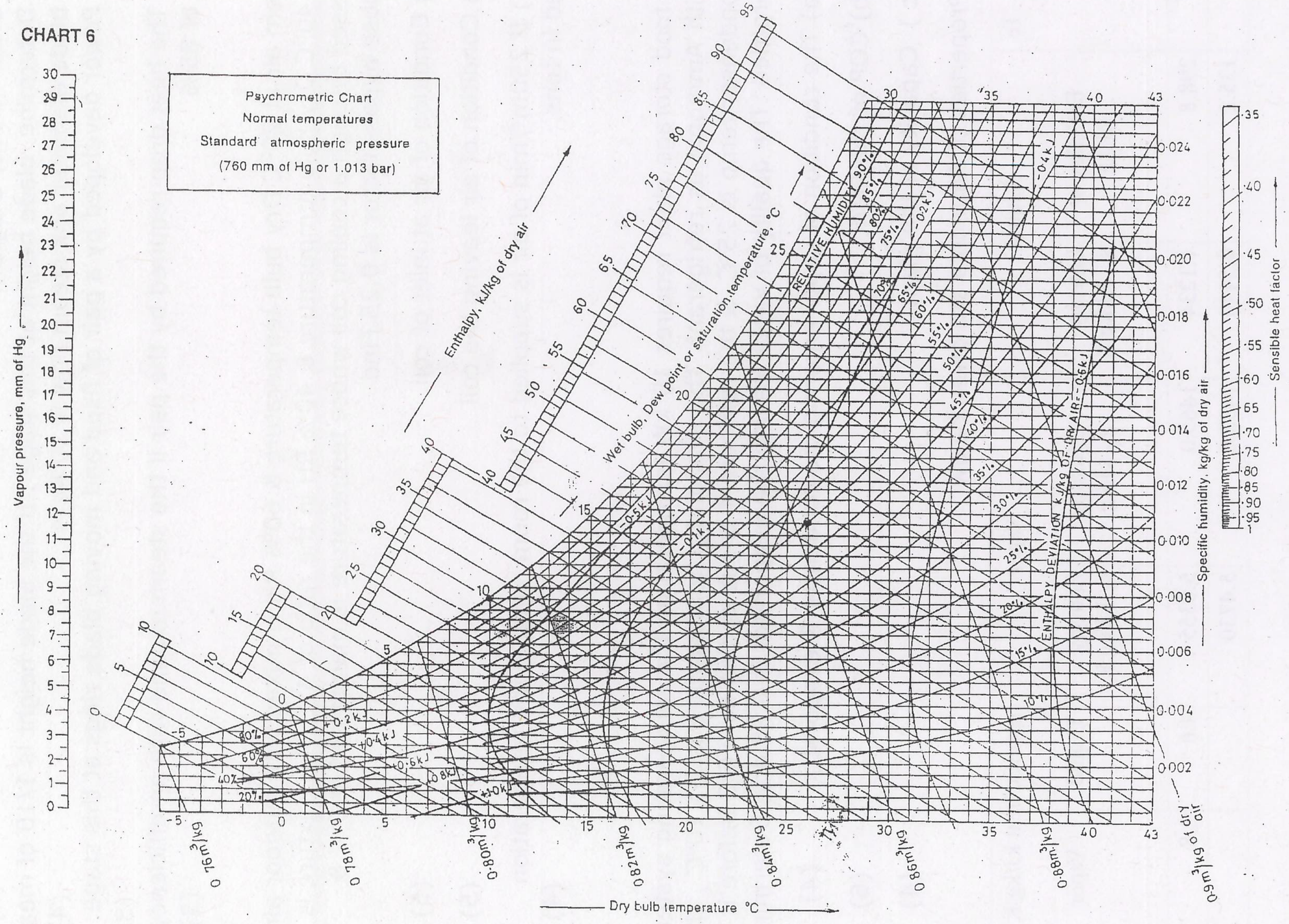
(b) COP of the Plant (6)

(c ) Capacity of the plant (4)

Properties of Ammonia are given below

| Temp °C | Liquid | | Vapor | | specific heat kJ/kg K | |
|---|---|---|---|---|---|---|
| | Enthalpy $h_f$ kJ/kg | Entropy $s_f$ kJ/kg K | Enthalpy $h_g$ kJ/kg | Entropy $s_g$ kJ/kg K | Liquid | Vapor |
| 25 | 298.8 | 1.1234 | 1465.0 | 5.0355 | 4.6 | 2.8 |
| (-)10 | 135.2 | 0.5440 | 1432.0 | 5.4730 | | |

CHART 6



Psychrometric Chart
Normal temperatures
Standard atmospheric pressure
(760 mm of Hg or 1.013 bar)
Vapour pressure, mm of Hg
Enthalpy, kJ/kg of dry air
Wet bulb, Dew point or saturation temperature, °C
RELATIVE HUMIDITY
ENTHALPY DEVIATION kJ/kg OF DRY AIR
Dry bulb temperature °C
Specific humidity, kg/kg of dry air
Sensible heat factor
0·76m³/kg
0·78m³/kg
0·80m³/kg
0·82m³/kg
0·84m³/kg
0·86m³/kg
0·88m³/kg
0·9m³/kg of dry air

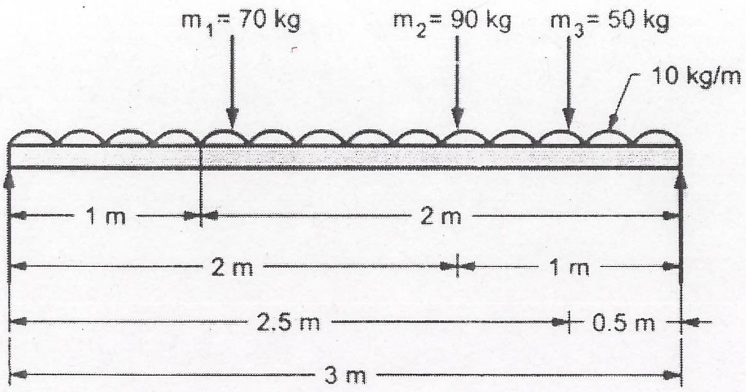



Fig. 2

Q.6 An engine weighing 1 kN is supported on four springs. It has a stroke length of 80 mm and runs at 1000 rpm. If the springs are symmetrically placed with respect to CG of the engine, find neglecting the damping the combined stiffness of the springs in order that the force transmitted to the foundation is 1/25 times of the impressed force. It is found that the damping however small reduces the amplitude of successive vibrations by 25%.

i) Force transmitted to the foundation at 1000 rpm ii) Force transmitted to the foundation at resonance and iii) the amplitude of vibration if the weight of the reciprocating parts is 20 N

Q.7 A disc of a torsional pendulum has a moment of inertia of 600 kg-cm$^2$ and is immersed in a viscous fluid. The brass shaft attached to it is of 10 cm diameter and 40 cm long. When the pendulum is vibrating, the observed amplitudes on the same side of the rest position for successive cycles are 9 deg. ,6 deg. and 4 deg..Determine i) logarithmic decrement ii) damping torque at unit velocity iii) the periodic time of vibrations. Assuming for the brass shaft, G=4.4 x10$^{10}$ N /m$^2$ .What would be the frequency, if the disc is removed from the viscous fluid.

Q.8 A refrigerator unit of mass 35 kg is to be supported by three springs of stiffness k N/m each. If the unit operates at 600 rpm, what should be value of spring constant, k if only 10% of the shaking force of the unit is to be transmitted to the supporting structure neglecting damping?

*****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Computer Science (UG11T1205/ UG11T2205)**

Date : 20.06.2017 Maximum Marks: 100
Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. a) *Give an example for nested if-else conditions.*

   b) *Differentiate between RAM and ROM?*

   c) *Convert 7E0C$_{[16]}$ to equivalent binary number.*

   d) *Briefly discuss the advantages of flow chart.*

   e) *What is infinite loop, give an example?*

   f) *What is LAN and where it is used?*

   g) *What will be the length of a variable if it is declared as int, float and char?*

   h) *What is the correct order of evaluation (operators) for the below expression in C programming?*

   *z = x + y * z / 4 % 2 - 1*

   i) *What is ASCII code?*

   j) *Describe the using of Clrscr ( ) and Scanf ( ) functions in C program.*

## Part – B (5 x 14=70 marks)

**(Answer any FIVE of the following)**

2. a) *Difference between Static and Dynamic Memory* (7)

   b) *Describe evaluation of computer generations.* (7)

3. a) *Briefly explain software development steps.*

   b) *Describe evaluation of computer generations.*

4. a) *Define algorithm and flowchart. How is it useful in the context of software development?* (7)

   b) *Write an algorithm and flowchart to convert Centigrade to Fahrenheit, where Fahrenheit = 32 + (centigrade * (1.8))* (7)

5. a) *Write a short note on standard hardware configurations of a personal computer.* (7)

   b) *What is pointer in C program and explain it with an example.* (7)

6. a) *Write a C program to find the roots of a quadratic equation* $aX^2 + bX + c = 0$, *where a, b and c will be taken as runtime.* (10)

   b) *What are the differences between structure, union?* (4)

7. a) *Write a C program to checks whether an year (integer) entered by the user is a leap year or not.* (7)

   b) *Write C program to calculate Power of a number using function, where number and power should entered through Keyboard.* (7)

8. a) *Write a program in C for Matrix multiplication using array* (10)

   b) *What is the difference between ++i and i++?, explain with suitable example.* (4)

******

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Engineering Mechanics - II (UG11T1206/ UG11T2206)**

Date : 22.06.2017 Maximum Marks: 100
Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. (a) State Coulomb's laws of dry friction.
   (b) Explain angle of repose with a sketch.
   (c) Define sensitivity of governors.
   (d) What is the function of governor? How does it differ from a flywheel?
   (e) Write an expression for Kinetic energy of a rigid body undergoing general plane motion(rolling without slipping) and explain the expression.
   (f) What is centrifugal tension in a belt and how does it affect power Transmitted?
   (g) A block of 50kg mass is pushed up an incline plane by a force acting parallel to incline plane. The angle of inclination is $30^0$ and coefficient of friction is 0.25. Find the force required to impend motion in upwords direction along incline plane.
   (h) What are the advantages of using rope drives?
   (i) What is the advantage of using cross belt drive compared to open belt?
   (j) A 44.5 N weight is suspended by a helical spring having a constant k = 890 N / m. Neglecting the mass of spring, find the time period t for small amplitudes of vertical vibration.

**PART – B** **(5 x 14=70 marks)**

**(Answer any 5 of the following)**

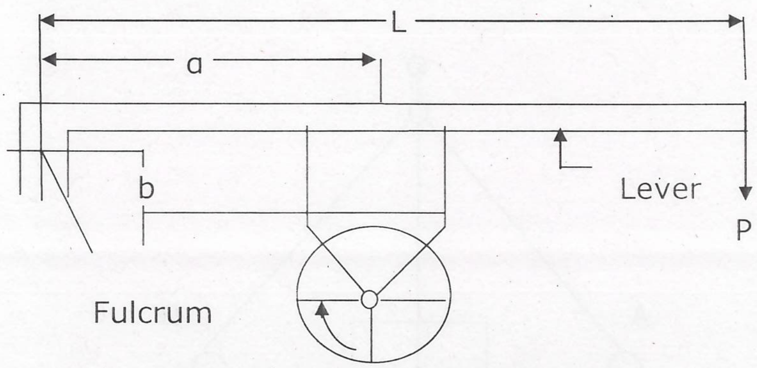
2. A multi-disc clutch transmitting 25 kW of power at 1500 rpm has three discs on the driving shaft and two on the driven shaft. The outside and inside diameters of the contacting surfaces are 240 mm and 120 mm respectively. Assuming the condition of uniform wear, determine the maximum axial intensity of pressure between the discs. Take coefficient of friction as 0.3. (14)

3.(a) A single start square threaded spindle of a screw jack has mean diameter of 45 mm and a pitch of 10 mm. If coefficient of friction between the screw and nut is 0.25, determine (i) the force required to be applied at the screw to raise a load of 5000 N, (ii) efficiency of screw jack and (iii) the force required to be applied at pitch radius to lower the same load of 5000 N Neglect friction between the nut and the collar. (4+3+3=10)

(b) Is the screw jack mentioned above self locking? Which type of screw jack will you recommend, over hauling or self locking and why? (4)

4. A flywheel is made up of steel ring 40 mm thick and 200 mm wide plate with mean diameter of 2 metres. If initially the flywheel is rotating at 300 r.p.m., find the time taken by the wheel in coming to rest due to frictional couple of 100 Nm. Take mass density of the steel as 7900 kg/$m^3$. Neglect the effect of inertia of the spokes. The flywheel may be treated as thin ring. (14)

5. The brake drum of a single block brake is rotating at 500 r.p.m. in the clockwise direction. The diameter of the drum is 400 mm and the single block brake is of the type as shown in Figure given below:




The force P required at the end of the lever to apply the brake is 300 N. If angle of contact is $30^0$ and L = 1 m, a = 300 mm and b = 25 mm then determine the braking torque. The co-efficient of friction is equal to 0.3. (14)

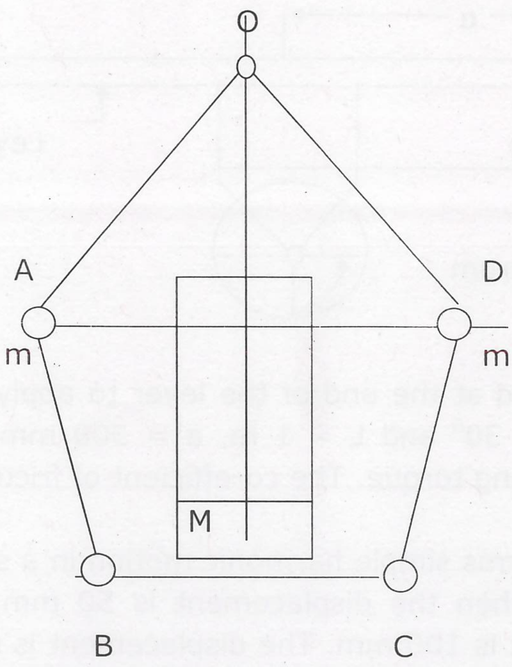
6.(a) A body performs simple harmonic motion in a straight line. Its velocity is 12 m/s when the displacement is 50 mm, and 3 m/s when the displacement is 100 mm. The displacement is measured from the mid position. Calculate the frequency and amplitude of motion. What is the acceleration when the displacement is 75 mm from the mid position? (3+3+4=10)

(b) What is centre of Percussion? What is the significance of centre of Percussion? (4)

7. A 100 mm wide and 10 mm thick belt transmits 5 kW of power between two parallel shafts. The distance between the shaft centres is 1.5 m and the diameter of smaller pulley is 440 mm. The driving and driven shafts rotate at 60 rpm and 150 rpm respectively. The coefficient of friction is 0.22. Find the stress in the belt if the two pulleys are connected by an open belt. (14)

8.In a porter governor shown in figure below, each of the arms is 400 mm long. The upper arms are pivoted on the axis of the sleeve where as the lower arms are attached to the sleeve at a distance of 45 mm from the axis of rotation. Each ball has a mass of 8 kg and the load on the sleeve is 60 kg. What will be the equilibrium speeds for the two extreme radii of 250 mm and 300 mm of rotation of the governor balls? (7+7=14)

P.T.O.


O
A
D
m
m
M
B
C

******

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Mathematics - II (UG11T1202/ UG11T2202)**

Date : 13.06.2017 — Maximum Marks: 100
Time: 3 Hrs — Pass Marks : 50

**Note:** Use of approved type scientific calculator is permitted.

---

**PART – A** **(10 x 3=30 Marks)**

**(All questions are compulsory)**

1.(a)Find $a_0$ for the Fourier series expansion of the function

$$f(x)= x^2 -2 \; ; \qquad -2<x<2$$

(b) Find the Laplace Transform of $e^{-3t}$ sin5t sin 3t.

(c) Find the Inverse Laplace Transform of $\frac{s}{(2s-1)(3s-1)}$.

(d) Solve the differential equation: $2y' \cos x + 4y \sin x = \sin 2x$.

(e)Find the particular integral of the differential equation:

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 3x = \sin t\,.$$

(f)Find the orthogonal trajectory of the family of semi-cubical parabolas $ay^2 = x^3$.

(g) If 3 of 20 tyres in storage are defective and 4 of them are randomly chosen for inspection (that is, each tyre has the same chance of being selected) what is the probability that only one of the defective tyres will be included?

(h) In a game, a player tosses 3 fair coins. He wins Rs.10 if 3 heads occur, Rs. 5 if 2 heads occur, Rs.2 if only 1 head occur and losses Rs.15 if no heads occur. What is his expected gain?

(i) Point out the fallacy of the statement. The Mean of Binomial distribution is 3 and variance 5.

(j) Find mode and median of given probability distribution.

| X : | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| P(X): | 0.2 | 0.3 | 0.1 | 0.1 | 0.3 |

**PART – B** **(5 x 14=70 marks)**

**(Answer any FIVE of the following)**

2. (a) Obtain the Fourier series for the function f(x)= $x^2$ ; $-\pi \leq x \leq \pi$ , Sketch the graph of f(x). Hence show that $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\cdots=\frac{\pi^2}{6}$

(b) Obtain half range sine series for f(x)= $e^x$ in $0 < x < 1$. (8+6 marks)

3. (a) Find the Laplace Transform of $\frac{1-e^t}{t}$.

(b) Evaluate $\int_0^\infty \frac{\cos 6t-\cos 4t}{t}\,dt$, using Laplace Transform.

(c) Find the Inverse Laplace Transform of $\frac{s+3}{s^2-4s+13}$.

(d) Find the Inverse Laplace Transform using Convolution Theorem of $\frac{1}{s^2(s^2+a^2)}$. (3.5 X 4 marks)

4. (a) Solve the following differential equation :

(i) $x^4\frac{dy}{dx}+x^3y+cosec(xy)=0.$

(ii) $(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0$

(b) $x^2\frac{d^2y}{dx^2}+4x\frac{dy}{dx}+2y=\log x.$ (3.5 x x 4 marks)

5. (a) Solve : $\frac{d^2y}{dx^2}+2y=x^2e^{3x}+e^x\cos 2x$

(b) A horizontal tie-rod of length 2l with concentrated load W at the centre and ends freely hinged, satisfies the differential equation $EI\frac{d^2y}{dx^2}=Py-\frac{W}{2}x.$ With conditions x = 0 , y = 0 and x = l , $\frac{dy}{dx}=0$ , prove that the deflection $\delta$ and the bending moment M at the centre (x = l) are given by $\delta=\frac{W}{2Pn}(nl-\tanh nl)$ and $M=-\frac{W}{2n}\tanh nl$ ,where $n^2EI=P.$ (7+7 marks)

6. (a) A company has two plants to manufacture scooters. Plant I manufactures 80% of the scooters and Plant II manufactures 20% .

At plant I, 85 out of 100 scooters are rated standard quality or better. At plant II, only 65 out of 100 scooters are rated standard quality or better.

(i) What is the probability that scooter selected at random came from plant I if it is known that the scooter is of standard quality?

(ii) What is the probability that scooter selected at random came from plant II if it is known that the scooter is of standard quality?

(b) A random variable x has a following probability distribution

| X | 1 | 2 | 3 | 4 | 5 | 6 | | 7 |
|---|---|---|---|---|---|---|---|---|
| P(x) | k | 2k | 3k | $k^2$ | $k^2 + k$ | $2k^2$ | | $4k^2$ |

(i) Find k (ii) $P(x>5)$ (iii) $P( x=1/\tfrac{1}{2} < x < 5/2)$ (6+8 marks)

7. (a) A random variable X has the Probability density function

$$f(x) = k(1+x) \quad ; 2 \le x \le 5$$
$$= 0 \quad ; \text{otherwise}$$

Find (i) k (ii) $P(x>4)$ (iii) mean (iv) variance of x

(b) Experience has shown that 30%of rocket launching at NASA base have to be delayed due to weather conditions. Find the probabilities that among 10 rocket launching at that base :- (i)at most 3 (ii) at least 6, will have to be delayed due to weather conditions.

(8+6 marks)

8.(a) In a certain factory producing cycle tyres there is a small chance 1 in 500 for any tyre to be defective. The tyres are supplied in the lots of 20. Using Poisson's distribution calculate the approximate number of lots containing nodefective, one defective and two defective tyres respectively in aconsignmentof 20,000 tyres.

(b)The sizes of 10,000 items are Normally distributed with mean 20 cms and S.D. 4 cms. Find the probability that an item selected at random will have a size between (i) 18 cms and 23 cms (ii) above 26 cms.

(8+6 marks)

Note : Q.8(b)Where Area under standard normal probability curve is :

(i) $P( 0 < z < 0.5) = 0.1915$

(ii) $P( 0 < z < 0.75) = 0.2734$

(iii) $P( 0 < z < 1.5) = 0.4332$

*****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

# Seamanship, Elementary Navigation & Survival at Sea (UG11T1201/ UG11T2201)

Date : 10.06.2017 | Maximum Marks: 100
Time: 3 Hrs | Pass Marks : 50

---

## PART – A  Marks: (10x3=30)

**(Question number 1 is compulsory)**

1. Explain the following Terms:
   (a) Poop deck
   (b) Look out
   (c) Knot
   (d) GPS
   (e) Nautical mile
   (f) Flags used onboard ships
   (g) Keel
   (h) Rescue boat
   (i) Freeboard
   (j) Pyrotechnics

## PART – B  Marks: (5X14 marks = 70)

**(Answer any FIVE of the following)**

2. With a simple sketch briefly describe various parts of a ship.

3. What do you understand by Navigation Bridge? Describe any two Nautical instruments fitted in the bridge.

4. What are the types of ropes used on board ships and describe how we can avoid damage to mooring ropes during mooring operations.

5. What is MARPOL? What are its various annexures and its purpose?

6. Sketch and describe an "Anchor" briefly.

7. What is a speed log? Explain clearly any one type.

8. Explain the working principle of a marine sextant with a neat diagram.

****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Strength of Materials – I (UG11T1204/ UG11T2204)**

Date : 17.06.2017 Maximum Marks: 100
Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. a) Define True stress & True strain
   b) An alloy specimen has a modulus of elasticity of 120 GPa and modulus of rigidity of 45 GPa. Determine the Poisson's ratio of the material.
   c) Explain the term Strain Energy.
   d) Define point of inflexion.
   e) Write the Bending stress equation and name the terms used in it?
   f) Find the expressions for the modulus of section for Rectangular section
   g) Define the term circumferential stress & longitudinal stress.
   h) Find the expressions for the Torsional section modulus for solid circular shaft.
   i) A close-coiled helical spring is required to carry a load of 150 N. If the mean coil diameter is to be 8 times that of wire, calculate these diameters. Take maximum shear stress as 100 MPa
   j) What are the advantages of welded joints?

**Part-B** **(5x 14=70 marks)**
**(Answer any 5 of the Following)**

2. (a) A brass bar having cross-sectional area of 1000 $mm^2$ is subjected to axial forces shown in the figure 1. Find the total elongation of the bar.

   Take E for brass=100 $GN/m^2$ (8 marks)

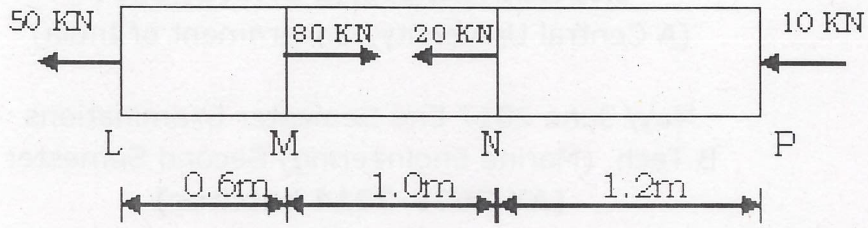



**Fig. 1**

(b) Draw a stress strain diagram for a ductile material and show all the points on them. Explain any one of these. (6 marks)

3. A steel bar 3 m long and 2500 $mm^2$ in area hangs vertically, which is securely fixed on a collar at its lower end. If a weight of 15 KN falls on the collar from a height of 10 mm, determine the stress developed in the bar. What will be the strain energy stored in the bar? Take E= 200 GPa. (14 marks)

4. The beam is supported & loaded as shown in figure 2. Draw Shear Force & Bending Moment diagrams indicating all important values. (14 marks)

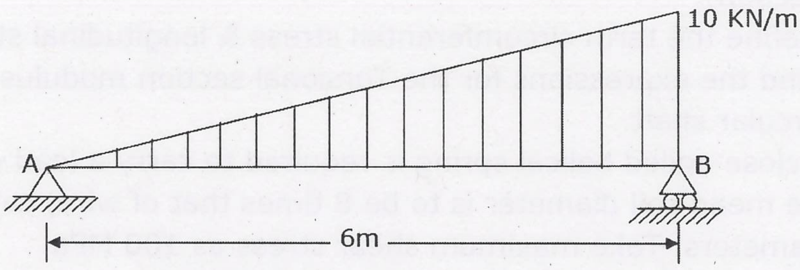



**Fig.2**

5. A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 3mm thick. The internal length & diameter of vessel are 50cm and 25cm respectively. Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 3 $MN/m^2$ .Also calculate increase in length, diameter and volume of the vessel. Take: E=200 $GN/m^2$, and $\mu$= 0.3. (14 marks)

6. a) State the assumptions made in the theory of simple bending. (4 marks)

b) Derive the expression for the bending stress and the radius of curvature for a straight beam subjected to pure bending.(10 marks)

7. A solid circular shaft transmit 75 KW power at 200 rpm.Calculate the shaft diameter, if the twist in the shaft is not to exceed $1^0$ in 2 meters length of shaft, shear stress is limited to 50 $MN/m^2$.Calculate the maximum external diameter satisfying these conditions. Take G= 100 $GN/m^2$.

(14 marks)

8. a) Find the expression for strain energy stored in a body due to torsion. (6 marks)

b) Derive an expression for closely-coiled helical springs subjected to an axial load. (8 marks)

****

compression index in both the stages is 1.25 and compressor runs at 600 rpm.

Determine the following neglecting clearance.(i) the intermediate pressure (ii) total volume of each cylinder (iii) power required to drive the compressor (iv)heat rejected in an intercooler (14 Marks)

7.A mixture consisting of 6 kg of $O_2$ and 9 kg of $N_2$ has a pressure of 3 bar and temperature of 20°C. For the mixture determine the following: (i) the mole fraction of each component (ii) the average molecular weight (iii) the specific gas constant (iv) the volume and density (v) the partial pressures and partial volumes. (14 Marks)

8. (a) The atmospheric conditions are 20°C and specific humidity of 0.0095kg/kg of dry air. The barometric pressure of air is 101 $kN/m^2$ .Calculate the following:

i) partial pressure of vapour

ii) relative humidity

iii) dew point temperature (10 Marks)

(b) Explain about psychrometric chart. (4 Marks)

****

# INDIAN MARITIME UNIVERSITY

(A Central University Government of India)

## END SEMESTER EXAMINATION DECEMBER 2017

| | | | |
|---|---|---|---|
| **Programme** | : B. Tech (Marine Engineering) | **Semester** | : II |
| **Subject Name** | : Applied Thermodynamics-I | **Subject Code** | : UG11T2203/UG11T1203 |
| **Date** | : 27.12.2017 | **Maximum Marks** | : 100 |
| **Time** | : 3 Hrs. | **Pass Marks** | : 50 |

---

**PART-A (10×3=30)**

**ANSWER THE COMPULSORY QUESTION**

1.a)State Clausius statement of second law of thermodynamics.

b) Define entropy and change of entropy.

c) Mention the improvements made to increase the ideal efficiency of rankine cycle.

d) What are the effects of condenser pressure on the rankine cycle.

e) Define Specific steam consumption of an ideal rankine cycle.

f) What are the factors that affect the volumetric efficiency of a reciprocating compressor?

g) What is compression ratio.

h) What is meant by free air delivered.

i) What is the difference between air conditioning and refrigeration.

j) State Amagats law of partial volume.

**PART-B (5×14=70)**

ANSWER ANY FIVE OF THE FOLLOWING

2.a)Dry saturated steam at 100 bar expands isothermally and reversibly to a pressure of 10 bar.calculate the heat supplied and the work done per kilogram of steam during the process.

(8 marks)

b)steam at 100 bar,375°C expands isentropically in a cylinder behind a piston to a pressure of 10 bar.calculate the work done per kilogram of steam. (6 marks)

3. Explain with block diagram and T-S diagram,the process of regenerative rankine cycle and how the efficiency of the cycle could be improved. (14 marks)

4.a)Explain modified rankine cycle in steam engines. (7 marks)

b) Consider a steam power plant operating on an ideal reheat rankine cycle, the steam enters the H.P turbine at 30 bar and 350°C ,after expansion to 5 bar ,the steam is reheated to 350°C and then expanded the L.P turbine to the condenser pressure of 0.075 bar.determine the thermal efficiency of the cycle and the quality of the steam at the outlet of the L.P turbine. (7 marks)

5. A single cylinder single acting reciprocating compressor takes in 8 $m^3$ /min of air at 1 bar and $15^0$c and compress into 7 bar. calculate the saving in the power required when the compression Process is changed from adiabatic compression to isothermal compression. (14 marks)

6.a)A single acting air compressor compresses air from 1 bar to 7 bar,the clearance volume is 2 litres,the compression and expansion follows the law $PV^{1.3} = C$.if the volumetric efficiency of a compressor is 85%.find the stroke volume of the cylinder.Assume diameter of the piston is equal to stroke. (8 marks)

b) Explain Multi stage reciprocating air compressor with intercooler. (6 marks)

7. Atmospheric air at 760 mm of Hg barometric pressure has 25°C dry bulb temperature and 15°C wet bulb temperature. with the help of psychometric chart,determine a)relative humidity b)humidity ratio c) dew point temperature d)enthalpy of air per kg of dry air e)partial pressure of vapour f)saturation pressure corresponding to dry bulb temperature of 25°C g)saturation pressure corresponding to wet bulb temperature of 15°C h)volume of air/kg of dry air. (14 marks)

8. An air conditioned room is to be maintained at 18°C ,percentage saturation 40%,the fabric heat gains are 3000 W and there are a maximum of 20 people in the room at any time.neglecting all other heat gains or losses,calculate the required volume flow rate of air to be supplied to the room and its percentage saturation when the air supply temperature is 10°C. (14 marks)

******

## INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

**END SEMESTER EXAMINATION December 2017**

**Programme:** B.Tech (Marine Engineering) **Semester:** II

**Subject Name:** Computer Science **Subject Code:** UG11T2205/ UG11T1205

**Date:** 29.12.2017 **Maximum Marks:** 100

**Time:** 10AM – 1PM **Pass Marks:** 50

---

**PART – A** Marks: 10 X 3 = 30

(All Questions are compulsory)

1.

a) Differentiate between RAM and ROM

b) What is use of headers files example any one

c) Explain ternary operator? Give example

d) find the output

```
#include<stdio.h>
int main()
{
  int i=3;
  i = i++;
  printf("%d\n", i);
  return 0;
}
```

e) Explain do while loop with example.

f) Describe the difference between structure and union.

g) Explain Flowchart with one example.

h) Explain scanf statement and printf statement with example.

i) Define Function and its advantages.

j) What is the Byte size of 'char' and 'float' in C.

**PART – B** Marks: 5 X 14 = 70

(Answer any 5 of the following)

2.

a) Write a C Program to find the factorial of a number where number will be taken as fly (runtime) (7 marks)

b) Write a C program to check whether a year is leap year or not year will be taken as fly (runtime) (7 marks)

3.

a) Explain Software Development Lifecycle in detail (7 marks)

b) Explain any three service provided by internet? (7 marks)

4.

a) Explain Switch Case with Example (10 marks)

b) Explain i)Multiuser Operating system ii)Multithreading operating system (4 marks)

5.

a) Explain Generations of Computer (7 marks)

b) Write a Program in C to find the Transpose of a Matrix (7 marks)

6.

a) Explain i) Call by Value ii) Call by reference with example (10 marks)

b) Explain gets () and puts () (4 marks)

7.

a) Explain the Types of Operators in C (10 marks)

b) Write a short note on SRAM and DRAM (4 marks)

8.

a)Write a C program to Store Information (name, roll and marks) of Student using Structure data where information will be taken as fly(runtime) (10 marks)

b) Write short note i) Motherboard ii) USB (4 marks)

*****

**INDIAN MARITIME UNIVERSITY**

(A Central University, Government of India)

May/ June 2017 End Semester Examinations

B.Tech. (Marine Engineering) Second Semester

**(AY 2009-2014 batches)**

**Mechanics of Machines - II (UG11T1403/ UG11T2403)**

Date : 15.06.2017 Maximum Marks: 100

Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**

**(All questions are compulsory)**

1. a) Explain the term static balancing and dynamic balancing. State necessary condition to achieve them

b) why balancing of rotating parts is necessary for high speed machine.

c) Draw the sketch and find the differential equation of motion of free vibration. Draw displacement vs. time curve and find time period.

d) All torsional vibration is angular vibration but all angular vibration is not torsional vibration – Explain

e) Draw a sketch of torsional pendulum and write down differential equation of motion.

f) Explain with sketch two node and single node torsional vibration of 3 – rotor system.

g) Explain critical speed of rotor.

h) Derive by energy method natural frequency of transverse vibration of a beam when several concentrated loads act on the beam.

i) Draw a sketch of forced damped vibration and write down differential equation of motion from free body diagram.

j) Explain the term "critical damping co-efficient". How it is related to "damping factor"

**Part – B** **(5 x 14 = 70 marks)**

**Answer Any Five of the following**

2. A shaft carries four masses in parallel plane A, B, C, D in this order along with it's length. The mass at B and C are 25 kg and 20 kg respectively and each has an eccentricity of 120 mm. the masses at A and D have an eccentricity of 150 mm. the angle between masses at B and C is 120$^{o}$ and that between the masses at B and A is 200$^{o}$, both being measured in the same direction. The axial distance between plane A and B is 500 mm and that between B and C is 1000 mm. If the shaft is in complete dynamic balance, determine
(a) magnitude of masses A and D
(b) Distance between plane A and D,
(c) the angular position of the mass at D. (14 Marks)

3. a) Find primary and secondary force of a single cylinder engine by direct and reverse crank method. Show primary and secondary crankangle position, location of mass and direction of angular velocity. (7 Marks)

b) Three cylinder of radial vertical engine have their axis at 120° to one another and connecting rods are coupled to a single crank. The stroke is 15cm and length of each connecting rod is 35 cm.The mass of reciprocating parts of each cylinder is 2kg. Determine primary and secondary forces of the engine running at 2000 rpm . The crank is in vertical position in line with axis of cylinder 1. (7 Marks)

4. a) A mass of 10 kg hangs from spring having stiffness 1500 N/m. Vibration has been created by hammering the mass and creates initial velocity 10 cm/sec. Find the equation of displacement, velocity, acceleration and draw their curves with time. Also find time period from curves. (7 Marks)

b) Find differential equation and natural frequency of a body mass "M" hanging from a spring of stiffness "k" and mass of spring is " m". (7 Marks)

5. a) Find the natural frequency of transverse vibration of beam of several concentrated load by Dunkerley's empirical equation of a simply supported beam. (7 Marks)

b) A simply supported beam of span 2.5 m, the cross section of beam is 250mm wide and 300 mm deep. The mass of beam is 200 kg/m. Two equal mass of 2 tonnes each are placed at 0.8 m and 0.9m from left and right support respectively. Find natural frequency of transverse vibration of beam. Assume E= 200 $GN/m^2$. (7 Marks)

6. A shaft, 20 mm diameter, rotates in a spherical bearing with a span of 1.2 m and carries of rotor of mass 15 kg at mid point of two bearings. Neglect the mass of shaft. Determine dynamic deflection of shaft in terms of angular velocity, if the mass centre of the rotor is 0.25 mm out of alignment. a) find whirling speed of shaft. b) if the bending stress is not to exceed 120 $MN/m^2$, determine range of speed within which it is unsafe to run the shaft and their corresponding frequencies. Take E=200$GN/m^2$. (14 Marks)

7. a) A steel shaft is fitted with rotor A and B at two ends having mass moment of inertia of A is 650 $Kgm^2$ and B is 200 $Kgm^2$. The stepped shaft has 90 mm dia. and 600 mm long; 70 mm dia. and 500 mm long and 60 mm dia. and 400 mm long. Rotor A is fitted with 90 mm dia. shaft end and rotor B is fitted with 60 mm dia. shaft end. Find the actual location of node point and natural frequencies of torsional vibration.
Take G=80 $GN/m^2$. (7 Marks)

b) A motor drives a centrifugal pump through gearing. The pump speed is one-third of motor. Mass moment of inertia of motor is 500 $kgm^2$ and impeller is 1200 $kgm^2$. The shaft diameter and length from motor to pinion is 60 mm dia. and 350 mm long; and from gear to pump is 90 mm dia. and 550 mm long. Find natural frequency of torsional vibration, neglecting inertia of gears and shaft. Take G = 80 $GN/m^2$. (7 Marks)

8. a) A mass of 10 Kg hangs from the spring and makes damped oscillation. The time of 50 complete oscillation requires 30 sec., the ratio of first amplitude to tenth consecutive amplitude is 3. Find spring stiffness and critical damping co-efficient of the system. (7 Marks)

b) A vertical reciprocating engine mounted on steel base plate fitted with dash-pot. Total mass of engine is 350kg and reciprocating mass is 25 kg, vertical stroke is 200 mm, the damping resistance of dashpot is 500 N at 0.3 m/sec and static deflection of base plate is 2 mm. Find the speed of driving shaft at which resonance will occur and find corresponding steady state amplitude. (7 Marks)

****

# INDIAN MARITIME UNIVERSITY

(A Central University, Govt. of India)

B.TECH (MARINE ENGINEERING)

Dec 2017- END SEMESTER EXAMINATION

**STRENGTH OF MATERIALS - I (UG11T1204/T2204)**

Time: 3 Hours Max Marks: 100

Date: 23.12.2017 Pass Marks: 50

---

## Part-A (3x10=30 Marks)

**Compulsory Questions**

1. a) State the principle of superposition.

   b) Define the term modulus of resilience.

   c) State Hooke's Law clearly.

   d) What is statistically indeterminate structure? Explain with diagram.

   e) Write down the relation between Young's modulus, Bulk modulus and Poisson's ratio.

   f) Define Poisson's ratio. What is the range of the value of Poisson's ration.

   e)What do you understand by the term, 'point of contraflexture'?

   f) Define Neutral axis is a beam.

   g) Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.

   h) Define "Shear Stress".

## Part-B (5x14=70Marks)

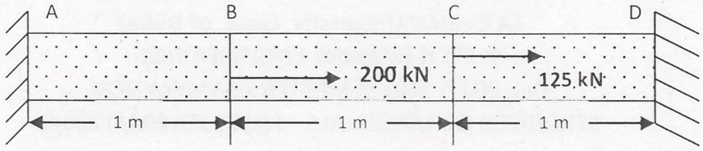
**Answer any five of the followings.**

2. a) Define modulus of elasticity.

   b) Find the expression of deformation of a body to self weight.

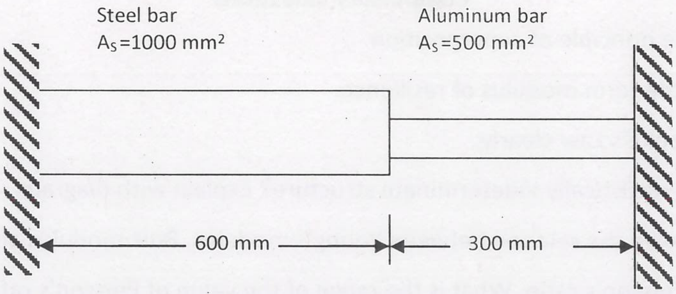
   c) A load Of 5kN is to be raised with the help of a steel wire. Find the minimum diametre of the steel wire, if the stress is not to exceed 100 Mpa. (2+6+6 = 14)

3. An aluminum bar 3m long and 2500 mm$^2$ in cross-section is rigidly fixed at A and D as shown in Figure.




Determine the loads sheared and stresses in each portion and the distances through which the points B and C will move. Take E for aluminum as 80 GPa. (14)

4. A composite bar made up of aluminum and steel, is held between two supports as shown

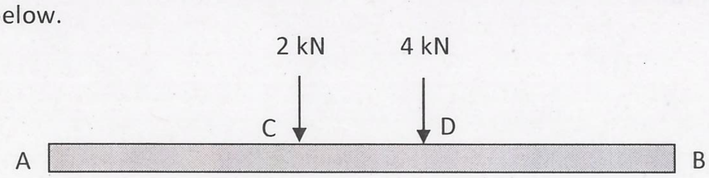


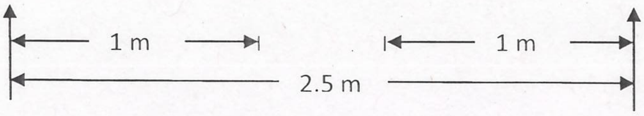

The bars are stress free at a temperature of 38° C. What will be the stress in the two bars, when the temperature is 21°C, if (a) the supports are unyielding; (b) the supports come nearer to each other by 0.1 mm? (Assume the change of temperature is uniform all along the length of bar)

Take E for steel as 200 GPa; E for aluminum as 75 Gpa and coefficient of expansion for steel as $11.7 \times 10^{-6}$ per °C and coefficient of expansion for aluminum as $23.4 \times 10^{-6}$ per °C. (14)

5. a) Deduce the relation between Modulus of Elasticity and Modulus of Rigidity.
b) A solid steel shaft has to transmit 100 kW at 600 r.p.m. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20 %. (7+7=14)

6. a)Draw the S.D.F (shear force diagram) and B.M.D (bending moment diagram) for a cantiliver beam with uniformly distributed load.
b) A simply supported beam AB of span 2.5 m is carrying two point loads as shown in the figure below.

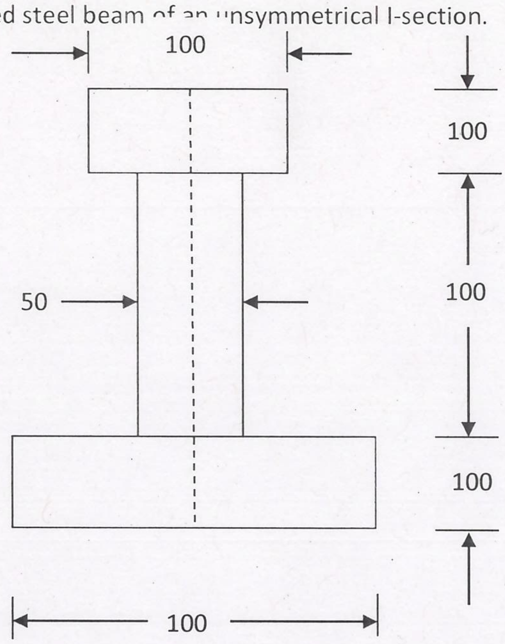





Draw the shear force and bending moment diagram for the beam. (7+7=14)

7. a) Prove that $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ (all the expressions are as per convention)

b) Figure shows a rolled steel beam of an unsymmetrical I-section.




If the maximum bending stress in the beam section is not to exceed 40 MPa, find the moment, which the beam can resist. (7+7=14)

8. a) Write advantage and disadvantages of welded joints.

b) A cylindrical thin drum 800 mm in diameter and 4 m long is made of 10 mm thick plate. If the drum is subjected to an internal pressure of 2.5 MPa, determine its changes in diameter and length. Take E as 200 GPa and Poisson's ratio as 0.25. (7+7=14)

****

## INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

**December 2016 End Semester Examinations**
**B.Tech. (Marine Engineering) Second Semester**

**Strength of Materials – I (UG11T1204/ UG11T2204)**

**Date : 06.01.2017** **Maximum Marks: 100**
**Time: 3 Hrs** (Pls Note: correction for Q.No. 7 (b).) **Pass Marks : 50**

---

### Part-A (3x10=30 Marks)

### Compulsory Questions

1. a) State the principle of superposition.

   b) Define the term modulus of resilience.

   c) State Hooke's Law clearly.

   d) What is statistically indeterminate structure? Explain with diagram.

   e) Write down the relation between Young's modulus, Bulk modulus and Poisson's ratio.

   f) Define Poisson's ratio. What is the range of the value of Poisson's ration.

   g) What do you understand by the term, 'point of contraflexture'?

   h) Define Neutral axis is a beam.

   i) Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.

   j) Define "Shear Stress".

### Part-B (5x14=70Marks)

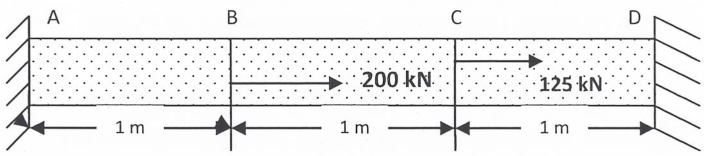
### Answer any five of the followings.

2. a) Define modulus of elasticity.

   b) Find the expression of deformation of a body to self weight.

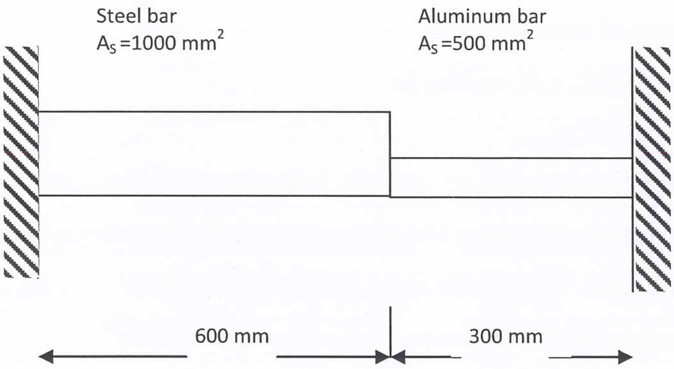
   c) A load 0f 5kN is to be raised with the help of a steel wire. Find the minimum diametre of the steel wire, if the stress is not to exceed 100 Mpa. (2+6+6 = 14)

3. An aluminum bar 3m long and 2500 $mm^2$ in cross-section is rigidly fixed at A and D as shown in Figure.




Determine the loads sheared and stresses in each portion and the distances through which the points B and C will move. Take E for aluminum as 80 GPa. (14)

4. A composite bar made up of aluminum and steel, is held between two supports as shown




The bars are stress free at a temperature of 38° C. What will be the stress in the two bars, when the temperature is 21°C, if (a) the supports are unyielding; (b) the supports come nearer to each other by 0.1 mm? (Assume the change of temperature is uniform all along the length of bar)

Take E for steel as 200 GPa; E for aluminum as 75 Gpa and coefficient of expansion for steel as $11.7 \times 10^{-6}$ per °C and coefficient of expansion for aluminum as $23.4 \times 10^{-6}$ per °C.

(14)

5. a) Deduce the relation between Modulus of Elasticity and Modulus of Rigidity.

**INDIAN MARITIME UNIVERSITY**

(A Central University, Government of India)

May/ June 2017 End Semester Examinations

B.Tech. (Marine Engineering) Second Semester

**(AY 2009-2014 batches)**

**Electrical Machines - II (UG11T1404/ UG11T2404)**

Date : 17.06.2017 Maximum Marks: 100

Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**

**(All questions are compulsory)**

1. (a) What is the difference between a squirrel-cage-type rotor and phase-wound rotor?

   (b) Why is it not possible to run an induction motor on synchronous speed?

   (c) What do you mean by breakdown torque of an induction motor?

   (d) What is the effect of variation of supply frequency in an induction motor?

   (e) What do you mean by the Crawling of induction motor?

   (f) What is synchronous reactance for synchronous machine?

   (g) Mention in brief starting methods of synchronous motor?

   (h) Why damper windings are used in a synchronous machine?

   (i) What is V-curve for 3-phase Alternator?

   (j) How can you protect the motor against single phasing?

**Part – B** **(5 x 14=70 Marks)**

**(Answer any 5 of the following)**

2. (a) Show that in an induction motor, "Rotor input : power developed : rotor copper losses :: 1 : (1-S) : S", where S is the fractional slip. (7 marks)

   (b) A 40 kW, 6-pole, 3-phase star-connected induction motor delivers full-load output at 950 rpm and with 0.85 pf when connected to a supply of 500 V (line value), 50-Hz. Friction and windage losses equal 1.5 kW and stator losses are 1.8 kW. Determine for this load (i) rotor copper loss (ii) efficiency and (iii) line current. (7 marks)

3. (a) If stator impedance of an induction motor is neglected, then show that $\frac{T_e}{T_{\max}} = \frac{2}{\frac{s_{mt}}{s} + \frac{s}{s_{mt}}}$. Where, $T_{\max}$ is maximum torque and $S_{mt}$ is the slip at maximum torque. (7 marks)

(b) A 3-phase star-connected 6.6-kV, 20-pole, 50-Hz induction motor has rotor resistance of 0.12 ohm and stand still reactance of 1.12 ohm. The motor has speed of 291 rpm at full load. Calculate slip at maximum torque and ratio of maximum torque to full load torque. Assume that stator resistance is neglected. (7 marks)

4. (a) Show that an induction motor with star-delta starter behaves as if it is started by an auto-transformer starter with 58% tapping. (7 marks)

(b) Design the 6-sections of a 7-stud rotor starter for a 3-phase wound induction motor. The slip at full load current is 2% and the maximum starting currents is 1.5 times full-load current. The resistance of rotor is 0.02 ohm per phase. (7 marks)

5.(a) Describe the production of Rotating Magnetic Field for 50-Hz two-pole 3-phase Y-connected synchronous generator using 3-phase currents diagram into a cross-section of the machine. (7 marks)

(b) A 3-phase, 4-pole winding of the double-layer type is to be installed on a 48-lot stator. The pitch of the stator windings is 5/6, and there are 10 turns per coil in the windings. All coils in each phase are connected in series, and the three phases are connected in Δ-delta. The flux per pole in the machine is 0.054 Wb, and the speed of rotation of the magnetic field is 1800 r/min.

(i) What is the pitch factor of this winding? (ii) What is the distribution factor of this winding? (iii) What are the frequency and terminal voltages produced in this winding? (7 marks)

6. (a) Derive the formula for distribution factor or winding factor or breadth factor or spread factor in windings used in a synchronous machine? (7 marks)

(b) A 480V, 200-kVA 0.8 pf lagging 50-Hz two-pole, Y-connected synchronous generator has a synchronous reactance of 0.25Ω and an armature resistance of 0.03Ω. At 50 Hz, its friction and windage losses are 6 kW, and its core losses are 4 kW. The field circuit has a DC voltage of 200V, and the maximum field current is 10-A. Assume that the field current of the generator is adjusted to achieve rated voltage (480 V) at full load conditions in each of the questions below:

(i) What is the efficiency of the generator at rated load?

(ii) What is the voltage regulation of the generator if it is loaded to rated kilo-voltamperes (kVA) with 0.8-pf lagging loads? Draw the Phasor.

(7 marks)

7.(a) Explain armature reaction of an alternator and its effect on main flux at zero power-factor-leading load. (7 marks)

(b) A 208V Star-connected synchronous motor is drawing 50-A at unity power factor from a 208-V power system. The field current flowing under these conditions is 2.7-A. Its synchronous reactance is 0.8Ω. Assume a linear open-circuit characteristic. (i) Find the torque angle. (ii) How much field current would be required to make the motor operate at 0.78 PF (power factor) leading? Also draw the phasors. (7 marks)

8.(a) Classify the single-phase induction motors. Write down the working principle of a single phase motor. (3+4 = 7 marks)

(b) Explain the double revolving field theory. (7 marks)

****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

**Fluid Mechanics- I (UG11T1405/ UG11T2405)**

Date : 20.06.2017 Maximum Marks: 100
Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. a) Define mass density, specific gravity and viscosity of a fluid.
   b) State Newton's law of viscosity. What are Newtonion and Ideal Fluids?
   c) Define hydrostatics, total pressure and centre of pressure.
   d) What is stable, unstable and neutral equilibrium?
   e) State continuity equation and derive it for incompressible fluids.
   f) Name three types of heads of flowing liquid, state Bernoulli's equation and write its expression.
   g) Give use of venturimeter, orificemeter and pitot tube.
   h) Define vortex motion, forced vortex flow and free vortex flow.
   i) Define Reynolds number, Froude's number and Euler's number.
   j) What is geometric similarity, kinematic similarity and dynamic similarity in model analysis?

**PART – B** **(5 x 14 = 70 marks)**
**(Answer any 5 of the following)**

2. A fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. the maximum shear stress at the pipe wall is 210 $N/m^2$. Find (i) pressure gradient (ii) centre line velocity (iii) average velocity (iv) Reynolds Number (v) friction coefficient of the pipe. (14 marks)

3. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m length from the tank the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm for the remaining length. The height of

water level in the tank is 8 m above the pipe. Take friction coefficient (f) = 0.01 for both sections of the pipe.

If 'V1' is the velocity in first section (150 mm diameter) and 'V2' is velocity in second section (300 mm diameter), calculate (i) all losses occurring in the flow in terms of kinetic head in section 2 ($V_2^2/2g$) (ii) velocity in section 2 ($V_2$) (14 marks)

4. Using Buckingham's pi-theorem show that velocity (V) through circular orifice is given by

$$V = \sqrt{2gH}\ \phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$$

Where, H = head causing the flow, D= Diameter of the orifice, μ = Co-efficient of viscosity, ρ = Mass density and g= acceleration due to gravity (14 marks)

5. Derive expression for rate of flow for venturimeter fitted in a horizontal pipe (14 marks)

6. A cylindrical vessel closed at the top and bottom is 0.24 m in diameter, 1.44 m high and contains water up to a height of 0.96 m.

(i) find the height of the paraboloid formed if it is rotated at 480 rpm about its vertical axis. (7 marks)

(ii) Find speed of rotation of the vessel when axial depth of water is zero. (7 marks)

7. Each gate of lock is 6 m high and 5 m wide, supported on one side by two hinges, each 0.5 m from top and from bottom. The angle between the gates in closed position is 120 degrees. If the water levels are 5 m and 1.25 m on the upstream and downstream side respectively, find

(i) magnitude of resultant water pressure (3 marks)

(ii) position of resultant water pressure from bottom of the gate (4 marks)

(iii) reaction at top hinge (3 marks)

(iv) reaction at bottom hinge. Assume reaction between the gates is in same horizontal plane as that of resultant water pressure. (4 marks)

8. a. A nozzle of 60 mm diameter delivers a stream of water at 24 m/s perpendicular to the plate that moves away from the jet at 6 m/s. Find (i) the force on the plate (ii) the work done (iii) efficiency of the jet. (7 marks)

b. A 400 mm diameter shaft is rotating at 200 rpm in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is 0.7 N-s/$m^2$, determine torque required to overcome friction in the bearing. (7 marks)

*****

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Government of India)**

**May/ June 2017 End Semester Examinations**
**B.Tech. (Marine Engineering) Second Semester**
**(AY 2009-2014 batches)**

**Ship Structure & Construction (UG11T1401/ UG11T2401)**

Date: 10.06.2017 Maximum Marks: 100
Time: 3 Hrs Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. (a) Define L.B.P, And LOA.

(b) With the help of sketch show Heaving, Yawing, Swaying, Surging, Rolling, Pitching.

(c) With the help of sketch show Bulb Angle, Bulb Plate, Equal Angle, and Channel.

(d) Why welding electrodes are coated with Flux ?

(e) Show with the help of simple sketch, the arrangement of margin plate, and tank side bracket.

(f) What is the Purpose of Beam Knee and Web Frame ?

(g) What do you understand by Class A bulkhead and Class B bulkhead?

(h) Write two advantages and two disadvantages of Bulbous Bow.

(i) Why Rudder is situated Aft of the Ship ?

(j) Write the name of any five classification society.

Contd..

**Part- B** **(5 x 14= 70 marks)**

**(Answer Any 5 of the following)**

2. (a) With the help of sketch explain in details the bottom construction of a ship of double bottom construction. (8)

   (b) With the help of sketch explain how the side shell of a ship is supported? What special arrangement is provided where tween deck frame is carried through a second Deck? (6)

3. (a) Mention five main functions of bulkhead. (5)

   (b) What is the purpose of collision bulkhead ? At what distance collision bulkhead is located from forward perpendicular? How the bulkheads are stiffened? How much is the gap between the stiffeners in normal bulkhead and collision bulkhead ? (6)

   (c) Write the procedure for testing of water tight bulkhead. (3)

4. (a) With the help of sketch show the forward construction of a ship? (8)

   (b) With the help of sketch explain how the forward end is specially constructed to resist panting ? (6)

5. (a) What is the purpose of rudder? Why rudders are hollow? (3)

   (b) What do you understand by balanced, semi-balanced and un-balanced rudder? Why semi balanced rudder is advantageous over the other two ? (5)

   (c) Describe with the help of sketch, the arrangement of a rudder carrier bearing having conical bearing surface. (6)

6. (a) What do you understand by classification society? (2)

   (b) What are the key points of the functioning of classification society? (6)

   (c) How "Flag State" and "Classification Society" are related to each other? (2)

   (d) What is the main role of IMO ? (4)

# INDIAN MARITIME UNIVERSITY

(A Central University, Govt. of India)

**End Semester Examinations December 2017**

**Prgramme:** B.Tech (Marine Engineering) **Semester:** Second Semester

**Subject Name:** Engineering Mechanics-II **Subject Code:** UG11T2206/UG11T1206

**Date:** **21.12.2017** **Max. Marks: 100**

**Time: 3 Hrs** **Pass Marks: 50**

---

**PART-A** Marks:10X3 =30

(All questions are Compulsory)

**1.**

(a) Define coefficient of friction and cone of friction.
(b) State the useful and harmful effects of friction.
(c) Write down any three laws of simple pendulum.
(d) Define D'Alembert's Principle.
(e) Define torque? What is the unit of torque?
(f) Explain the terms: Amplitude and Periodic Time as applied to SHM
(g) What are the advantages of V-Belt drive over a flat belt drive?
(h) Differentiate between the open Belt drive & cross belt drive
(i) Classify the different types of brake.
(j) What is the function of governor? Classify the different types of governor.

**PART-B** Marks: 5X14=70

(Answer any 5 of the Following)

**2.**

**(a)** The pitch of 50 mm in mean diameter threaded screw of a screw jack is 12.5 mm.The coefficient of the friction between the screw and the nut is 0.13.Determine the torque required on the screw to raise a load of 25 KN, assuming the load to rotate with the screw. (6 marks)

**(b)** Derive the expression for power lost in friction in flat pivot bearing considering uniform pressure theory. (8 marks)

3. The thrust of a Propeller shaft in a Marine Engine is taken up by 8 collars whose external and internal diameters are 600 mm and 300 mm respectively. The total thrust from the propeller is 100 kN. If the Coefficient of friction is 0.12 and speed of the engine 90 rpm, find the power absorbed in friction of thrust block, assuming i) uniform pressure; and ii) uniform wear (14 Marks)

4. **(a)** A simple pendulum of amplitude 4° performs 24 oscillations in one minute. Find (i) length of the pendulum (ii) maximum acceleration of the bob, (iii) maximum linear velocity of the bob; and (iv) maximum angular velocity of the bob. (10 Marks)

**(b)** A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find angular acceleration of the wheel. (4 Marks)

5. A single block brake is shown in Fig.1 The diameter of the drum is 250 mm and the angle of contact is 90°. If the operating force of 700 N is applied at the end of a lever and the coefficient of friction between the drum and the lining is 0.35, determine the torque that may be transmitted by the block brake. (14 Marks)

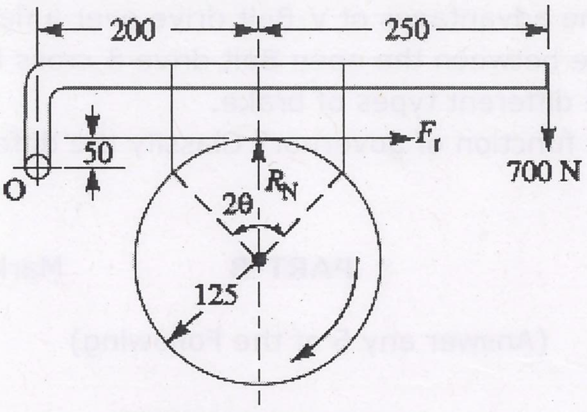



**Fig.1**

6. Find the power transmitted by a rope drive, from the following data:
   - Angle of contact=180°
   - Pulley groove angle=60°
   - Coefficient of friction=0.2
   - Mass of rope=0.4 Kg/meter length
   - Permissible tension=1.5 KN
   - Velocity of rope=15 m/s

(14 Marks)

7. A belt 100mm x 10 mm thick is transmitting power at 1200m/min. The net driving tension is 1.8 times the tension on the slack side. If the safe stress on the belt section is 1.8 $N/mm^2$, calculate the power that can be transmitted at this speed Assume mass density of the leather as 1000 $kg/m^3$.

Also calculate the absolute maximum power that can be transmitted by this belt and the speed at which this can be transmitted.

(14 Marks)

8. A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find minimum & maximum speed and range of speed of the governor. (14 Marks)

****

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Engineering Mechanics - II - (UG11T2206/UG11T1206)**

**Date : 20.06.2016** | **Max Marks: 100**
**Time: 3 Hrs** | **Pass Marks: 50**

---

**Part-A** (3 x 10 = 30 Marks)
**Compulsory Question**

1. a) Define D'Alembert's Principle
   b) Define torque? What is the unit of torque?
   c) What are advantages of rope drives?
   d) Define maximum and minimum equilibrium speeds.
   e) Define the law of Isochronisms as applied to simple pendulum
   f) State the useful and harmful effects of friction
   g) Define the term amplitude as applied to S.H.M.
   h) What is centrifugal tension in a belt? How does it affect the power transmitted?
   i) Distinguish between brakes and dynamometers
   j) What is functional difference between a governor and a flywheel?

**Part-B** (14 x 5 =70 Marks)
**Answer any Five Questions**

2) A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05.

   (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
   (ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending. (14)

3) Explain the terms and derive expression for 'effort' and 'power' of a porter governor. (14)

4) a) Show that the minimum periodic time of a compound pendulum is
   $T_{p(min)} = 2\pi\sqrt{(k_G/l)}$ [Where $k_G$ is the radius of gyration about the centre of gravity]

   b) What is the length of the simple pendulum which gives the same frequency as compound pendulum. (10+4)

5) A vertical shaft 150 mm in diameter rotating at 100 rpm rests on a flat pivot bearing. The shaft carries a load of 20 kN, the coefficient of friction is 0.05. Estimate the power lost in friction (a). assuming uniform pressure (b) assuming uniform wear. (14)

6) A simple band brake operates on a drum of 600mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of $270^0$, one end is fastened to a fixed pin and the other end to the brake arm 125mm from the fixed pin. The straight brake arm is 750mm long and placed perpendicular to the diameter that bisects the angle of contact.

(a) What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull?

(b) What width of steel band of 2.5mm thick is required for this brake if the maximum tensile stress is not to exceed 50 $N/mm^2$? (14)

7) Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2,angle of lap 160o and the maximum tension in the belt is 2.5 KN. (14)

8) A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find

(a) angular acceleration of the wheel; and

(b) no. of revolutions made by this wheel in 30 seconds. (14)

*****

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Engineering Mechanics - II - (UG11T2206/UG11T1206)**

**Date : 20.06.2016** **Max Marks: 100**
**Time: 3 Hrs** **Pass Marks: 50**

---

**Part-A** **(3 x 10 = 30 Marks)**
**Compulsory Question**

1. a) Define D'Alembert's Principle
   b) Define torque? What is the unit of torque?
   c) What are advantages of rope drives?
   d) Define maximum and minimum equilibrium speeds.
   e) Define the law of Isochronisms as applied to simple pendulum
   f) State the useful and harmful effects of friction
   g) Define the term amplitude as applied to S.H.M.
   h) What is centrifugal tension in a belt? How does it affect the power transmitted?
   i) Distinguish between brakes and dynamometers
   j) What is functional difference between a governor and a flywheel?

**Part-B** **(14 x 5 =70 Marks)**
**Answer any Five Questions**

2) A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05.

   (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
   (ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending. (14)

3) Explain the terms and derive expression for 'effort' and 'power' of a porter governor. (14)

4) a) Show that the minimum periodic time of a compound pendulum is
   $T_{p(min)} = 2\pi\sqrt{(k_G/l)}$ [Where $k_G$ is the radius of gyration about the centre of gravity]

   b) What is the length of the simple pendulum which gives the same frequency as compound pendulum. (10+4)

5) A vertical shaft 150 mm in diameter rotating at 100 rpm rests on a flat pivot bearing. The shaft carries a load of 20 kN, the coefficient of friction is 0.05. Estimate the power lost in friction (a). assuming uniform pressure (b) assuming uniform wear. (14)

6) A simple band brake operates on a drum of 600mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of $270^0$, one end is fastened to a fixed pin and the other end to the brake arm 125mm from the fixed pin. The straight brake arm is 750mm long and placed perpendicular to the diameter that bisects the angle of contact.

(a) What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull?

(b) What width of steel band of 2.5mm thick is required for this brake if the maximum tensile stress is not to exceed 50 $N/mm^2$? (14)

7) Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2,angle of lap 160o and the maximum tension in the belt is 2.5 KN. (14)

8) A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find

(a) angular acceleration of the wheel; and

(b) no. of revolutions made by this wheel in 30 seconds. (14)

*****

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Strength of Materials – I (UG11 T2204/T1204)**

**Date : 15.06.2016** — **Max Marks: 100**
**Time: 3 Hrs** — **Pass Marks: 50**

---

**Part-A** (3 x 10 = 30 Marks)
**Compulsory Question**

1. a) Define Poisson's ratio.
   b) Define Point of Contrafluxure.
   c) Draw the sheer force and bending moment diagram for a cantilever beam subjected to uniformly distributed load.
   d) Calculate the bursting pressure for cold drawn seamless steel tubing of 60mm inside diameter with 2mm wall thickness. The ultimate strength of steel is $300MN/m^2$.
   e) What is stiffness of a closed-coil Helical spring?
   f) What is neutral axis and why there is no stress at this section?
   g) What is hoop stress and Longitudinal Stress of a thin cylinder under internal Pressure?
   h) A steel rod having cross-section 15 X 25 $mm^2$ is to carry an axial load of 200 KN (tensile). Calculate the length of the steel rod if the extension of the rod is 0.069 mm. Given the modulus of Elasticity, $E=2.14 \times 10^8$ $KN/m^2$.
   i) What is 'load factor' and what is 'impact factor'?
   j) Define the term 'polar modulus'. Find the expressions for the polar modulus for a solid shaft and a hollow shaft.

**Part-B** (14 x 5 =70 Marks)
**Answer any Five Questions**

2) a. Define Hooke's law.
   b. A rigid bar is supported by three rods in the same plane and equidistant. The outer rods are of the brass and of length 600mm and diameter 30mm. the central rod is of steel is 900mm length and of 37.5mm diameter. Calculate the forces in the bars due to an applied force P, if the bar remains horizontal after the load has been applied. Take $\mathbf{E_s / E_b=2}$ (4+10)

3) A compound bars made of a central steel plate 60mm wide and 10mm thick to which copper plates 40mm wide by 5mm thickness are connected rigidly on each side. The length of the bar at normal temperature is 1m. If the temperature is raised by $80^0C$, determine the stresses in each metal and the change in length.
   Take $Es=200GN/m^2$ $Ec=100GN/m^2$
   $\alpha s= 12x10^{-6}/^0C$ $\alpha c= 17x10^{-6}/^0C$ (14)

4) A cylindrical shell 3m long which is closed at the ends has an internal diameter of 1m and a wall thickness of 15mm. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shells if it subjected to an internal pressure of $1.5MN/m^2$.Take $E=200GN/m^2$ and 1/m=0.3. (14)

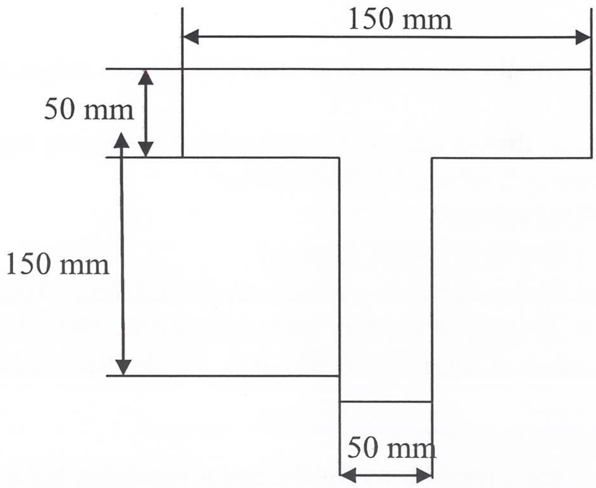
5) a) Prove that $\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$ in case of torsion of a cylindrical shaft. Notions have their usual meaning

b) A solid steel shaft has to transmit 100KW at 160 rpm. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceed the mean by 20%. (6+8)

6) a) Derive an expression of strain energy under gradual loading.

b) Calculate the strain energy stored in a Bar 2 m long 50 mm wide and 40 mm thick. When it is subjected to tensile load of 60 KN. Take Young Modulus as 200 GPa. (6+8)

7) A Beam having cross-section as shown below in the figure 3, is subjected to a bending moment of 3.5 KNm. Find the Tensile and the compressive stresses (at extreme fibres) developed in the beam. What will be the bending stress at a distance of 10 mm from the neutral axis? (14)

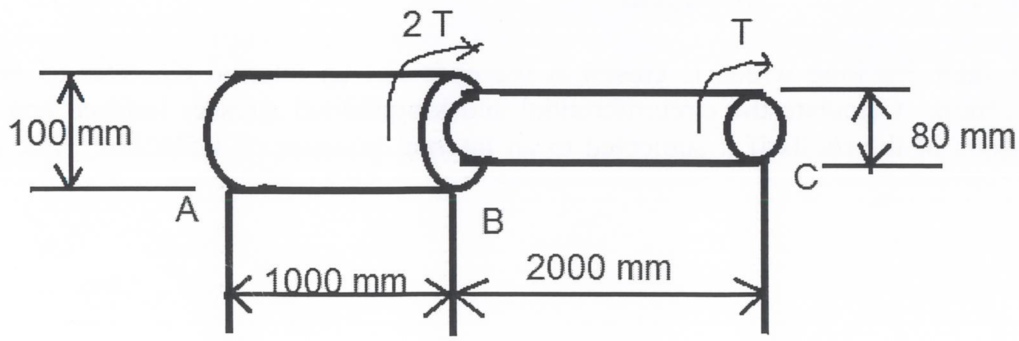



8) a) A beam 10 m long and simply supported at each end, has a uniformly distributed load of 1000 N/m extending from the left end up to the centre of the beam. There is also an anti-clockwise couple of 15 KNm at a distance of 2.5 m from the right end. Draw the S.F and B.M diagrams.

b) How will you draw the S.F and B.M diagrams for a beam which is subjected to inclined loads? (10+4)

9) a) Internal diameter of a hollows shaft is two-third of its external diameter. Compare its resistance to torsion with that of a solid shaft of the same weight and material.

b) A stepped steel shaft is subjected to a torque T at the free end and a torque 2T at the junction of the two sizes as shown in figure. Find the total angel of twist at the free end, if the maximum shear stress in the shaft material is limited to 70 N/mm2. Take the modulus of rigidity as $0.8 \times 10^5$ N/mm$^2$. (7+7)




*****

# INDIAN MARITIME UNIVERSITY

**(A Central University, Government of India)**

**December 2016 End Semester Examinations**

**B.Tech. (Marine Engineering) Third Semester**

**Strength of Materials - II (UG11T1304/ UG11T2304)**

**Date : 21.12.2016** | **Maximum Marks: 100**

**Time: 3 Hrs** | **Pass Marks : 50**

**Part-A** **(3x10=30 Marks)**

**(Compulsory Question)**

1. a) Define principle planes and principle stress.
   b) What is a Mohr's circle; explain the method of Drawing Mohr's Stress Circle.
   c) State Mohr's Theorem.
   d) Define the term 'obliquity' and how it is determined. $\frac{d}{t} \geq 20$
   e) How built-in and continuous beams can be differentiated?
   f) Define Claperyon's three moment theorem.
   g) What do you mean by thick compound cylinder?
   h) How the strain energy due to twisting can be measured?
   i) Write the assumptions made in Euler's theory.
   j) Define slenderness ratio.

**Part-B** **(5x 14= 70 Marks)**

**(Answer any five of the followings)**

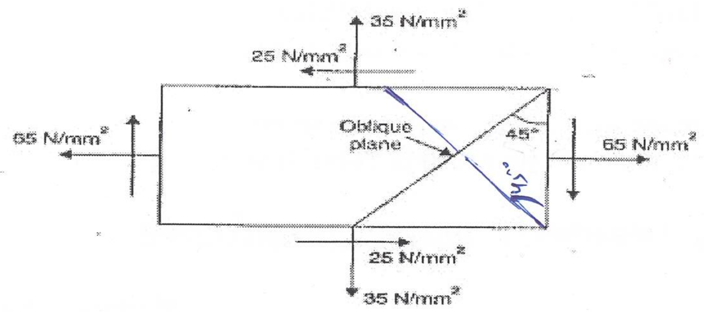
2. A rectangular block of material is subjected to tensile stress of 110 $N/mm^2$ on one plane and a tensile stress of 47 $N/mm^2$ on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63 $N/mm^2$ and that associated with the former tensile stress tends to rotate the block anticlockwise. Find:

   (i) The direction and magnitude of each of the principle stress.
   (ii) Magnitude of the greatest shear stress. (7 + 7)

3. A point in a strained material is subjected to stresses shown in the figure below. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. (14)

78.5

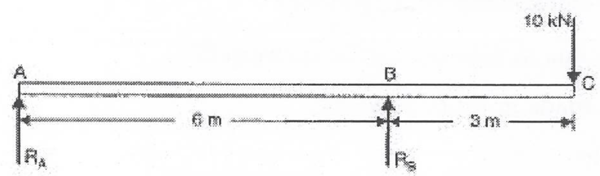
(70.43)




4. A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a uniformly distributed load of 9kN/m run over the entire span of 5m. If the value of E for the beam material is 1 X $10^4$ N/mm$^4$, Find (7+7)

   (i) Slope at the supports
   (ii) Maximum Deflection

5. An overhanging beam ABC is loaded as shown in the figure below. Find the slopes over each support and at the right end. Find also the maximum upward deflection between the supports and the deflection at the right end. (14)
   Take E= 2 X $10^5$ N/mm$^2$ and I = 5 X $10^8$ mm$^4$




6. A cantilever of length 2 m carries a point load of 20 kN at the free end and another load of 20 kN at its centre. If E = $10^5$ N/ mm$^2$ and I = $10^8$ mm$^4$ for the cantilever then determine by moment area method, the slope and deflection of the cantilever at the free end. (14)

7. A thick spherical shell of 200 mm internal diameter is subjected to an internal fluid pressure of 7 N/mm$^2$. If the permissible tensile stress in the shell material is 8 N/mm$^2$,
   $\sigma_c$ $\sigma_{r\text{-comp}}$

   (a) Find the thickness of the shell.
   (b) Also find the minimum value of the hoop stress. (7+7)
   $\sigma_c$ min

8. (a) Explain Rankine-Gordan Formula.

   (b) Determine Euler's Crippling load for an I-section joist 40 cm X 20 cm X 1 cm and 5 m long which is used as a strut with both ends fixed. Take Young's modulus for the joist as 2.1 X $10^5$ N/mm$^2$. ( 4 + 10=14)

****

$l_e = (l/2)$ I

min = at $r_2$ | max at $r_1$; $\sigma_{r1} = 0$; $\sigma_c = \sigma_{c\,max}$ | $\frac{2b}{r^3} + a = \sigma_c$ (Hoop)
$\frac{2b}{r^3} - a = \sigma_r$ (radial stress)

$\frac{2b}{r^3}$

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Applied Thermodynamics – I (UG11T2203/UG11T1203)**

**Date : 13.06.2016** | **Max Marks: 100**
**Time: 3 Hrs** | **Pass Marks: 50**

**Note: (Non Programmable Scientific calculator ,Steam tables , Mollier Chart are allowed)**

---

**Part-A** **(3 x 10 = 30 Marks)**

**Compulsory Question**

1)

a) State different statements of second law of thermodynamics.
b) Define entropy and irreversibility.
c) Draw the T-S diagram and P-V diagram for simple Rankine cycle with superheated steam.
d) Give reasons for compounding steam engines.
e) What is meant by Mean Effective pressure Of steam Engines.
f) What are the advantages of centrifugal air compressors?
g) What are advantages of multi stage air compressor over single stage compressor.
h) What are the uses of compressed air?
i) State Gibbs Daltons law for gas Mixtures.
j) Define the terms (i) Relative Humidity (ii) Specific Humidity (iii) Dew point temperature.

**Part-B** **(14 x 5 = 70 Marks)**

**Answer any Five Questions**

2. (a) Establish a General Expression for Change in entropy of an Ideal gas in terms of Volume and Absolute Temperature

(b) 2.0 kg of air is heated from 27degC to 427degC while the pressure changes from 100 kPa to 600 kPa. Calculate the change in entropy.
(R = 0.257 kJ / kg K, Cp = 1.005 kJ / kg K ) (7+7)

3. (a) What is (i)Heat engine (ii) Heat pump (iii) Refrigerator .

(b) A Carnot cycle operates between source and sink temperatures of 250°C and –15°C. If the system receives 90 kJ from the source, find (i) Efficiency of the system ; (ii) The net work transfer ;(iii) Heat rejected to sink. (6+8)

4. (a) What are the various methods to improve efficiency of Rankine cycle.

(b) A Rankine cycle works between 40 bar, 400DegC (at the boiler exit) and 0.035 bar at the condenser. Calculate the Rankine efficiency. Assume isentropic expansion. Neglect the feed pump work. (7+7)

5. (a) Explain the term ‘ *diagram factor* ’as applied to steam engines?

(b) A single-cylinder, double-acting steam engine of 20 cm diameter and 40 cm stroke is supplied with steam at 834 kPa and exhausts at 14.7 kPa. Cut-off takes place at one third stroke and the engine runs at 120 RPM. diagram factor is 0.7, Calculate the actual mean effective pressure and the indicated power of the engine. (4+10)

6. (a) Derive an expression for work required for single stage reciprocating air compressor neglecting clearance volume.

(b) A double-acting, single cylinder air compressor runs at 100 r.p.m. The air is compressed from an initial pressure of 100 kPa (1 bar) to a delivery pressure of 750 kPa (7.5 bar). The stroke volume is 0.15 $m^3$ and law of compression and expansion is $pv^{1.25} = C$. If the clearance volume is 1/18th of the stroke volume. Calculate: (a) Volumetric efficiency (b) the volume of air taken in per stroke, and (c) the indicated power of the compressor. (5+9)

7. A vessel of 1.8 m3 capacity contains oxygen at 8 bar and 50°C. The vessel is connected to another vessel of 3.6 m3 capacity containing carbon monoxide at 1 bar and 20°C. A connecting valve is opened and the gases mix adiabatically. Calculate (i) The final temperature and (ii)pressure of the mixture (Take : For oxygen Cv = 21.07 kJ/mole K. For carbon monoxide Cv = 20.86 kJ/mole K Universal gas constant, R=8314J/kg K ). (14)

8. (a) Describe a Psychometric Chart

(b) Atmospheric air at 1.01325 bar has 30°C Dry bulb temperature and 15°C Dew point temperature. Calculate:

1. Partial pressures of air and water vapour
2. Specific humidity
3. Relative humidity

(8+6)

*****

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Engineering Mechanics - II - (UG11T2206/UG11T1206)**

**Date : 20.06.2016** | **Max Marks: 100**
**Time: 3 Hrs** | **Pass Marks: 50**

---

**Part-A** (3 x 10 = 30 Marks)
**Compulsory Question**

1. a) Define D'Alembert's Principle
   b) Define torque? What is the unit of torque?
   c) What are advantages of rope drives?
   d) Define maximum and minimum equilibrium speeds.
   e) Define the law of Isochronisms as applied to simple pendulum
   f) State the useful and harmful effects of friction
   g) Define the term amplitude as applied to S.H.M.
   h) What is centrifugal tension in a belt? How does it affect the power transmitted?
   i) Distinguish between brakes and dynamometers
   j) What is functional difference between a governor and a flywheel?

**Part-B** (14 x 5 =70 Marks)
**Answer any Five Questions**

2) A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05.

   (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
   (ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending. (14)

3) Explain the terms and derive expression for 'effort' and 'power' of a porter governor. (14)

4) a) Show that the minimum periodic time of a compound pendulum is
   $T_{p(min)} = 2\pi\sqrt{(k_G/l)}$ [Where $k_G$ is the radius of gyration about the centre of gravity]

   b) What is the length of the simple pendulum which gives the same frequency as compound pendulum. (10+4)

5) A vertical shaft 150 mm in diameter rotating at 100 rpm rests on a flat pivot bearing. The shaft carries a load of 20 kN, the coefficient of friction is 0.05. Estimate the power lost in friction (a). assuming uniform pressure (b) assuming uniform wear. (14)

6) A simple band brake operates on a drum of 600mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of $270^0$, one end is fastened to a fixed pin and the other end to the brake arm 125mm from the fixed pin. The straight brake arm is 750mm long and placed perpendicular to the diameter that bisects the angle of contact.

(a) What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull?

(b) What width of steel band of 2.5mm thick is required for this brake if the maximum tensile stress is not to exceed 50 $N/mm^2$? (14)

7) Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2,angle of lap 160o and the maximum tension in the belt is 2.5 KN. (14)

8) A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find

(a) angular acceleration of the wheel; and

(b) no. of revolutions made by this wheel in 30 seconds. (14)

*****

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Engineering Mechanics - II - (UG11T2206/UG11T1206)**

**Date : 20.06.2016** | **Max Marks: 100**
**Time: 3 Hrs** | **Pass Marks: 50**

---

**Part-A** (3 x 10 = 30 Marks)
**Compulsory Question**

1. a) Define D'Alembert's Principle
   b) Define torque? What is the unit of torque?
   c) What are advantages of rope drives?
   d) Define maximum and minimum equilibrium speeds.
   e) Define the law of Isochronisms as applied to simple pendulum
   f) State the useful and harmful effects of friction
   g) Define the term amplitude as applied to S.H.M.
   h) What is centrifugal tension in a belt? How does it affect the power transmitted?
   i) Distinguish between brakes and dynamometers
   j) What is functional difference between a governor and a flywheel?

**Part-B** (14 x 5 =70 Marks)
**Answer any Five Questions**

2) A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05.

   (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
   (ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending. (14)

3) Explain the terms and derive expression for 'effort' and 'power' of a porter governor. (14)

4) a) Show that the minimum periodic time of a compound pendulum is
   $T_{p(min)} = 2\pi\sqrt{(k_G/l)}$ [Where $k_G$ is the radius of gyration about the centre of gravity]

   b) What is the length of the simple pendulum which gives the same frequency as compound pendulum. (10+4)

5) A vertical shaft 150 mm in diameter rotating at 100 rpm rests on a flat pivot bearing. The shaft carries a load of 20 kN, the coefficient of friction is 0.05. Estimate the power lost in friction (a). assuming uniform pressure (b) assuming uniform wear. (14)

6) A simple band brake operates on a drum of 600mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of $270^0$, one end is fastened to a fixed pin and the other end to the brake arm 125mm from the fixed pin. The straight brake arm is 750mm long and placed perpendicular to the diameter that bisects the angle of contact.

   (a) What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull?

   (b) What width of steel band of 2.5mm thick is required for this brake if the maximum tensile stress is not to exceed 50 $N/mm^2$? (14)

7) Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2,angle of lap 160o and the maximum tension in the belt is 2.5 KN. (14)

8) A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find

   (a) angular acceleration of the wheel; and

   (b) no. of revolutions made by this wheel in 30 seconds. (14)

*****

**INDIAN MARITIME UNIVERSITY**
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Second Semester
**(AY 2009-2014 batches)**

## Engineering Mechanics - II (UG11T1206/ UG11T2206)

Date : 22.06.2017 — Maximum Marks: 100
Time: 3 Hrs — Pass Marks : 50

**Part – A** **(10 x 3=30 marks)**
**(All questions are compulsory)**

1. (a) State Coulomb's laws of dry friction.
   (b) Explain angle of repose with a sketch.
   (c) Define sensitivity of governors.
   (d) What is the function of governor? How does it differ from a flywheel?
   (e) Write an expression for Kinetic energy of a rigid body undergoing general plane motion(rolling without slipping) and explain the expression.
   (f) What is centrifugal tension in a belt and how does it affect power Transmitted?
   (g) A block of 50kg mass is pushed up an incline plane by a force acting parallel to incline plane. The angle of inclination is $30^0$ and coefficient of friction is 0.25. Find the force required to impend motion in upwords direction along incline plane.
   (h) What are the advantages of using rope drives?
   (i) What is the advantage of using cross belt drive compared to open belt?
   (j) A 44.5 N weight is suspended by a helical spring having a constant k = 890 N / m. Neglecting the mass of spring, find the time period t for small amplitudes of vertical vibration.

**PART – B** **(5 x 14=70 marks)**

**(Answer any 5 of the following)**

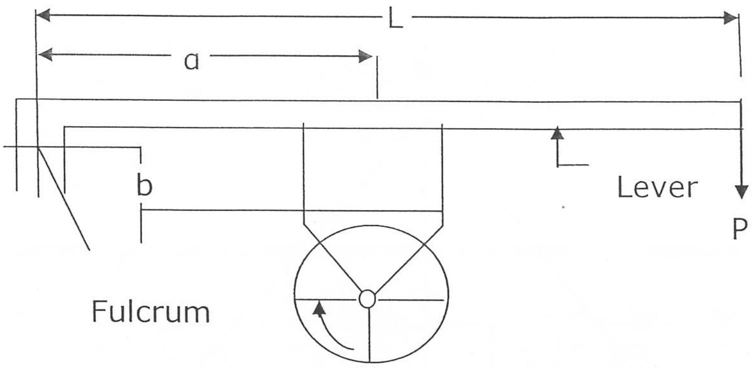
2. A multi-disc clutch transmitting 25 kW of power at 1500 rpm has three discs on the driving shaft and two on the driven shaft. The outside and inside diameters of the contacting surfaces are 240 mm and 120 mm respectively. Assuming the condition of uniform wear, determine the maximum axial intensity of pressure between the discs. Take coefficient of friction as 0.3. (14)

3.(a) A single start square threaded spindle of a screw jack has mean diameter of 45 mm and a pitch of 10 mm. If coefficient of friction between the screw and nut is 0.25, determine (i) the force required to be applied at the screw to raise a load of 5000 N, (ii) efficiency of screw jack and (iii) the force required to be applied at pitch radius to lower the same load of 5000 N Neglect friction between the nut and the collar. (4+3+3=10)

(b) Is the screw jack mentioned above self locking? Which type of screw jack will you recommend, over hauling or self locking and why? (4)

4. A flywheel is made up of steel ring 40 mm thick and 200 mm wide plate with mean diameter of 2 metres. If initially the flywheel is rotating at 300 r.p.m., find the time taken by the wheel in coming to rest due to frictional couple of 100 Nm. Take mass density of the steel as 7900 kg/m$^3$. Neglect the effect of inertia of the spokes. The flywheel may be treated as thin ring. (14)

5. The brake drum of a single block brake is rotating at 500 r.p.m. in the clockwise direction. The diameter of the drum is 400 mm and the single block brake is of the type as shown in Figure given below:




The force P required at the end of the lever to apply the brake is 300 N. If angle of contact is $30^0$ and L = 1 m, a = 300 mm and b = 25 mm then determine the braking torque. The co-efficient of friction is equal to 0.3. (14)

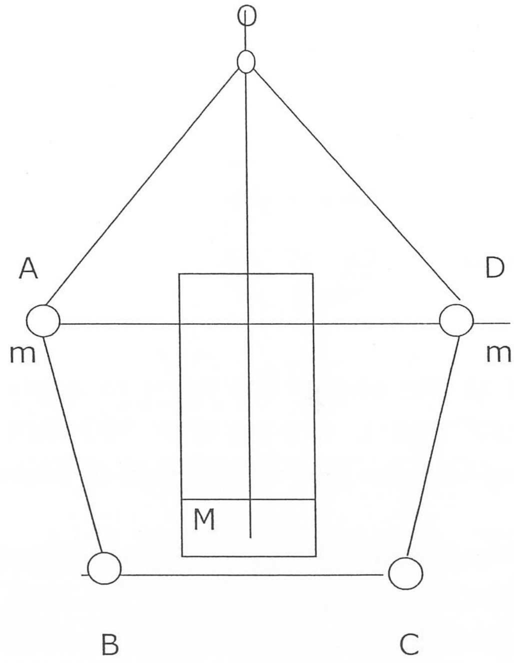
6.(a) A body performs simple harmonic motion in a straight line. Its velocity is 12 m/s when the displacement is 50 mm, and 3 m/s when the displacement is 100 mm. The displacement is measured from the mid position. Calculate the frequency and amplitude of motion. What is the acceleration when the displacement is 75 mm from the mid position? (3+3+4=10)

(b) What is centre of Percussion? What is the significance of centre of Percussion? (4)

7. A 100 mm wide and 10 mm thick belt transmits 5 kW of power between two parallel shafts. The distance between the shaft centres is 1.5 m and the diameter of smaller pulley is 440 mm. The driving and driven shafts rotate at 60 rpm and 150 rpm respectively. The coefficient of friction is 0.22. Find the stress in the belt if the two pulleys are connected by an open belt. (14)

8.In a porter governor shown in figure below, each of the arms is 400 mm long. The upper arms are pivoted on the axis of the sleeve where as the lower arms are attached to the sleeve at a distance of 45 mm from the axis of rotation. Each ball has a mass of 8 kg and the load on the sleeve is 60 kg. What will be the equilibrium speeds for the two extreme radii of 250 mm and 300 mm of rotation of the governor balls? (7+7=14)

P.T.O.



O
A
D
m
m
M
B
C


******

**INDIAN MARITIME UNIVERSITY**

(A CENTRAL UNIVERSITY, GOVERNMENT OF INDIA)

**B.TECH (MARINE ENGINEERING)**

DECEMBER2014/JANUARY END SEMSTER EXAMINATION

II SEMESTER

**ENGINEERING MECHANICS – II (T 2206 / T 1206)**

Time: 03.00 Hrs

Date:16-12-2014

Max. Marks: 100

Pass Marks: 50

**Part - A ($3\times10=30$ Marks)**

**Compulsory Questions**

1.

a) Define Limiting Friction and Cone of friction?

b) Explain the phenomenon of "Creep" in a belt drive.

c) A body is moving with SHM has an amplitude of 1.2m and a periodic time of 3 s. Calculate the velocity and acceleration when the body is displaced 0.6 m from its mid position

d) Define the terms: Effort and Power of a Governor..

e) Define the law of Isochronisms as applied to simple pendulum

f) Distinguish between Fly wheel and Governor

g) A body of weight 100N is placed on a rough horizontal plane. Determine the coefficient of friction when a horizontal pull of 20 N is applied on the body

h) Explain "Initial Tension" in a belt drive.

i) State the effect on velocity ratio of belt drive to "Slip".

j) State the useful and harmful effects of friction.

**Part - B ($5\times14=70$ Marks)**

**Answer Any Five of the following**

2. a) Show that the minimum periodic time of a compound pendulum is

$T_{p(min)} = 2\pi\sqrt{(k_G/l)}$ [Where $k_G$ is the radius of gyration about the centre of gravity]

b) What is the length of the simple pendulum which gives the same frequency as compound pendulum.

[10+ 4=14]

3. In a screw Jack has a thread of 36mm mean diameter and a pitch of 6 mm. It is of V form with an inclined angle of $55^0$ and the coefficient of friction is 0.15. If the jack supports a load of 8 kN, find the torque required to (a) raise the load and (b) lower the load

[14]

4. An open belt connects two flat pulleys. The smaller pulley is 0.25 m in diameter and runs at 200 rpm. The angle of Lap on the pulley is $160^0$ and the coefficient of friction between belt and pulley is 0.25. The belt is on the point of slipping when 10 kW is being applied. Which of the following alternatives would be more effective in increasing the power which could be transmitted?
   (a) increasing initial tension in the belt by 10% ?
   (b) increasing coefficient of friction by 10% by application of suitable dressing ?[14 marks]

5. A vertical shaft 150 mm in diameter rotating at 100 rpm rests on a flat pivot bearing. The shaft carries a load of 20 kN, the coefficient of friction is 0.05. Estimate the power lost in friction (a). assuming uniform pressure (b) assuming uniform wear. [14 marks]

6. The arms of a Porter governor has equal arms are each 250 mm long and pivoted on the governor axis. Each ball has a mass of 6 kg and the mass of central load on the sleeve is 18 kg. The radius of rotation of the ball is 150mm when the governor begins to lift and 200mm when the governor is at maximum speed. Find the maximum and minimum speeds and also range of speed of governor. [ 14 marks]

7. (a) Prove the equation of braking torque of a band brake = $T_B = (T_1 - T_2) r_e$ [Where $T_1$ and $T_2$ are tension in tight and slack side of the band respective, $r_e$ is effective radius of drum]
   (b) What is a self locking brake?

   [10+ 4=14]

8. The thrust of a Propeller shaft in a Marine Engine is taken up by 8 collars whose external and internal diameters are 600 mm and 300 mm respectively. The total thrust from the propeller is 100 kN. If the Coefficient of friction is 0.12 and speed of the engine 90 rpm, find the power developed in friction of thrust block, assuming i). uniform pressure; and ii) uniform wear

   [ 14 marks]

9. A rope drive is required to transmit 35 kW at 160 rev/min. The grooved pulley has a mean diameter to the rope centre of 1.2 m and the groove angle is $45^0$. Taking the coefficient of friction as 0.25 and the arc of contact of the ropes as $109^0$, determine the number of ropes required if the greatest pull is limited to 700 N. [ 14 marks]

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Engineering Mechanics - II - (UG11T2206/UG11T1206)**

**Date : 20.06.2016** **Max Marks: 100**
**Time: 3 Hrs** **Pass Marks: 50**

---

**Part-A** **(3 x 10 = 30 Marks)**
**Compulsory Question**

1. a) Define D'Alembert's Principle
   b) Define torque? What is the unit of torque?
   c) What are advantages of rope drives?
   d) Define maximum and minimum equilibrium speeds.
   e) Define the law of Isochronisms as applied to simple pendulum
   f) State the useful and harmful effects of friction
   g) Define the term amplitude as applied to S.H.M.
   h) What is centrifugal tension in a belt? How does it affect the power transmitted?
   i) Distinguish between brakes and dynamometers
   j) What is functional difference between a governor and a flywheel?

**Part-B** **(14 x 5 =70 Marks)**
**Answer any Five Questions**

2) A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05.

   (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
   (ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending. (14)

3) Explain the terms and derive expression for 'effort' and 'power' of a porter governor. (14)

4) a) Show that the minimum periodic time of a compound pendulum is
   $T_{p(min)} = 2\pi\sqrt{(k_G/l)}$ [Where $k_G$ is the radius of gyration about the centre of gravity]

   b) What is the length of the simple pendulum which gives the same frequency as compound pendulum. (10+4)

5) A vertical shaft 150 mm in diameter rotating at 100 rpm rests on a flat pivot bearing. The shaft carries a load of 20 kN, the coefficient of friction is 0.05. Estimate the power lost in friction (a). assuming uniform pressure (b) assuming uniform wear. (14)

6) A simple band brake operates on a drum of 600mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of $270^0$, one end is fastened to a fixed pin and the other end to the brake arm 125mm from the fixed pin. The straight brake arm is 750mm long and placed perpendicular to the diameter that bisects the angle of contact.

(a) What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull?

(b) What width of steel band of 2.5mm thick is required for this brake if the maximum tensile stress is not to exceed 50 $N/mm^2$? (14)

7) Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2,angle of lap 160o and the maximum tension in the belt is 2.5 KN. (14)

8) A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find

(a) angular acceleration of the wheel; and

(b) no. of revolutions made by this wheel in 30 seconds. (14)

*****

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Engineering Mechanics - II - (UG11T2206/UG11T1206)**

**Date : 20.06.2016** **Max Marks: 100**
**Time: 3 Hrs** **Pass Marks: 50**

---

**Part-A** **(3 x 10 = 30 Marks)**
**Compulsory Question**

1. a) Define D'Alembert's Principle
   b) Define torque? What is the unit of torque?
   c) What are advantages of rope drives?
   d) Define maximum and minimum equilibrium speeds. of the governor
   e) Define the law of Isochronisms as applied to simple pendulum
   f) State the useful and harmful effects of friction
   g) Define the term amplitude as applied to S.H.M.
   h) What is centrifugal tension in a belt? How does it affect the power transmitted?
   i) Distinguish between brakes and dynamometers
   j) What is functional difference between a governor and a flywheel?

**Part-B** **(14 x 5 =70 Marks)**
**Answer any Five Questions**

2) A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05.

   (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
   (ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending. (14)

3) Explain the terms and derive expression for 'effort' and 'power' of a porter governor. (14)

4) a) Show that the minimum periodic time of a compound pendulum is
   $T_{p(min)} = 2\pi\sqrt{(k_G/l)}$ [Where $k_G$ is the radius of gyration about the centre of gravity]

   b) What is the length of the simple pendulum which gives the same frequency as compound pendulum. (10+4)

5) A vertical shaft 150 mm in diameter rotating at 100 rpm rests on a flat pivot bearing. The shaft carries a load of 20 kN, the coefficient of friction is 0.05. Estimate the power lost in friction (a). assuming uniform pressure (b) assuming uniform wear. (14)

6) A simple band brake operates on a drum of 600mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of $270^0$, one end is fastened to a fixed pin and the other end to the brake arm 125mm from the fixed pin. The straight brake arm is 750mm long and placed perpendicular to the diameter that bisects the angle of contact.

(a) What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull?

(b) What width of steel band of 2.5mm thick is required for this brake if the maximum tensile stress is not to exceed 50 $N/mm^2$? (14)

7) Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2,angle of lap 160o and the maximum tension in the belt is 2.5 KN. (14)

8) A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find

(a) angular acceleration of the wheel; and

(b) no. of revolutions made by this wheel in 30 seconds. (14)

*****

(a)

$$\alpha = \frac{\omega_{final} - \omega_{initial}}{\text{Time taken}}$$

$$\omega_{final} = \frac{100}{60} \times 2\pi = \frac{10}{3}\pi \text{ rad/sec}$$

$$\omega_{initial} = \frac{50}{60} \times 2\pi = \frac{5}{3}\pi \text{ rad/sec}$$

$$\alpha = \frac{\frac{10}{3}\pi - \frac{5}{3}\pi}{30} = \frac{5\pi}{90} = \frac{\pi}{18} \frac{\text{rad}}{\text{sec}^2}$$

$$\boxed{\alpha = \frac{\pi}{18} \frac{\text{rad}}{\text{sec}^2}}$$

(b)

$$\Delta\theta = \omega_i \times t + \frac{1}{2}\alpha t^2$$

$$= \frac{5}{3}\pi \times 30 + \frac{1}{2} \times \frac{\pi}{18} \times 900$$

$$= 50\pi + 25\pi$$

$$= 75\pi$$

$\therefore$ No of revolution $= \frac{\Delta\theta}{2\pi} = \frac{75\pi}{2\pi} = 37.5$ revolution

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Engineering Mechanics - II - (UG11T2206/UG11T1206)**

**Date : 20.06.2016** **Max Marks: 100**
**Time: 3 Hrs** **Pass Marks: 50**

---

**Part-A** **(3 x 10 = 30 Marks)**
**Compulsory Question**

1. a) Define D'Alembert's Principle
   b) Define torque? What is the unit of torque?
   c) What are advantages of rope drives?
   d) Define maximum and minimum equilibrium speeds.
   e) Define the law of Isochronisms as applied to simple pendulum
   f) State the useful and harmful effects of friction
   g) Define the term amplitude as applied to S.H.M.
   h) What is centrifugal tension in a belt? How does it affect the power transmitted?
   i) Distinguish between brakes and dynamometers
   j) What is functional difference between a governor and a flywheel?

**Part-B** **(14 x 5 =70 Marks)**
**Answer any Five Questions**

2) A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05.

   (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
   (ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending. (14)

3) Explain the terms and derive expression for 'effort' and 'power' of a porter governor. (14)

4) a) Show that the minimum periodic time of a compound pendulum is
   $T_{p(min)} = 2\pi\sqrt{(k_G/l)}$ [Where $k_G$ is the radius of gyration about the centre of gravity]

   b) What is the length of the simple pendulum which gives the same frequency as compound pendulum. (10+4)

5) A vertical shaft 150 mm in diameter rotating at 100 rpm rests on a flat pivot bearing. The shaft carries a load of 20 kN, the coefficient of friction is 0.05. Estimate the power lost in friction (a). assuming uniform pressure (b) assuming uniform wear. (14)

6) A simple band brake operates on a drum of 600mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of $270^0$, one end is fastened to a fixed pin and the other end to the brake arm 125mm from the fixed pin. The straight brake arm is 750mm long and placed perpendicular to the diameter that bisects the angle of contact.

(a) What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull?

(b) What width of steel band of 2.5mm thick is required for this brake if the maximum tensile stress is not to exceed 50 $N/mm^2$? (14)

7) Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2,angle of lap 160o and the maximum tension in the belt is 2.5 KN. (14)

8) A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find

(a) angular acceleration of the wheel; and

(b) no. of revolutions made by this wheel in 30 seconds. (14)

*****

**INDIAN MARITIME UNIVERSITY**
**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Engineering Mechanics - II - (UG11T2206/UG11T1206)**

**Date : 20.06.2016** **Max Marks: 100**
**Time: 3 Hrs** **Pass Marks: 50**

---

**Part-A** **(3 x 10 = 30 Marks)**
**Compulsory Question**

1. a) Define D'Alembert's Principle
 b) Define torque? What is the unit of torque?
 c) What are advantages of rope drives?
 d) Define maximum and minimum equilibrium speeds.
 e) Define the law of Isochronisms as applied to simple pendulum
 f) State the useful and harmful effects of friction
 g) Define the term amplitude as applied to S.H.M.
 h) What is centrifugal tension in a belt? How does it affect the power transmitted?
 i) Distinguish between brakes and dynamometers
 j) What is functional difference between a governor and a flywheel?

**Part-B** **(14 x 5 =70 Marks)**
**Answer any Five Questions**

2) A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05.

 (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
 (ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending. (14)

3) Explain the terms and derive expression for 'effort' and 'power' of a porter governor. (14)

4) a) Show that the minimum periodic time of a compound pendulum is
 $T_{p(min)} = 2\pi\sqrt{(k_G/l)}$ [Where $k_G$ is the radius of gyration about the centre of gravity]

 b) What is the length of the simple pendulum which gives the same frequency as compound pendulum. (10+4)

5) A vertical shaft 150 mm in diameter rotating at 100 rpm rests on a flat pivot bearing. The shaft carries a load of 20 kN, the coefficient of friction is 0.05. Estimate the power lost in friction (a). assuming uniform pressure (b) assuming uniform wear. (14)

6) A simple band brake operates on a drum of 600mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of $270^0$, one end is fastened to a fixed pin and the other end to the brake arm 125mm from the fixed pin. The straight brake arm is 750mm long and placed perpendicular to the diameter that bisects the angle of contact.

(a) What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull?

(b) What width of steel band of 2.5mm thick is required for this brake if the maximum tensile stress is not to exceed 50 $N/mm^2$? (14)

7) Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2,angle of lap 160o and the maximum tension in the belt is 2.5 KN. (14)

8) A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find

(a) angular acceleration of the wheel; and

(b) no. of revolutions made by this wheel in 30 seconds. (14)

*****

# INDIAN MARITIME UNIVERSITY
(A Central University, Govt.of India)

**May/June 2015 End Semester Examinations**

**SEMESTER – II, B.TECH ( MARINE ENGINEERING)**

**<u>MATHEMATICS II (T 2202 / T 1202)</u>**

**Date:08.06.2015** **Max.Marks:100**
**Time:-3 Hrs** **Pass Marks:50**

---

**PART – A** **(3 x10 = 30 Marks)**
**(Compulsory Questions)**

1. a) Find the Fourier coefficients $a_1$ and $b_1$ for the function
$$f(t)=\begin{cases}\sin t, 0 \le t \le \pi \\ 0, \pi \le t \le 2\pi\end{cases}$$

b) Use unit step functions to evaluate the Laplace transform of the following function: $f(t)=\begin{cases}t, 0<t<2 \\ 2, t>2\end{cases}$

c) Solve the differential equation $\frac{dy}{dx}=e^{2x-3y}+4x^2e^{-3y}$.

d) Evaluate $L^{-1}\left\{\frac{1}{2}\log\frac{s^2+b^2}{s^2+a^2}\right\}$.

e) Calculate the PI for the differential equation $(D^2-16)u=2e^{4x}$.

f) Find only the integrating factor for the non-exact equation
$$(x^2y^3-y)dx+(x^3y^2+x)dy=0.$$

g) In a Binomial distribution the mean is 4 and the variance is 8/3. Find the mode of the distribution.

h) Find the value of $k$ if $f(x)=\begin{cases}kx^2, 0<x<3 \\ 0, otherwise\end{cases}$, is a probability density function.

i) If a random variable has a Poisson distribution such that P(1)=P(2), find (i) the mean of the distribution and (ii) P(4)

j) Find the orthogonal trajectory to the family of curves $y=ax^2$.

PART – B (5 x 14 = 70 Marks)

(Answer any five of the following)

2. a) Find the half range cosine series for the function $f(t) = \begin{cases} t, 0 < t < 2 \\ 4 - t, 2 < t < 4 \end{cases}$

b) Find the Fourier series for the function $f(x) = \begin{cases} -1, -\pi < x < -\pi/2 \\ 0, -\pi/2 < x < \pi/2 \\ 1, \pi/2 < x < \pi \end{cases}$

(7+7)

3. a) Use Convolution theorem to calculate the inverse Laplace transform

$$L^{-1}\left[\frac{1}{(s+2)^2(s-2)}\right]$$

b) Solve the initial value problem $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = e^{-t}\sin t$, $x(0) = 0, x'(0) = 1$

**(6+8)**

4. a) Solve the equation $y(xy + 2x^2y^2)dx + x(xy - x^2y^2)dy = 0$

b) Find the complete solution (CS) for the differential equation

$(D^2 + 4D + 3)y(x) = e^{-x}\sin x + xe^{3x}$

**(6+8)**

5. a) Solve by the method of variation of parameters $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$

b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current $i$ amperes at time $t$ is given by $L\frac{di}{dt} + Ri = E$. Use method of integrating factor to find $i(t)$ with $E = 10\sin t$, while the initial condition is $i(t) = 0$ at $t = 0$

(7+7)

6. a) A problem in mathematics is given to three students whose chances of solving the problem are 1/2, 1/3, and 1/4. What is the probability that the problem is solved

b) There are three bags; the first containing 1 white, 2 red and 3 green balls; the second containing 2 white, 3 red and 1 green balls and the third bag containing 3 white, 1 red and 2 green balls. Two balls are drawn from a bag chosen at random. They are found to be 1 white and 1 red. Find the probability that the balls so drawn came from the second bag and the first bag.

(6+8)

# INDIAN MARITIME UNIVERSITY
(A Central University, Govt.of India)

May/June 2015 End Semester Examinations

SEMESTER – II, B.TECH ( MARINE ENGINEERING)

MATHEMATICS II (T 2202 / T 1202)

Date:08.06.2015
Time:-3 Hrs

Max.Marks:100
Pass Marks:50

---

PART – A (3 x10 = 30 Marks)
(Compulsory Questions)

1. a) Find the Fourier coefficients $a_1$ and $b_1$ for the function
$$f(t) = \begin{cases} \sin t, 0 \le t \le \pi \\ 0, \pi \le t \le 2\pi \end{cases}$$

b) Use unit step functions to evaluate the Laplace transform of the following function: $f(t) = \begin{cases} t, 0 < t < 2 \\ 2, t > 2 \end{cases}$

c) Solve the differential equation $\frac{dy}{dx} = e^{2x-3y} + 4x^2 e^{-3y}$.

d) Evaluate $L^{-1}\left\{\frac{1}{2}\log\frac{s^2+b^2}{s^2+a^2}\right\}$.

e) Calculate the PI for the differential equation $(D^2 - 16)u = 2e^{4x}$.

f) Find only the integrating factor for the non-exact equation
$$(x^2y^3 - y)dx + (x^3y^2 + x)dy = 0.$$

g) In a Binomial distribution the mean is 4 and the variance is 8/3. Find the mode of the distribution.

h) Find the value of $k$ if $f(x) = \begin{cases} kx^2, 0 < x < 3 \\ 0, otherwise \end{cases}$, is a probability density function.

i) If a random variable has a Poisson distribution such that P(1)=P(2), find (i) the mean of the distribution and (ii) P(4).

j) Find the orthogonal trajectory to the family of curves $y = ax^2$.

60

PART – B (5 x 14 = 70 Marks)

(Answer any five of the following)

2. a) Find the half range cosine series for the function $f(t) = \begin{cases} t, 0 < t < 2 \\ 4 - t, 2 < t < 4 \end{cases}$

b) Find the Fourier series for the function $f(x) = \begin{cases} -1, -\pi < x < -\pi/2 \\ 0, -\pi/2 < x < \pi/2 \\ 1, \pi/2 < x < \pi \end{cases}$

(7+7)

3. a) Use Convolution theorem to calculate the inverse Laplace transform
$$L^{-1}\left[\frac{1}{(s+2)^2(s-2)}\right]$$

b) Solve the initial value problem $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = e^{-t}\sin t$, $x(0) = 0, x'(0) = 1$

**(6+8)**

4. a) Solve the equation $y(xy + 2x^2y^2)dx + x(xy - x^2y^2)dy = 0$

b) Find the complete solution (CS) for the differential equation
$(D^2 + 4D + 3)y(x) = e^{-x}\sin x + xe^{3x}$

**(6+8)**

5. a) Solve by the method of variation of parameters $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$

b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current $i$ amperes at time $t$ is given by $L\frac{di}{dt} + Ri = E$. Use method of integrating factor to find $i(t)$ with $E = 10\sin t$, while the initial condition is $i(t) = 0$ at $t = 0$

(7+7)

6. a) A problem in mathematics is given to three students whose chances of solving the problem are 1/2, 1/3, and 1/4. What is the probability that the problem is solved

b) There are three bags; the first containing 1 white, 2 red and 3 green balls; the second containing 2 white, 3 red and 1 green balls and the third bag containing 3 white, 1 red and 2 green balls. Two balls are drawn from a bag chosen at random. They are found to be 1 white and 1 red. Find the probability that the balls so drawn came from the second bag and the first bag.

(6+8)

7. a) Show that the Poisson's distribution is a limiting case of binomial distribution When $n$ is very large and $p$ is very small in such a way that $np \to \lambda$.

b) Out of 800 families with five children each, how many families would be expected to have

i) three boys and two girls (ii) two boys and three girls

iii) at the most two girls, under the assumption that the probabilities for boys and girls are equal.

**(6+8)**

8. a) Derive the recurring relation for the moments of binomial distribution

$$\mu_{r+1} = pq\left[nr\mu_{r-1} + \frac{d\mu_r}{dp}\right]$$ where symbols have their usual meanings.

b) Use method of undetermined coefficients to solve the differential equation

$$\frac{d^2u}{dx^2} + 4u = 2\sin 2x$$

(7+7)

9. a) The Fourier series $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$ is not always convergent. Write down the conditions (Dirichlet's) of a convergent Fourier series. If $f(x)$ is discontinuous at $x = c$, what value of the function should be used at the point of discontinuity, for all practical purpose.

b) Calculate the Laplace transform of the periodic function

$$f(t) = \begin{cases} A, 0 < t < a \\ -A, a < t < 2a \end{cases}$$

where $A$ is a constant and $f(t) = f(t+2a)$.

**(6+8)**

********

# INDIAN MARITIME UNIVERSITY
(A Central University, Govt.of India)

**May/June 2015 End Semester Examinations**

**SEMESTER – II, B.TECH ( MARINE ENGINEERING)**

**MATHEMATICS II (T 2202 / T 1202)**

**Date:08.06.2015** **Max.Marks:100**
**Time:-3 Hrs** **Pass Marks:50**

---

**PART – A** **(3 x10 = 30 Marks)**
**(Compulsory Questions)**

1. a) Find the Fourier coefficients $a_1$ and $b_1$ for the function

$$f(t) = \begin{cases} \sin t, 0 \le t \le \pi \\ 0, \pi \le t \le 2\pi \end{cases}$$

b) Use unit step functions to evaluate the Laplace transform of the following function: $f(t) = \begin{cases} t, 0 < t < 2 \\ 2, t > 2 \end{cases}$

c) Solve the differential equation $\dfrac{dy}{dx} = e^{2x-3y} + 4x^2 e^{-3y}$.

d) Evaluate $L^{-1}\left\{\dfrac{1}{2}\log\dfrac{s^2+b^2}{s^2+a^2}\right\}$.

e) Calculate the PI for the differential equation $(D^2 - 16)u = 2e^{4x}$.

f) Find only the integrating factor for the non-exact equation
$$(x^2y^3 - y)dx + (x^3y^2 + x)dy = 0.$$

g) In a Binomial distribution the mean is 4 and the variance is 8/3. Find the mode of the distribution.

h) Find the value of $k$ if $f(x) = \begin{cases} kx^2, 0 < x < 3 \\ 0, otherwise \end{cases}$, is a probability density function.

i) If a random variable has a Poisson distribution such that P(1)=P(2), find (i) the mean of the distribution and (ii) P(4).

j) Find the orthogonal trajectory to the family of curves $y = ax^2$.

## PART – B

(5 x14 = 70 Marks)

(Answer any five of the following)

2. a) Find the half range cosine series for the function $f(t) = \begin{cases} t, 0 < t < 2 \\ 4 - t, 2 < t < 4 \end{cases}$

   b) Find the Fourier series for the function $f(x) = \begin{cases} -1, -\pi < x < -\pi/2 \\ 0, -\pi/2 < x < \pi/2 \\ 1, \pi/2 < x < \pi \end{cases}$

   **(7+7)**

3. a) Use Convolution theorem to calculate the inverse Laplace transform

   $$L^{-1}\left[\frac{1}{(s+2)^2(s-2)}\right]$$

   b) Solve the initial value problem $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = e^{-t}\sin t$, $x(0) = 0, x'(0) = 1$

   **(6+8)**

4. a) Solve the equation $y(xy + 2x^2y^2)dx + x(xy - x^2y^2)dy = 0$

   b) Find the complete solution (CS) for the differential equation

   $(D^2 + 4D + 3)y(x) = e^{-x}\sin x + xe^{3x}$

   **(6+8)**

5. a) Solve by the method of variation of parameters $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$

   b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current $i$ amperes at time $t$ is given by.

   $L\frac{di}{dt} + Ri = E$. Use method of integrating factor to find $i(t)$ with $E = 10\sin t$, while the initial condition is $i(t) = 0$ at $t = 0$

   (7+7)

6. a) A problem in mathematics is given to three students whose chances of solving the problem are 1/2, 1/3, and 1/4. What is the probability that the problem is solved

   b) There are three bags; the first containing 1 white, 2 red and 3 green balls; the second containing 2 white, 3 red and 1 green balls and the third bag containing 3 white, 1 red and 2 green balls. Two balls are drawn from a bag chosen at random. They are found to be 1 white and 1 red. Find the probability that the balls so drawn came from the second bag and the first bag.

   (6+8)

7. a) Show that the Poisson's distribution is a limiting case of binomial distribution When $n$ is very large and $p$ is very small in such a way that $np \to \lambda$.

b) Out of 800 families with five children each, how many families would be expected to have

i) three boys and two girls (ii) two boys and three girls

iii) at the most two girls, under the assumption that the probabilities for boys and girls are equal.

**(6+8)**

8. a) Derive the recurring relation for the moments of binomial distribution

$\mu_{r+1} = pq\left[nr\mu_{r-1} + \frac{d\mu_r}{dp}\right]$ where symbols have their usual meanings.

b) Use method of undetermined coefficients to solve the differential equation

$$\frac{d^2u}{dx^2} + 4u = 2\sin 2x$$

(7+7)

9. a) The Fourier series $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$ is not always convergent. Write down the conditions (Dirichlet's) of a convergent Fourier series. If $f(x)$ is discontinuous at $x = c$, what value of the function should be used at the point of discontinuity, for all practical purpose.

b) Calculate the Laplace transform of the periodic function

$$f(t) = \begin{cases} A, 0 < t < a \\ -A, a < t < 2a \end{cases}$$

where $A$ is a constant and $f(t) = f(t + 2a)$.

**(6+8)**

********

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Govt. of India)**

B.Tech (Marine Engineering) - Semester -III
December 2015 End Semester Examinations

**Strength of Materials - II**
Subject Code: UG11T2304/ UG11T1304

Time: 3 hrs — Max Marks: 100
Date: 18.12.2015 — Pass Marks: 50

---

**Part-A (3 x 10 = 30 Marks)**
**Compulsory Questions**

1. a) What do you mean by principal plane?
   b) What do you understand by the term 'Point of contraflexure'?
   c) A rod of diameter 30 mm and length 400 mm was found to elongate 0.35 mm when it was subjected to a load of 65 kN. Compute the modulus of elasticity of the material of this rod.
   d) List any four methods of determining slope and deflection of loaded beam.
   e) What is Claperyon's three moment theorem?
   f) State Castigliano's theorem.
   g) What are assumptions involved in the analysis of thin cylindrical shells.
   h) The actual length of a column is 10 m. Determine its effective length if both the ends of the column are rigidity fixed.
   i) Write the difference between built-in and continuous beams
   j) Define bulk modulus.

**Part-B (5 x 14 = 70 Marks)**
**Answer any five of the followings.**

2. At a point in a strained material, the principle stress are $100N/mm^2$ tensile and $40N/mm^2$ compressive. Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principle stress. What is the maximum intensity of shear force in the material at the point? (11+3=14)

3. The tensile stresses at a point across two mutually perpendicular planes are $120N/mm^2$ and $60N/mm^2$. Determine the normal, tangential and resultant stress on a plane inclined at 30° to the axis of the major stress. Use Graphical Method (Mohr's circle method) (14)

4. a) A beam AB of length, simply supported at ends A and B carries a point load at the centre. Determine maximum slope and maximum deflection by moment area method.
   b) A beam 4 meter long, simply supported at its ends, and carries a point load W at its centre. If the slope at the ends of the beam is not to exceed 1°, find the deflection at the centre of the beam. (7+7)

5. Obtain expression for the maximum bending moment and deflection of a beam of length L and flexural rigidity EI, fixed horizontally at both end ( built in) carrying a point load at centre. (14)

6. a) A cantilever beam AB of length L and carrying a uniformly distributed load. Find the expression for maximum slope and maximum deflection for the beam (any method).

   b) A cantilever of length 3 m is carrying a point load of 50 kN at a distance of 2 m from the fixed end. If $I=10^8 mm^4$ and $E=2\times10^5\ N/mm^2$, find (i) slope at the free end and (ii) deflection at the free end. (7+7 = 14)

7. Find the thickness of metal necessary for a cylinder shell of internal diameter 160 mm to withstand an internal pressure of $8\ N/mm^2$. The maximum hoop stress in the section is not to exceed $35\ N/mm^2$. (14)

8. a) Explain the limitation of Euler's formula.
   b) A solid round bar 3 m long and 5 cm in diameter is used as a strut with both ends hinged. Determine the crippling (or collapsing) load. Take $E = 2.0 \times 10^5\ N/\ mm^2$. (5+9=14)

# INDIAN MARITIME UNIVERSITY
(A Central University, Govt.of India)

May/June 2015 End Semester Examinations

SEMESTER – II, B.TECH ( MARINE ENGINEERING)

STRENGTH OF MATERIALS - I (T 2204 / T 1204)

Date:15.06.2015 | Max.Marks:100
Time:-3 Hrs | Pass Marks:50

Note : 1. Section "A" Compulsory carry (10 X 3) = 30 marks.
2. Section "B" answer any **FIVE** questions out of seven questions. All question carry equal marks (14 X 5 = 70 marks.)

## PART – A (3 x10 = 30 Marks)
**(Compulsory Questions)**

1. a) State Hook's law for elastic materials. (3)

   b) Show the symbol for Roller support and the its expected reaction due to load applied on the beam where it supports the beam (3)

   c) List all type of loads which are applicable and sketch one type of load with a simply supported beam. (3)

   d) Define Torsional section modulus and work out torsional section modulus for a solid circular shaft having a diameter "D" mm. (3)

   e) Define Poisson's ratio (μ) and state its value for metals. (3)

   f) Define proof resilience. (3)

   g) Give relation between modulus of Elasticity & modulus of rigidity. (3)

   h) Explain the term hydrostatic state of stress. Give formula or relation between volumetric strain & linear stain. (3)

   i) Define stress and mention the type of stresses. (3)

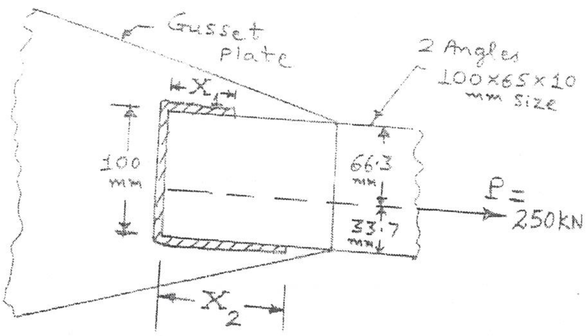
   j) Define Torsional Fleseibility and Torsional Rigidity. (3)

## PART – B (5 x14 = 70 Marks)
**(Answer any five of the following)**

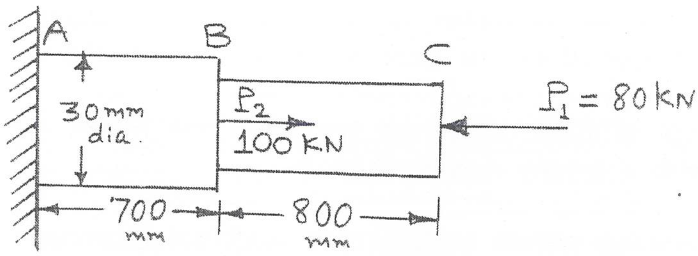
2. a) Draw stress-strain curve for mild-steel structural material and specify the important points on the curve (7)

   b) Find power transmitted by a shaft having 60 mm diameter rotating at 150 R.P.M. if maximum permissible shear stress is 80 MPa. (7)

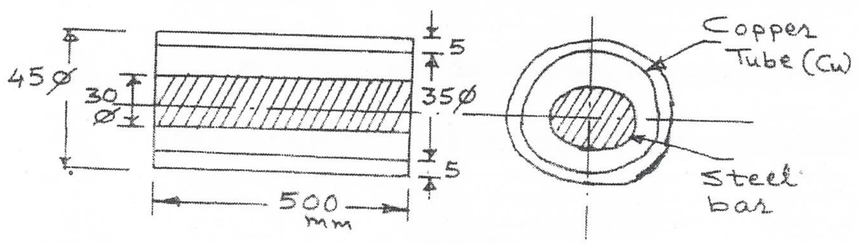
3. A tie-bar in a truss consisting of a double angle section 100 X 65mm X 10 mm thickness. It carries a tensile load of 250 KN is to be welded to a gusset plate as shown in figure. Design the joint with 8 mm fillet welds allowing a shear stress of 102.5 N/$mm^2$ in the weld. **(14)**




4. For a member ABC as shown in figure find diameter of the portion BC, if the total deformation of the member is 3 mm. Diameter of AB portion is 30 mm use modulus of electricity E = 200 Gpa **(14)**




5. A steel bar is enclosed in a copper tube and ends are welded together. The combined structure is heated and increase in temperature observed is $30^0$C calculate actual expansion of the composite bar. The temp. co-efficient for steel & copper are $\alpha$ s = 12 X $10^{-6}/^0$C and $\alpha$ cu = 16 X $10^{-6}/^0$C respectively. Modulus of Elasticity E-steel = 200 GPa and E-copper = 100 GPa. Copper tube is 45 mm outside diameter & thickness of tube is 5 mm, Length 500 mm. Steel bar diameter is 30 mm & Length 500 mm. **(14)**

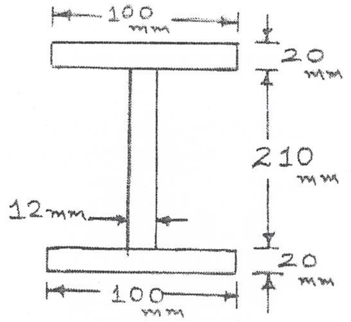



6. A hollow circular shaft has external diameter 100 mm and Internal diameter 80 mm. Find the safe power that can be transmitted if allowable shear stress is 100 MPa and maximum angle of twist is $3^0$ for 2 meter length. Take speed of shaft as 2.5 RPS and maximum torque to exceed by mean torque by 20% take G=80 GPa. **(14)**

7. a) Draw stress-strain curve for mild-steel structural material and specify the important points on the curve. (7)

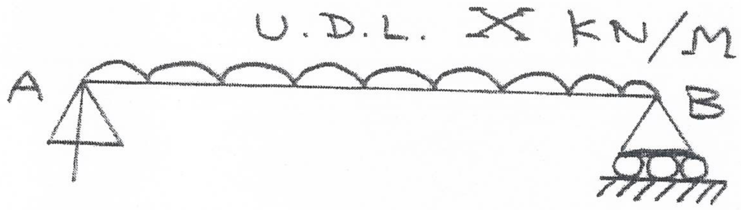
   b) Find power transmitted by a shaft having 60 mm diameter rotating at 150 R.P.M. if maximum permissible shear stress is 80 MPa. (7)

8. Find moment of resistance of the beam section 100 X 250 mm, having both flange thickness are 20 mm and web' thickness is 12 mm; for the given conditions. **(14)**




   i) Permissible stress in bending $\sigma b = 100$ Mpa
   ii) Permissible stress in bending compression and tension is 80 Mpa and 100 MPa respectively.

9. Draw a S.F.D. (sheer force diagram) and B.M.D. (bending moment diagram) for the given simply supported beam shown below and is loaded with U.D.L. of "X" KN/meter.




10. A boiler shell is to be made of 15 mm thick plate having tensile stress of 120 MN/m$^2$. If the efficiencies of the longitudinal and circumferential joints are 40% and 30% respectively. Determine : **(14)**

   i) Maximum permissible diameter of the shell for an internal pressure of 2MN / m$^2$.
   ii) Permissible intensity of internal pressure when the shell diameter is 1.5 m.

*******

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Government of India)**

B.Tech. (Marine Engineering )
Semester – II – December 2015 End Semester Examinations

Mathematics - II
Subject Code: UG11T2202/UG11T1202

Time: 3 Hours | Max Marks: 100
Date: 10.12.2015 | Pass Marks: 50

**PART –A**
**Compulsory question** **(3 x 10=30 Marks)**

1 (a) Find the Fourier coefficients $a_0$ for the function

$$f(x) = |\sin x|$$

(b) Use first shifting property to find the Laplace transform of the following function:

$$f(t) = e^{2t} \sin 3t$$

(c) Solve the separable equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$.

(d) Find inverse Laplace transform of $\frac{2s-3}{s^2+4s+13}$.

(e) Calculate the complimentary function for the differential equation

$$(D^2 - 7D + 12)u(x) = 0.$$

(f) Derive the conditions for the equation $Mdx + Ndy = 0$ to be exact.

(g) Let A and B are two mutually exclusive events of an experiment. If $P(\bar{A}) = 0.65$, $P(AUB) = 0.65$ and $P(B) = p$, find $p$.

(h) A random variable x has the following probability function

| x: | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| P(x): | 0.1 | k | 0.2 | 2k | 0.3 | k |

Find the value of k and calculate the mean.

(i) If a random variable has a Poisson distribution such that P(1)=P(2), find (i) the mean of the distribution.

(j) Write down the Pearson's constants $\beta_1, \beta_2, \gamma_1, \gamma_2$ for Binomial distribution in terms of $n, p, q$.

**PART – B**
**Answer any five questions** **(5 x 14=70 Marks)**

2 (a) Expand the Fourier series for the following function

$$f(t) = \begin{cases} 0, -\pi \le t < 0 \\ 1, 0 < t \le \pi \end{cases}.$$

(b) Find the Fourier series for the function $f(x) = e^{-x}, 0 < x < 2\pi$ (7+7 Marks)

3 (a) Use Laplace transform to evaluate the integral $\int_0^\infty e^{-3t} t \sin t dt$

(b) Solve the initial value problem $\frac{d^2x}{dt^2} - 6\frac{dx}{dt} + 9x = t^2 e^{-3t}$, $x(0) = 2, x'(0) = 6$

( 6+8 Marks)

4 (a) Solve the differential equation $(x^4 + y^4)dx - xy^3 dy = 0$

(b) Find the complete solution (CS) for the differential equation

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = x^2 e^{3x}$$

( 6+8 Marks)

5 (a) Solve by the method of variation of parameters

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$$

(b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current $i$ amperes at time $t$ is given by $L\frac{di}{dt} + Ri = E$. Use method of integrating factor to find $i(t)$ with $E = 10\sin t$, while the initial condition is $i(t) = 0$ at $t = 0$. (8+6 Marks)

6 (a) A married couple appeared for interview for two vacancies. The probability of husband's selection is 1/6 and that of wife's selection is 2/5. What is the probability that (i) both of them be selected (ii) only one of them selected (iii) none of them will be selected.

(b) An item is manufactured by three factories A, B, and C. The number of such items produces by the three factories are 2x, x, and x respectively. It is known that 2% of the items produced by A and B are defective while 4% of the items produced by C are defective. All these units are put together in one stockpile and one unit is chosen at random from this stockpile. It is found that the item is defective. Calculate the probabilities of this defective unit came from A, B, or C. (6+8 Marks)

7 (a) Obtain the moment generating function for

$$f(x) = \begin{cases} x, 0 \le x < 1 \\ 2 - x, 1 \le x < 2 \\ 0, otherwise \end{cases}$$

(b) The probability that a bomb dropped from a fighter jet will strike the target is 1/5. If six bombs are dropped, find the probability that (i) exactly two will strike the target and (ii) at least two will strike the target. (7+7 Marks)

8 (a) The probability density $p(x)$ of a continuous random variable is given by $p(x) = y_o e^{-|x|}, -\infty < x < \infty$. Find $y_0$, mean and the variance of the distribution.

(b) The mortality rate for a certain disease is 6 per 1000. What is the probability for just four deaths from that disease in a group of 400 ? (7+7 Marks)

*****

# INDIAN MARITIME UNIVERSITY
## (A Central University, Govt.of India)

**May/June 2015 End Semester Examinations**

**SEMESTER – II, B.TECH ( MARINE ENGINEERING)**

**MATHEMATICS II (T 2202 / T 1202)**

**Date:08.06.2015**
**Time:-3 Hrs**

**Max.Marks:100**
**Pass Marks:50**

---

**PART – A** **(3 x10 = 30 Marks)**
**(Compulsory Questions)**

1. a) Find the Fourier coefficients $a_1$ and $b_1$ for the function

$$f(t) = \begin{cases} \sin t, 0 \le t \le \pi \\ 0, \pi \le t \le 2\pi \end{cases}$$

b) Use unit step functions to evaluate the Laplace transform of the following function: $f(t) = \begin{cases} t, 0 < t < 2 \\ 2, t > 2 \end{cases}$

c) Solve the differential equation $\frac{dy}{dx} = e^{2x-3y} + 4x^2 e^{-3y}$.

d) Evaluate $L^{-1}\left\{\frac{1}{2}\log\frac{s^2+b^2}{s^2+a^2}\right\}$.

e) Calculate the PI for the differential equation $(D^2 - 16)u = 2e^{4x}$.

f) Find only the integrating factor for the non-exact equation

$$(x^2y^3 - y)dx + (x^3y^2 + x)dy = 0.$$

g) In a Binomial distribution the mean is 4 and the variance is 8/3. Find the mode of the distribution.

h) Find the value of $k$ if $f(x) = \begin{cases} kx^2, 0 < x < 3 \\ 0, otherwise \end{cases}$, is a probability density function.

i) If a random variable has a Poisson distribution such that P(1)=P(2), find (i) the mean of the distribution and (ii) P(4).

j) Find the orthogonal trajectory to the family of curves $y = ax^2$.

## PART – B

**(5 x14 = 70 Marks)**

(Answer any five of the following)

2. a) Find the half range cosine series for the function $f(t)=\begin{cases} t, 0<t<2 \\ 4-t, 2<t<4 \end{cases}$

   b) Find the Fourier series for the function $f(x)=\begin{cases} -1, -\pi<x<-\pi/2 \\ 0, -\pi/2<x<\pi/2 \\ 1, \pi/2<x<\pi \end{cases}$

(7+7)

3. a) Use Convolution theorem to calculate the inverse Laplace transform

   $$L^{-1}\left[\frac{1}{(s+2)^2(s-2)}\right]$$

   b) Solve the initial value problem $\frac{d^2x}{dt^2}+2\frac{dx}{dt}+5x=e^{-t}\sin t$, $x(0)=0, x'(0)=1$

**(6+8)**

4. a) Solve the equation $y(xy+2x^2y^2)dx+x(xy-x^2y^2)dy=0$

   b) Find the complete solution (CS) for the differential equation
   $(D^2+4D+3)y(x)=e^{-x}\sin x+xe^{3x}$

**(6+8)**

5. a) Solve by the method of variation of parameters $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=\frac{e^{3x}}{x^2}$

   b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current $i$ amperes at time $t$ is given by $L\frac{di}{dt}+Ri=E$. Use method of integrating factor to find $i(t)$ with $E=10\sin t$, while the initial condition is $i(t)=0$ at $t=0$

(7+7)

6. a) A problem in mathematics is given to three students whose chances of solving the problem are 1/2, 1/3, and 1/4. What is the probability that the problem is solved

   b) There are three bags; the first containing 1 white, 2 red and 3 green balls; the second containing 2 white, 3 red and 1 green balls and the third bag containing 3 white, 1 red and 2 green balls. Two balls are drawn from a bag chosen at random. They are found to be 1 white and 1 red. Find the probability that the balls so drawn came from the second bag and the first bag.

(6+8)

7. a) Show that the Poisson's distribution is a limiting case of binomial distribution When $n$ is very large and $p$ is very small in such a way that $np \to \lambda$.

b) Out of 800 families with five children each, how many families would be expected to have

i) three boys and two girls (ii) two boys and three girls

iii) at the most two girls, under the assumption that the probabilities for boys and girls are equal.

**(6+8)**

8. a) Derive the recurring relation for the moments of binomial distribution

$$\mu_{r+1} = pq\left[nr\mu_{r-1} + \frac{d\mu_r}{dp}\right]$$ where symbols have their usual meanings.

b) Use method of undetermined coefficients to solve the differential equation

$$\frac{d^2u}{dx^2} + 4u = 2\sin 2x$$

(7+7)

9. a) The Fourier series $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$ is not always convergent. Write down the conditions (Dirichlet's) of a convergent Fourier series. If $f(x)$ is discontinuous at $x = c$, what value of the function should be used at the point of discontinuity, for all practical purpose.

b) Calculate the Laplace transform of the periodic function

$$f(t) = \begin{cases} A, 0 < t < a \\ -A, a < t < 2a \end{cases}$$

where $A$ is a constant and $f(t) = f(t + 2a)$.

**(6+8)**

********

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Government of India)**

B.Tech. (Marine Engineering )
Semester – II – December 2015 End Semester Examinations

Mathematics - II
Subject Code: UG11T2202/UG11T1202

Time: 3 Hours | Max Marks: 100
Date: 10.12.2015 | Pass Marks: 50

## PART –A

**Compulsory question** **(3 x 10=30 Marks)**

1 (a) Find the Fourier coefficients $a_0$ for the function

$$f(x) = |\sin x|$$

(b) Use first shifting property to find the Laplace transform of the following function:

$$f(t) = e^{2t} \sin 3t$$

(c) Solve the separable equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$.

(d) Find inverse Laplace transform of $\frac{2s-3}{s^2+4s+13}$.

(e) Calculate the complimentary function for the differential equation

$$(D^2 - 7D + 12)u(x) = 0.$$

(f) Derive the conditions for the equation $Mdx + Ndy = 0$ to be exact.

(g) Let A and B are two mutually exclusive events of an experiment. If $P(\overline{A}) = 0.65$, $P(AUB) = 0.65$ and $P(B) = p$, find $p$.

(h) A random variable x has the following probability function

| | | | | | | |
|---|---|---|---|---|---|---|
| x: | -2 | -1 | 0 | 1 | 2 | 3 |
| P(x): | 0.1 | k | 0.2 | 2k | 0.3 | k |

Find the value of k and calculate the mean.

(i) If a random variable has a Poisson distribution such that P(1)=P(2), find (i) the mean of the distribution.

(j) Write down the Pearson's constants $\beta_1, \beta_2, \gamma_1, \gamma_2$ for Binomial distribution in terms of $n, p, q$.

## PART – B

**Answer any five questions** **(5 x 14=70 Marks)**

2 (a) Expand the Fourier series for the following function

$$f(t) = \begin{cases} 0, -\pi \le t < 0 \\ 1, 0 < t \le \pi \end{cases}.$$

(b) Find the Fourier series for the function $f(x) = e^{-x}, 0 < x < 2\pi$ (7+7 Marks)

3 (a) Use Laplace transform to evaluate the integral $\int_0^{\infty} e^{-3t} t \sin t dt$

(b) Solve the initial value problem $\frac{d^2x}{dt^2} - 6\frac{dx}{dt} + 9x = t^2 e^{-3t}$, $x(0) = 2, x'(0) = 6$

( 6+8 Marks)

4 (a) Solve the differential equation $(x^4 + y^4)dx - xy^3 dy = 0$

(b) Find the complete solution (CS) for the differential equation

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = x^2 e^{3x}$$

( 6+8 Marks)

5 (a) Solve by the method of variation of parameters

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$$

(b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current $i$ amperes at time $t$ is given by $L\frac{di}{dt} + Ri = E$. Use method of integrating factor to find $i(t)$ with $E = 10\sin t$, while the initial condition is $i(t) = 0$ at $t = 0$.

(8+6 Marks)

6 (a) A married couple appeared for interview for two vacencies. The probability of husband's selection is 1/6 and that of wife's selection is 2/5. What is the probability that (i) both of them be selected (ii) only one of them selected (iii) none of them will be selected.

(b) An item is manufactured by three factories A, B, and C. The number of such items produces by the three factories are 2x, x, and x respectively. It is known that 2% of the items produced by A and B are defective while 4% of the items produced by C are defective. All these units are put together in one stockpile and one unit is chosen at random from this stockpile. It is found that the item is defective. Calculate the probabilities of this defective unit came from A, B, or C.

(6+8 Marks)

7 (a) Obtain the moment generating function for

$$f(x) = \begin{cases} x, 0 \le x < 1 \\ 2 - x, 1 \le x < 2 \\ 0, otherwise \end{cases}$$

(b) The probability that a bomb dropped from a fighter jet will strike the target is 1/5. If six bombs are dropped, find the probability that (i) exactly two will strike the target and (ii) at least two will strike the target.

(7+7 Marks)

8 (a) The probability density $p(x)$ of a continuous random variable is given by $p(x) = y_o e^{-|x|}, -\infty < x < \infty$. Find $y_0$, mean and the variance of the distribution.

(b) The mortality rate for a certain disease is 6 per 1000. What is the probability for just four deaths from that disease in a group of 400 ?

(7+7 Marks)

*****

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Govt. of India)**

B.Tech. (Marine Engineering)
December 2015 End Semester Examinations – Semester - I

**Workshop Technology**
Subject Code: UG11T2106/UG11T1106

Time: 3 hrs — Max Marks: 100
Date: 29.12.2015 — Pass Marks: 50

---

**PART- A** **(10 x 3 = 30 Marks )**
**(Compulsory Question )**

1. (a) Draw and name different type of files used at Work Shop.
   (b) Draw a vernier scale and level the parts.
   (c) What is the function of soft hammer at the Work Shop. What is ball pin hammer?
   (d) With respect to machine process define the term 'cutting speed' and ' feed'.
   (e) What is the basic purpose of cutting fluid used in the machine process?
   (f) What all checks to be carried out before starting a lathe machine?
   (g) Describe different type of packing and joints used for pipe fitting purpose.
   (h) Write short note on PPE.
   (i) Briefly describe the safety precaution to be taken during grinding operation with fixed grinder fitted at Work Shop.
   (j) Explain the term weldability. What all factor it depends upon?

**PART-B** **(5 x 14 = 70 Marks)**
**( Answer any FIVE of the following )**

2. (a) Draw an external calliper and try square and mention their use.
   (b) Draw a neat sketch of twist drill and mention the different angle. (7+7)

3. (a) Sketch and describe a Glob valve ? Mention the materials of different parts.
   (b) Briefly state the operational principal of reducing valve. (9+5)

4. (a) Discuss the " principle of metal cutting".
   (b) What is the advantage of larger positive rake angle respect to single point cutting tool.
   (c) A bar of diameter 110 mm and length (L) 800mm has to be machined to reduce its diameter to 101mm while keeping the length same. It takes 5 minute to load and unload the work piece. Maximum depth of cut(t) that can be taken care of on this machine is 2mm. Roughing feed(fr) is 0.5mm per revolution and finishing feed(ff)is 0.2mm per revolution. Maximum cutting speed ''V" allowed 40 meter per minute. Calculate the total time required. (4+3+7)

5. (a) With respect to lathe machine differentiate between four jaw independent chuck and self cantering chuck.
   (b) Briefly describe the straight turning and taper turning process by a common work shop lathe. Mention the rough turning and finish turning. (4+10)

6. (a) Write short note on (i) Honning and (ii) lapping .
   (b) What is the function of feeler gauge used at the Work Shop.
   (c) What is the advantage of jig and fixture. (7+3+4)

7. (a) Point out the potential sources of dangers present at work shop. How they encountered.
   (b) What is risk assessment?
   (c) Briefly discuss the important provision of the Factory Act 1948. When das it entered into force? (6+2+6)

8. (a) With respect to oxy-acetylene gas welding describe different type of flame used . Mention the practical use of each flame.
   (b) Briefly discuss the oxy-acetylene gas welding process.
   (c) Why storing of acetylene gas is difficult? How it can be stored in high press condition. (4+6+4)

9. (a) What are the different electrode used for the metal arc welding? Discuss each type.
   (b) Briefly describe the TIG welding process
   (c) What is the methodology of soldering joints? How bonding is formed? (4 +6 +4)

*****

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Govt. of India)**

B.Tech (Marine Engineering) - Semester II
December 2015 End Semester Examinations

**Strength of Materials - I**
Subject Code: UG11T2204/ UG11T1204

Time: 3 hrs — Max Marks: 100
Date: 17.12.2015 — Pass Marks: 50

---

## Part-A (3x10=30 Marks)

**Compulsory Questions**

1. a) State the principle of superposition.
   b) Define the term modulus of resilience.
   c) State Hooke's Law clearly.
   d) What is statistically indeterminate structure? Explain with diagram.
   e) Write down the relation between Young's modulus, Bulk modulus and Poisson's ratio.
   f) Define Poisson's ratio. What is the range of the value of Poisson's ratio?
   g)What do you understand by the term, 'point of contraflexure'?
   h) Define Neutral axis in a beam.
   i) Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.
   j) Define "Shear Stress".

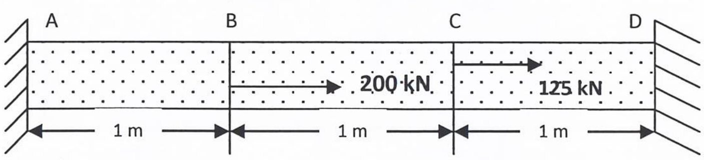
## Part-B (5x14=70Marks)

**Answer any five of the followings.**

2. a) Define modulus of elasticity.
   b) Find the expression of deformation of a body to self weight.

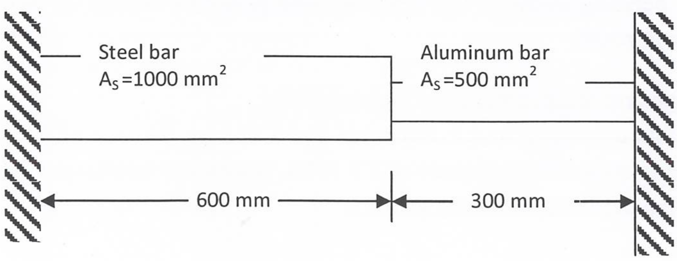
   c) A load 0f 5kN is to be raised with the help of a steel wire. Find the minimum diameter of the steel wire, if the stress is not to exceed 100 MPa. (2+6+6 = 14)

3. An aluminum bar 3m long and 2500 $mm^2$ in cross-section is rigidly fixed at A and D as shown in Figure.




   Determine the loads sheared and stresses in each portion and the distances through which the points B and C will move. Take E for aluminum as 80 GPa. (14)

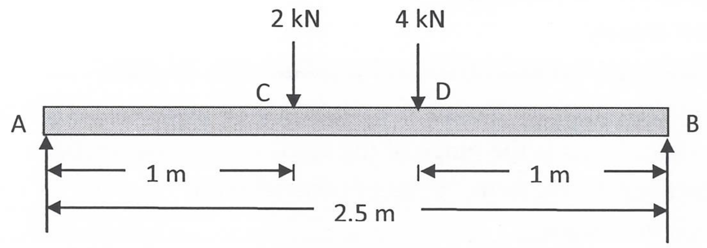
4. A composite bar made up of aluminum and steel, is held between two supports as shown



The bars are stress free at a temperature of 38° C. What will be the stress in the two bars, when the temperature is 21°C, if (a) the supports are unyielding; (b) the supports come nearer to each other by 0.1 mm? (Assume the change of temperature is uniform all along the length of bar)
Take E for steel as 200 GPa; E for aluminum as 75 GPa and coefficient of expansion for steel as $11.7 \times 10^{-6}$ per °C and coefficient of expansion for aluminum as $23.4 \times 10^{-6}$ per °C. (14)

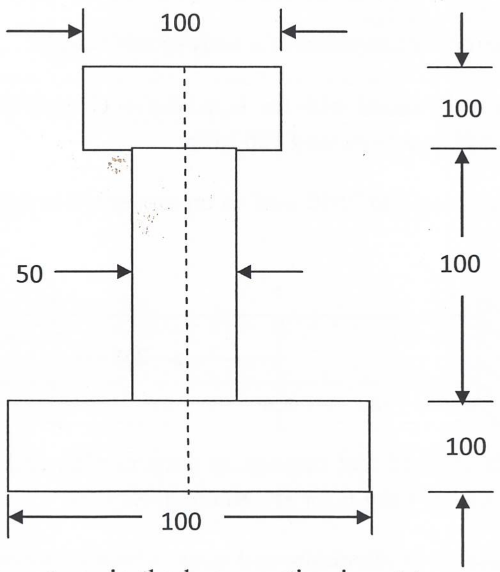
5. a) Deduce the relation between Modulus of Elasticity and Modulus of Rigidity.
b) A solid steel shaft has to transmit 100 kW at 600 r.p.m. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20 %. (7+7=14)

6. a)Draw the S.D.F (shear force diagram) and B.M.D (bending moment diagram) for a cantiliver beam with uniformly distributed load.
b) A simply supported beam AB of span 2.5 m is carrying two point loads as shown in the figure below.




Draw the shear force and bending moment diagram for the beam. (7+7=14)

7. a) Prove that $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ (all the expressions are as per convention)
b) Figure shows a rolled steel beam of an unsymmetrical I-section.




If the maximum bending stress in the beam section is not to exceed 40 MPa, find the moment, which the beam can resist. (7+7=14)

8. a) Write advantage and disadvantages of welded joints.
b) A cylindrical thin drum 800 mm in diameter and 4 m long is made of 10 mm thick plate. If the drum is subjected to an internal pressure of 2.5 MPa, determine its changes in diameter and length. Take E as 200 GPa and Poisson's ratio as 0.25. (7+7=14)

# INDIAN MARITIME UNIVERSITY
(A Central University, Govt.of India)

May/June 2015 End Semester Examinations

SEMESTER – II, B.TECH ( MARINE ENGINEERING)

STRENGTH OF MATERIALS - I (T 2204 / T 1204)

Date:15.06.2015 | Max.Marks:100
Time:-3 Hrs | Pass Marks:50

Note : 1. Section "A" Compulsory carry (10 X 3) = 30 marks.
2. Section "B" answer any FIVE questions out of seven questions. All question carry equal marks (14 X 5 = 70 marks.)

**PART – A** (3 x10 = 30 Marks)
**(Compulsory Questions)**

1. a) State Hook's law for elastic materials. (3)

b) Show the symbol for Roller support and the its expected reaction due to load applied on the beam where it supports the beam (3)

c) List all type of loads which are applicable and sketch one type of load with a simply supported beam. (3)

d) Define Torsional section modulus and work out torsional section modulus for a solid circular shaft having a diameter "D" mm. (3)

e) Define Poisson's ratio ($\mu$) and state its value for metals. (3)

f) Define proof resilience. (3)

g) Give relation between modulus of Elasticity & modulus of rigidity. (3)

h) Explain the term hydrostatic state of stress. Give formula or relation between volumetric strain & linear stain. (3)

i) Define stress and mention the type of stresses. (3)

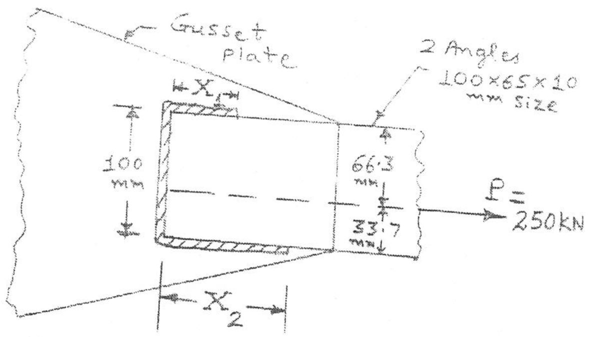
j) Define Torsional Fleseibility and Torsional Rigidity. (3)

**PART – B** (5 x14 = 70 Marks)
**(Answer any five of the following)**

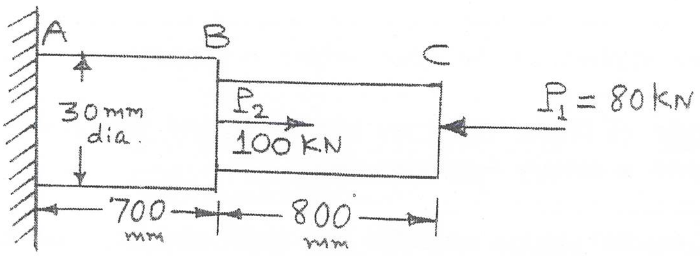
2. a) Draw stress-strain curve for mild-steel structural material and specify the important points on the curve (7)

b) Find power transmitted by a shaft having 60 mm diameter rotating at 150 R.P.M. if maximum permissible shear stress is 80 MPa. (7)

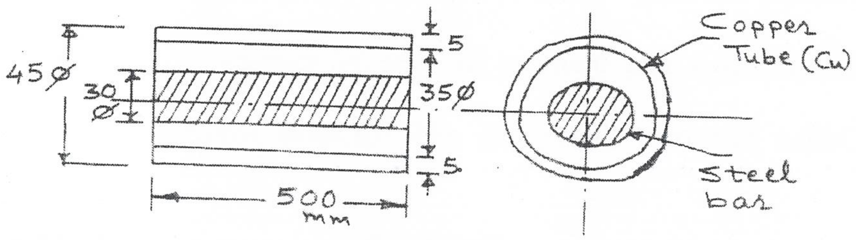
3. A tie-bar in a truss consisting of a double angle section 100 X 65mm X 10 mm thickness. It carries a tensile load of 250 KN is to be welded to a gusset plate as shown in figure. Design the joint with 8 mm fillet welds allowing a shear stress of 102.5 N/mm$^2$ in the weld. **(14)**




4. For a member ABC as shown in figure find diameter of the portion BC, if the total deformation of the member is 3 mm. Diameter of AB portion is 30 mm use modulus of electricity E = 200 Gpa **(14)**




5. A steel bar is enclosed in a copper tube and ends are welded together. The combined structure is heated and increase in temperature observed is 30$^0$C calculate actual expansion of the composite bar. The temp. co-efficient for steel & copper are $\alpha$ s = 12 X 10$^{-6}$/$^0$C and $\alpha$ cu = 16 X 10$^{-6}$/$^0$C respectively. Modulus of Elasticity E-steel = 200 GPa and E-copper = 100 GPa. Copper tube is 45 mm outside diameter & thickness of tube is 5 mm, Length 500 mm. Steel bar diameter is 30 mm & Length 500 mm. **(14)**

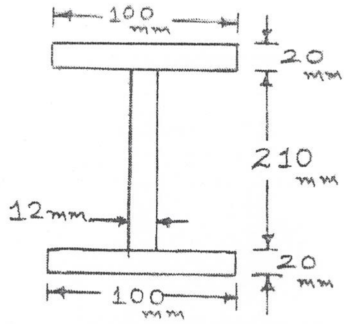



6. A hollow circular shaft has external diameter 100 mm and Internal diameter 80 mm. Find the safe power that can be transmitted if allowable shear stress is 100 MPa and maximum angle of twist is 3$^0$ for 2 meter length. Take speed of shaft as 2.5 RPS and maximum torque to exceed by mean torque by 20% take G=80 GPa. **(14)**

7. a) Draw stress-strain curve for mild-steel structural material and specify the important points on the curve. (7)

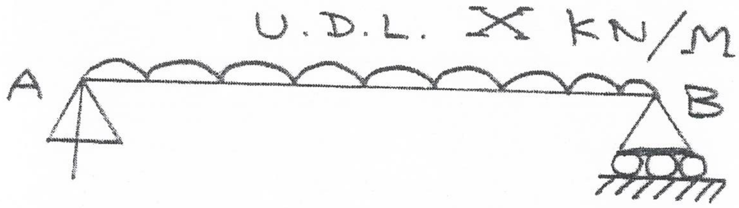
   b) Find power transmitted by a shaft having 60 mm diameter rotating at 150 R.P.M. if maximum permissible shear stress is 80 MPa. (7)

8. Find moment of resistance of the beam section 100 X 250 mm, having both flange thickness are 20 mm and web' thickness is 12 mm; for the given conditions. **(14)**




   i) Permissible stress in bending $\sigma b =$ 100 Mpa
   ii) Permissible stress in bending compression and tension is 80 Mpa and 100 MPa respectively.

9. Draw a S.F.D. (sheer force diagram) and B.M.D. (bending moment diagram) for the given simply supported beam shown below and is loaded with U.D.L. of "X" KN/meter.




10. A boiler shell is to be made of 15 mm thick plate having tensile stress of 120 MN/m$^2$. If the efficiencies of the longitudinal and circumferential joints are 40% and 30% respectively. Determine : **(14)**

   i) Maximum permissible diameter of the shell for an internal pressure of 2MN / m$^2$.
   ii) Permissible intensity of internal pressure when the shell diameter is 1.5 m.

*******

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Govt. of India)**

B.Tech (Marine Engineering) - Semester II
December 2015 End Semester Examinations

**Strength of Materials - I**
Subject Code: UG11T2204/ UG11T1204

Time: 3 hrs — Max Marks: 100
Date: 17.12.2015 — Pass Marks: 50

## Part-A (3x10=30 Marks)

**Compulsory Questions**

1. a) State the principle of superposition.
   b) Define the term modulus of resilience.
   c) State Hooke's Law clearly.
   d) What is statistically indeterminate structure? Explain with diagram.
   e) Write down the relation between Young's modulus, Bulk modulus and Poisson's ratio.
   f) Define Poisson's ratio. What is the range of the value of Poisson's ratio?
   g)What do you understand by the term, 'point of contraflexure'?
   h) Define Neutral axis in a beam.
   i) Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.
   j) Define "Shear Stress".

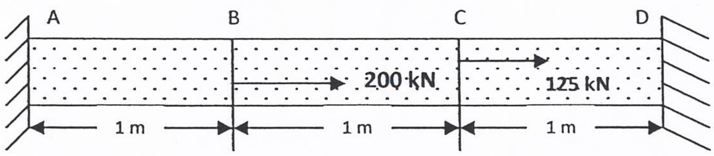
## Part-B (5x14=70Marks)

**Answer any five of the followings.**

2. a) Define modulus of elasticity.
   b) Find the expression of deformation of a body to self weight.

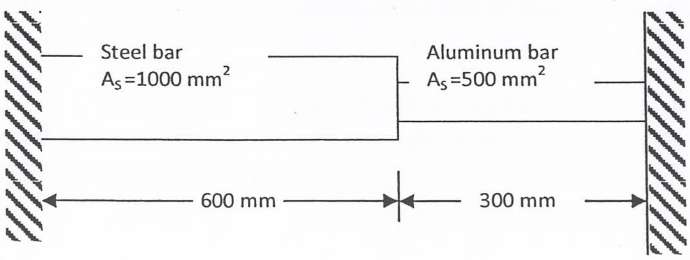
   c) A load 0f 5kN is to be raised with the help of a steel wire. Find the minimum diameter of the steel wire, if the stress is not to exceed 100 MPa. (2+6+6 = 14)

3. An aluminum bar 3m long and 2500 $mm^2$ in cross-section is rigidly fixed at A and D as shown in Figure.




Determine the loads sheared and stresses in each portion and the distances through which the points B and C will move. Take E for aluminum as 80 GPa. (14)

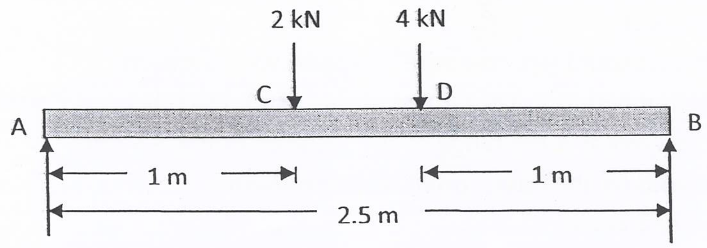
4. A composite bar made up of aluminum and steel, is held between two supports as shown



The bars are stress free at a temperature of 38° C. What will be the stress in the two bars, when the temperature is 21°C, if (a) the supports are unyielding; (b) the supports come nearer to each other by 0.1 mm? (Assume the change of temperature is uniform all along the length of bar)
Take E for steel as 200 GPa; E for aluminum as 75 GPa and coefficient of expansion for steel as $11.7 \times 10^{-6}$ per °C and coefficient of expansion for aluminum as $23.4 \times 10^{-6}$ per °C. (14)

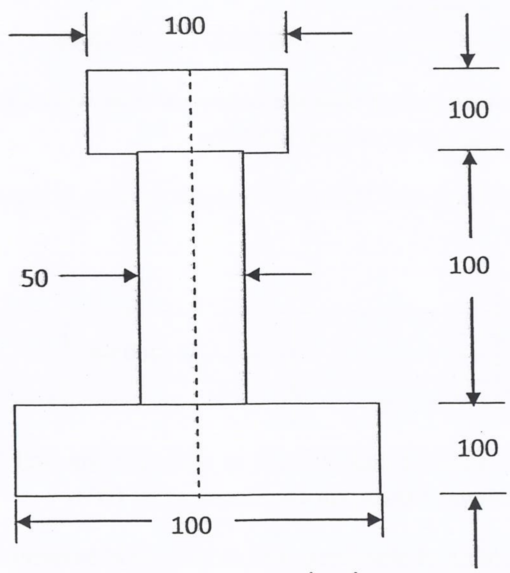
5. a) Deduce the relation between Modulus of Elasticity and Modulus of Rigidity.
b) A solid steel shaft has to transmit 100 kW at 600 r.p.m. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20 %. (7+7=14)

6. a)Draw the S.D.F (shear force diagram) and B.M.D (bending moment diagram) for a cantiliver beam with uniformly distributed load.
b) A simply supported beam AB of span 2.5 m is carrying two point loads as shown in the figure below.




Draw the shear force and bending moment diagram for the beam. (7+7=14)

7. a) Prove that $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ (all the expressions are as per convention)
b) Figure shows a rolled steel beam of an unsymmetrical I-section.




If the maximum bending stress in the beam section is not to exceed 40 MPa, find the moment, which the beam can resist. (7+7=14)

8. a) Write advantage and disadvantages of welded joints.
b) A cylindrical thin drum 800 mm in diameter and 4 m long is made of 10 mm thick plate. If the drum is subjected to an internal pressure of 2.5 MPa, determine its changes in diameter and length. Take E as 200 GPa and Poisson's ratio as 0.25. (7+7=14)

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Govt. of India)**

**B.Tech (Marine Engineering) - Semester II**
December 2015 End Semester Examinations

**Engineering Mechanics - II**
Subject Code:UG11T2206/UG11T1206

Time : 0300 Hrs — Max Marks-100
Date : 26.12.2015 — Pass Marks-50

---

**Part-A (10x3=30 Marks)**

**Compulsory Questions**

1)
   a) Write the laws of dynamic friction.
   b) Write about the term helix angle in screw friction.
   c) Define 'D'Alembert's principle.
   d) What do you understand by the term angular velocity, angular acceleration and angular displacement?
   e) Write the conditions required for a body to move or vibrate, with simple harmonic motion.
   f) A mass supported by a spring has a static deflection of 0.5 mm. Determine its natural frequency of oscillation.
   g) What is centrifugal tension in a belt? How does it affect the power transmitted.
   h) The following data were recorded in a laboratory experiment with rope brake :
   Diameter of flywheel = 1.2 m; diameter of rope = 12.5 mm; engine speed = 200 r.p.m.; dead load on brake = 600 N, and spring balance reading 150 N. Calculate the brake power of the engine.
   i) Calculate the vertical height of a Watt governor when it rotates at 60 r.p.m. Also find the change in vertical height when its speed increases to 61 r.p.m.
   j) Define and explain the following terms relating to governors :
   1. Stability 2. Sensitiveness 3. Hunting.

**Part-B (5x14=70Marks)**

**Answer any five of the followings.**

2) A conical friction clutch is used to transmit 90 kW at 1500 r.p.m. The semi-cone angle is 20° and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is375 mm and the intensity of normal pressure is not to exceed 0.25 $N/mm^2$, find the dimensions of the conical bearing surface and the axial load required. (14)

3) Explain with neat diagram the motion of a rolling wheel without slipping. (14)

4) A thrust shaft of a ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 kN. If the coefficient of friction is 0.12 and speed of the engine 90 r.p.m., find the power absorbed in friction at the thrust block, assuming l) uniform pressure ; and 2) Uniform wear. (14)

5)

i) A simple pendulum of amplitude 4° performs 24 oscillations in one minute. Find (a) length of the pendulum (b) maximum acceleration of the bob, (c) maximum linear velocity of the bob; and (d) maximum angular velocity of the bob. (10)

ii) A conical pendulum 1.5 m long is revolving at 30 revolutions per minute. Find the angle which the string will make with the vertical, if the bob describes a circle of 500 mm radius. (4)

6) The power is transmitted from a pulley 1 m diameter running at 200 r.p.m. to a pulley 2.25 m diameter by means of a belt. Find the speed lost by the driven pulley as a result of creep, if the stress on the tight and slack side of the belt is 1.4 MPa and 0.5 MPa respectively. The Young's modulus for the material of the belt is 100 MPa. (14)

7) Classify the absorption dynamometer and describe the construction and operation. (14)

8) A Proell governor has equal arms of length 300mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150mm and 200mm. The mass of each ball is 10kg and the mass of the central load is 100 kg. Determine the range of speed of the governor. (14)

******

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Govt. of India)**

**B.Tech (Marine Engineering) - Semester II**
December 2015 End Semester Examinations

**Engineering Mechanics - II**
Subject Code:UG11T2206/UG11T1206

Time : 0300 Hrs — Max Marks-100
Date : 26.12.2015 — Pass Marks-50

---

**Part-A (10x3=30 Marks)**
**Compulsory Questions**

1)
a) Write the laws of dynamic friction.
b) Write about the term helix angle in screw friction.
c) Define 'D'Alembert's principle.
d) What do you understand by the term angular velocity, angular acceleration and angular displacement?
e) Write the conditions required for a body to move or vibrate, with simple harmonic motion.
f) A mass supported by a spring has a static deflection of 0.5 mm. Determine its natural frequency of oscillation.
g) What is centrifugal tension in a belt? How does it affect the power transmitted.
h) The following data were recorded in a laboratory experiment with rope brake :
Diameter of flywheel = 1.2 m; diameter of rope = 12.5 mm; engine speed = 200 r.p.m.; dead load on brake = 600 N, and spring balance reading 150 N. Calculate the brake power of the engine.
i) Calculate the vertical height of a Watt governor when it rotates at 60 r.p.m. Also find the change in vertical height when its speed increases to 61 r.p.m.
j) Define and explain the following terms relating to governors :
1. Stability 2. Sensitiveness 3. Hunting.

**Part-B (5x14=70Marks)**
**Answer any five of the followings.**

2) A conical friction clutch is used to transmit 90 kW at 1500 r.p.m. The semi-cone angle is 20º and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is375 mm and the intensity of normal pressure is not to exceed 0.25 $N/mm^2$, find the dimensions of the conical bearing surface and the axial load required. (14)

3) Explain with neat diagram the motion of a rolling wheel without slipping. (14)

4) A thrust shaft of a ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 kN. If the coefficient of friction is 0.12 and speed of the engine 90 r.p.m., find the power absorbed in friction at the thrust block, assuming l) uniform pressure ; and 2) Uniform wear. (14)

5)

i) A simple pendulum of amplitude 4° performs 24 oscillations in one minute. Find (a) length of the pendulum (b) maximum acceleration of the bob, (c) maximum linear velocity of the bob; and (d) maximum angular velocity of the bob. (10)

ii) A conical pendulum 1.5 m long is revolving at 30 revolutions per minute. Find the angle which the string will make with the vertical, if the bob describes a circle of 500 mm radius. (4)

6) The power is transmitted from a pulley 1 m diameter running at 200 r.p.m. to a pulley 2.25 m diameter by means of a belt. Find the speed lost by the driven pulley as a result of creep, if the stress on the tight and slack side of the belt is 1.4 MPa and 0.5 MPa respectively. The Young's modulus for the material of the belt is 100 MPa. (14)

7) Classify the absorption dynamometer and describe the construction and operation. (14)

8) A Proell governor has equal arms of length 300mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150mm and 200mm. The mass of each ball is 10kg and the mass of the central load is 100 kg. Determine the range of speed of the governor. (14)

******

# INDIAN MARITIME UNIVERSITY
(A Central University, Govt.of India)

**May/June 2015 End Semester Examinations**

**SEMESTER – II, B.TECH ( MARINE ENGINEERING)**

**MATHEMATICS II (T 2202 / T 1202)**

**Date:08.06.2015** **Max.Marks:100**
**Time:-3 Hrs** **Pass Marks:50**

---

**PART – A** **(3 x10 = 30 Marks)**
**(Compulsory Questions)**

1. a) Find the Fourier coefficients $a_1$ and $b_1$ for the function
$$f(t) = \begin{cases} \sin t, 0 \le t \le \pi \\ 0, \pi \le t \le 2\pi \end{cases}$$

b) Use unit step functions to evaluate the Laplace transform of the following function: $f(t) = \begin{cases} t, 0 < t < 2 \\ 2, t > 2 \end{cases}$

c) Solve the differential equation $\frac{dy}{dx} = e^{2x-3y} + 4x^2 e^{-3y}$.

d) Evaluate $L^{-1}\left\{\frac{1}{2}\log\frac{s^2+b^2}{s^2+a^2}\right\}$.

e) Calculate the PI for the differential equation $(D^2 - 16)u = 2e^{4x}$.

f) Find only the integrating factor for the non-exact equation
$$(x^2y^3 - y)dx + (x^3y^2 + x)dy = 0.$$

g) In a Binomial distribution the mean is 4 and the variance is 8/3. Find the mode of the distribution.

h) Find the value of $k$ if $f(x) = \begin{cases} kx^2, 0 < x < 3 \\ 0, otherwise \end{cases}$, is a probability density function.

i) If a random variable has a Poisson distribution such that P(1)=P(2), find (i) the mean of the distribution and (ii) P(4).

j) Find the orthogonal trajectory to the family of curves $y = ax^2$

## PART – B (5 x 14 = 70 Marks)

(Answer any five of the following)

2. a) Find the half range cosine series for the function $f(t)=\begin{cases} t, 0<t<2 \\ 4-t, 2<t<4 \end{cases}$

   b) Find the Fourier series for the function $f(x)=\begin{cases} -1, -\pi<x<-\pi/2 \\ 0, -\pi/2<x<\pi/2 \\ 1, \pi/2<x<\pi \end{cases}$

   (7+7)

3. a) Use Convolution theorem to calculate the inverse Laplace transform

   $L^{-1}\left[\frac{1}{(s+2)^2(s-2)}\right]$

   b) Solve the initial value problem $\frac{d^2x}{dt^2}+2\frac{dx}{dt}+5x=e^{-t}\sin t$, $x(0)=0, x'(0)=1$

   **(6+8)**

4. a) Solve the equation $y(xy+2x^2y^2)dx+x(xy-x^2y^2)dy=0$

   b) Find the complete solution (CS) for the differential equation
   $(D^2+4D+3)y(x)=e^{-x}\sin x+xe^{3x}$

   **(6+8)**

5. a) Solve by the method of variation of parameters $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=\frac{e^{3x}}{x^2}$

   b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current $i$ amperes at time $t$ is given by $L\frac{di}{dt}+Ri=E$. Use method of integrating factor to find $i(t)$ with $E=10\sin t$, while the initial condition is $i(t)=0$ at $t=0$

   (7+7)

6. a) A problem in mathematics is given to three students whose chances of solving the problem are 1/2, 1/3, and 1/4. What is the probability that the problem is solved

   b) There are three bags; the first containing 1 white, 2 red and 3 green balls; the second containing 2 white, 3 red and 1 green balls and the third bag containing 3 white, 1 red and 2 green balls. Two balls are drawn from a bag chosen at random. They are found to be 1 white and 1 red. Find the probability that the balls so drawn came from the second bag and the first bag.

   (6+8)

7. a) Show that the Poisson's distribution is a limiting case of binomial distribution When $n$ is very large and $p$ is very small in such a way that $np \to \lambda$.

b) Out of 800 families with five children each, how many families would be expected to have

i) three boys and two girls (ii) two boys and three girls

iii) at the most two girls, under the assumption that the probabilities for boys and girls are equal.

**(6+8)**

8. a) Derive the recurring relation for the moments of binomial distribution

$$\mu_{r+1} = pq\left[nr\mu_{r-1} + \frac{d\mu_r}{dp}\right]$$ where symbols have their usual meanings.

b) Use method of undetermined coefficients to solve the differential equation

$$\frac{d^2u}{dx^2} + 4u = 2\sin 2x$$ **(7+7)**

9. a) The Fourier series $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$ is not always convergent. Write down the conditions (Dirichlet's) of a convergent Fourier series. If $f(x)$ is discontinuous at $x = c$, what value of the function should be used at the point of discontinuity, for all practical purpose.

b) Calculate the Laplace transform of the periodic function

$$f(t) = \begin{cases} A, 0 < t < a \\ -A, a < t < 2a \end{cases}$$

where $A$ is a constant and $f(t) = f(t + 2a)$. **(6+8)**

********

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Govt. of India)**

B.Tech (Marine Engineering) - Semester II
December 2015 End Semester Examinations

**Strength of Materials - I**
Subject Code: UG11T2204/ UG11T1204

Time: 3 hrs | Max Marks: 100
Date: 17.12.2015 | Pass Marks: 50

---

## Part-A (3x10=30 Marks)

**Compulsory Questions**

1. a) State the principle of superposition.
   b) Define the term modulus of resilience.
   c) State Hooke's Law clearly.
   d) What is statistically indeterminate structure? Explain with diagram.
   e) Write down the relation between Young's modulus, Bulk modulus and Poisson's ratio.
   f) Define Poisson's ratio. What is the range of the value of Poisson's ratio?
   g)What do you understand by the term, 'point of contraflexure'?
   h) Define Neutral axis in a beam.
   i) Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.
   j) Define "Shear Stress".

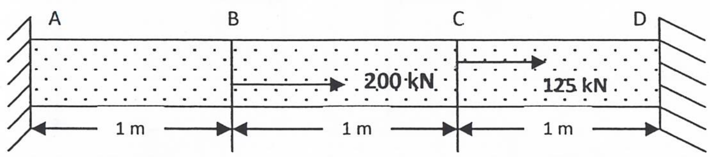
## Part-B (5x14=70Marks)

**Answer any five of the followings.**

2. a) Define modulus of elasticity.
   b) Find the expression of deformation of a body to self weight.

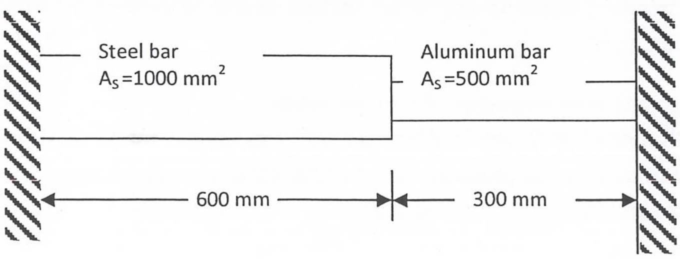
   c) A load 0f 5kN is to be raised with the help of a steel wire. Find the minimum diameter of the steel wire, if the stress is not to exceed 100 MPa. (2+6+6 = 14)

3. An aluminum bar 3m long and 2500 $mm^2$ in cross-section is rigidly fixed at A and D as shown in Figure.




Determine the loads sheared and stresses in each portion and the distances through which the points B and C will move. Take E for aluminum as 80 GPa. (14)

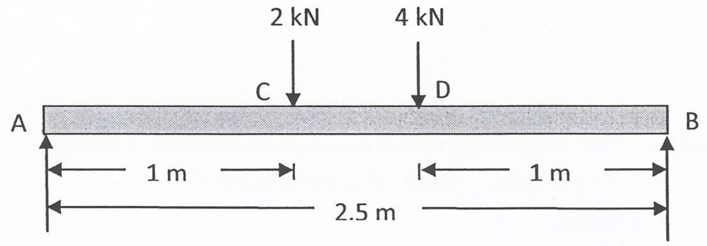
4. A composite bar made up of aluminum and steel, is held between two supports as shown



The bars are stress free at a temperature of 38° C. What will be the stress in the two bars, when the temperature is 21°C, if (a) the supports are unyielding; (b) the supports come nearer to each other by 0.1 mm? (Assume the change of temperature is uniform all along the length of bar)
Take E for steel as 200 GPa; E for aluminum as 75 GPa and coefficient of expansion for steel as $11.7 \times 10^{-6}$ per °C and coefficient of expansion for aluminum as $23.4 \times 10^{-6}$ per °C. (14)

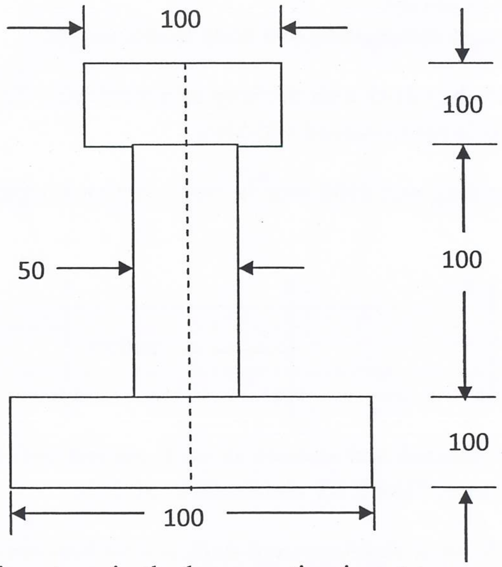
5. a) Deduce the relation between Modulus of Elasticity and Modulus of Rigidity.
b) A solid steel shaft has to transmit 100 kW at 600 r.p.m. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20 %. (7+7=14)

6. a)Draw the S.D.F (shear force diagram) and B.M.D (bending moment diagram) for a cantiliver beam with uniformly distributed load.
b) A simply supported beam AB of span 2.5 m is carrying two point loads as shown in the figure below.




Draw the shear force and bending moment diagram for the beam. (7+7=14)

7. a) Prove that $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ (all the expressions are as per convention)
b) Figure shows a rolled steel beam of an unsymmetrical I-section.




If the maximum bending stress in the beam section is not to exceed 40 MPa, find the moment, which the beam can resist. (7+7=14)

8. a) Write advantage and disadvantages of welded joints.
b) A cylindrical thin drum 800 mm in diameter and 4 m long is made of 10 mm thick plate. If the drum is subjected to an internal pressure of 2.5 MPa, determine its changes in diameter and length. Take E as 200 GPa and Poisson's ratio as 0.25. (7+7=14)

# INDIAN MARITIME UNIVERSITY

## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** — **Max Marks : 100**
**Date: 30.06.2014** — **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
    (i) the maximum speed and
    (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
    (a) angular acceleration of the wheel; and
    (b) no. of revolutions made by this wheel in 30 seconds. (14)

*********

Determine the total strain energy of the compound shaft. Given the Modulus of Rigidity G=80 G Pa. (14)

5. A hollow shaft is to transmit 400 KW at 100 R.P.M. If the shear stress is not to exceed 70 $MN/m^2$ and the internal diameter is 0.5 times of the external diameter, find the value of the internal and he external diameters assuming that the maximum torque is 1.5 times the mean torque. If the shaft is a solid circular shaft and transmits same torque developing same shear stress calculate the diameter of the solid shaft. (14)

6. A beam AB has following portions, AC=1m, CD=1m, DE=2m, EF=1m, FB=1m. The beam AB is simply supported at the two ends A and B. Two concentrated loads of 1 KN and 4 KN acts at point C and F. There is a distributed load of 2 KN/m at the portion DE. Draw the Shear force and Bending Moment diagram showing the maximum Bending Moment point and determine the value of the maximum Bending Moment. (14)

7. A straight uniform bar AD is clamped at both ends and loaded as shown in the figure 1. Initially the bar is stress free. Determine the stresses at all the portions AB, BC, CD if the cross sectional area of the bar is 1000 $mm^2$. (14)

8. a) Derive the expression for power Transmitted by a shaft. (7)

b) A solid shaft has to transmit 75 KW at 200 R.P.M. Taking Allowable shear stress as 70 $MN/m^2$, find suitable diameter of the shaft, if the maximum torque transmitted in each revolution exceed the mean by 30 %. (7)

# INDIAN MARITIME UNIVERSITY

**(A CENTRAL UNIVERSITY, GOVT. OF INDIA)**

## SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS

## ENGINEERING MECHANICS - II (T 2206)

**(AY 2013-14 batch onwards)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. a) Define co-efficient of friction and angle of friction. (3)
   b) Explain an open and closed belt pulley. (3)
   c) Define the terms Amplitude, Phase difference in S.H.M. (3)
   d) What is radius of gyration? (3)
   e) What is D'Alembert's e principle? (3)
   f) do you understand by 'open belt and crossed belt pulley? (3)
   g) What is the rise of a governor? How does a governor differ from that of flywheel? (3)
   h) What is a simple band brake? When it becomes self locking? (3)
   i) What is the moment of inertia? Why it is important in curvilinear motion? (3)
   j) What is centrifugal tension in a belt and how it affects the power transmitted? (3)

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A thrust shaft of a marine ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 KN. If the co-efficient of friction is 0.12 and speed of the engine is 90 R.P.M., find the power absorbed in friction at the thrust block, assuming
   a) Uniform pressure b) Uniform wear. (14)

3. Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 R.P.M., if the maximum permissible tension in the belt is 1.0 KN and the coefficient of friction between the belt and pulley is 0.25? (14)

# INDIAN MARITIME UNIVERSITY

(A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 2206)**

**(AY 2013-14 batch onwards)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. a) Define co-efficient of friction and angle of friction. (3)
   b) Explain an open and closed belt pulley. (3)
   c) Define the terms Amplitude, Phase difference in S.H.M. (3)
   d) What is radius of gyration? (3)
   e) What is D'Alembert's e principle? (3)
   f) do you understand by 'open belt and crossed belt pulley? (3)
   g) What is the rise of a governor? How does a governor differ from that of flywheel? (3)
   h) What is a simple band brake? When it becomes self locking? (3)
   i) What is the moment of inertia? Why it is important in curvilinear motion? (3)
   j) What is centrifugal tension in a belt and how it affects the power transmitted? (3)

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A thrust shaft of a marine ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 KN. If the co-efficient of friction is 0.12 and speed of the engine is 90 R.P.M., find the power absorbed in friction at the thrust block, assuming
   a) Uniform pressure  b) Uniform wear. (14)

3. Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 R.P.M., if the maximum permissible tension in the belt is 1.0 KN and the coefficient of friction between the belt and pulley is 0.25? (14)

8. The rotation of a rod OA about O is defined by the relation, $\theta = 2.0t^2$, where $\theta$ is expressed in radians and $t$ in seconds. Collar B slides along the rod in such a way that it's distance from $O$ is $r = 260t^2 - 20t^3$, where $r$ is in mm and $t$ in seconds. When $t = 1$ determine (14)

a) The velocity of the collar
b) The total acceleration of the collar
c) The acceleration of the collar w.r.t. the rod.

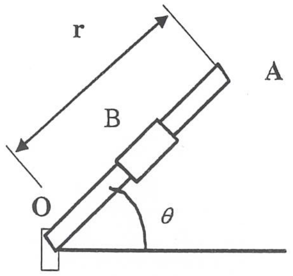



Fig.2

9. a) A body resting on a rough horizontal plane required a pull of 180 N inclined at 30° to the plane just moves it. It was found that a push of 220 N inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. (7)

b) Show that the time period of a compound pendulum is given by

$$T = 2\pi\sqrt{\frac{\frac{k^2}{a} + a}{g}},$$ where, $T$ is the time period, $a$ is the distance of centre of gravity from the point of suspension and $k$ is the radius of gyration, $g$ is the acceleration due to gravity. (7)

********

# INDIAN MARITIME UNIVERSITY

**(A Central University, Government of India)**
**East Coast Road, Uthandi, Chennai-600 119.**

**B.Tech. (MARINE ENGINEERING)**
**December 2012 Examinations**
**SECOND SEMESTER EXAMINATION**
**<u>Engineering Mechanics - II</u>**

**Old Sub Code: UG/ME/BS/T/126** **QP Code: T0511206**

**Date: 08.01.13** **Max Marks: 100**
**Time : 3 Hrs**

**Part – A** **(10 X 3 = 30 Marks)**

***Answer all the questions***

1.

a. Define coefficient of friction and limiting friction.
b. State the laws of static friction
c. Define D'Alembert's Principle.
d. Define torque? What is the unit of torque?
e. A body is vibrating with S.H.M of amplitude 100mm and Frequency 2 Vibrations/Sec. Calculate the maximum velocity and acceleration.
f. What are advantages of rope drives?
g. The tensions in the two sides of the belt are 1000 and 800 newtons respectively. If the speed of the belt is 75 meters per second, find the power transmitted by the belt.
h. In a workshop, a engine drives a shaft by a belt. The diameters of the engine pulley and the shaft pulley are 500mm and 250mm respectively. Another pulley of 700mm diameter on the same shaft drives a pulley 280m in diameter of the follower. If the engine runs at 180 revolution per minute. Find the speed of the follower.
i. Define maximum and minimum equilibrium speeds.
j. For a governor, each ball has a mass of 4kg and mass on the sleeve is 45kg and the height of the governor is 0.287m for 1 per cent speed change. Find the power of the governor. Take q = 0.904.

6. A vehicle moving on a rough plane inclined at $10^0$ with the horizontal at a speed of 36km/h has a wheel base 1.8metres. The centre of gravity of the vehicle is 0.8 meter from the rear wheels and 0.9 meter above the inclined plane. Find the distance travelled by the vehicle before coming to rest and the time taken to do so when (a) The vehicle moves up the plane, and (b) The vehicle moves down the plane.

The brakes are applied to all the four wheels and coefficient of friction is 0.5.

(14 Marks)

7. A loaded porter governor has a four links each 250mm long, two revolving masses each of 3kg and a central dead weight of mass 20kg. All the links are attached to respective sleeves at radial distances of 40mm from the axis of rotation. The masses revolve at a radius of 150mm at minimum speed and at a radius of 200mm at maximum speed. Determine the range of speed. (14 Marks)

8. Explain the terms and derive expression for 'effort' and 'power' of a porter governor.

(14 Marks)

*********

**Part – B** (5 X 14 =70 Marks)

***Answer any five of the following***

2. A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05. (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
(ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending.

(14 Marks)

3. a) Two bodies A and B of masses 800kg and 600kg are attached at the ends of a flexible rope. The rope passes over a pulley of 800mm diameter. The pulley has a mass of 100kg with a radius of gyration as 400mm about its axis of rotation. Find the torque, which must be applied to the pulley to raise the 800kg body with an acceleration of $1 m/s^2$. Neglect friction of the spindle. (8 Marks)

b) A flywheel of an engine has a mass of 6.5 tonnes and radius of gyration 1.8 meters. If maximum and minimum speeds of the flywheel are 120r.p.m. and 118r.p.m.respectively.Find the fluctuation of energy (6 Marks)

4. A simple pendulum of amplitude $4^0$ performs 24 oscillations in one minute. Find (14 Marks)

(a) length of the pendulum
(b) Maximum acceleration of the bob
(c) Maximum linear velocity of the bob; and
(d) Maximum angular velocity of the bob.

5. A laminated belt 8mm thick and 150mm wide drives a pulley of 1.2m diameter at 180 r.p.m. The angle of lap is $190^0$ and mass of the belt material is $1000 kg/m^3$. If the stress in the belt is not to exceed $1.5 N/mm^2$ and the coefficient of friction between the belt and the pulley is 0.3, determine the power transmitted when the centrifugal tension is (a) considered, and (b) Neglected. (14 Marks)

/

# INDIAN MARITIME UNIVERSITY

**(A Central University, Government of India)**
**East Coast Road, Uthandi, Chennai-600 119.**

## B.Tech. (MARINE ENGINEERING)

**December 2012 Examinations**
**SECOND SEMESTER EXAMINATION**

**<u>Engineering Mechanics - II</u>**

**Old Sub Code: UG/ME/BS/T/126** **QP Code: T0511206**

**Date: 08.01.13** **Max Marks: 100**
**Time : 3 Hrs**

**Part – A** **(10 X 3 = 30 Marks)**

***Answer all the questions***

1.

a. Define coefficient of friction and limiting friction.
b. State the laws of static friction
c. Define D'Alembert's Principle.
d. Define torque? What is the unit of torque?
e. A body is vibrating with S.H.M of amplitude 100mm and Frequency 2 Vibrations/Sec. Calculate the maximum velocity and acceleration.
f. What are advantages of rope drives?
g. The tensions in the two sides of the belt are 1000 and 800 newtons respectively. If the speed of the belt is 75 meters per second, find the power transmitted by the belt.
h. In a workshop, a engine drives a shaft by a belt. The diameters of the engine pulley and the shaft pulley are 500mm and 250mm respectively. Another pulley of 700mm diameter on the same shaft drives a pulley 280m in diameter of the follower. If the engine runs at 180 revolution per minute. Find the speed of the follower.
i. Define maximum and minimum equilibrium speeds.
j. For a governor, each ball has a mass of 4kg and mass on the sleeve is 45kg and the height of the governor is 0.287m for 1 per cent speed change. Find the power of the governor. Take q = 0.904.

# INDIAN MARITIME UNIVERSITY

## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2 x 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY

**(A CENTRAL UNIVERSITY, GOVT. OF INDIA)**

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**<u>ENGINEERING MECHANICS - II (T 1206)</u>**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds. (14)

*********

INDIAN MARITIME UNIVERSITY

**(A Central University, Government of India)**

**East Coast Road, Uthandi, Chennai-600 119.**

**B.Tech. (MARINE ENGINEERING)**

**December 2012 Examinations**

**SECOND SEMESTER EXAMINATION**

**Engineering Mechanics - II**

**Old Sub Code: UG/ME/BS/T/126** **QP Code: T0511206**

**Date: 08.01.13** **Max Marks: 100**

**Time : 3 Hrs**

**Part – A** (10 X 3 = 30 Marks)

*Answer all the questions*

1.

a. Define coefficient of friction and limiting friction.

b. State the laws of static friction

c. Define D'Alembert's Principle.

d. Define torque? What is the unit of torque?

e. A body is vibrating with S.H.M of amplitude 100mm and Frequency 2 Vibrations/Sec. Calculate the maximum velocity and acceleration.

f. What are advantages of rope drives?

g. The tensions in the two sides of the belt are 1000 and 800 newtons respectively. If the speed of the belt is 75 meters per second, find the power transmitted by the belt.

h. In a workshop, a engine drives a shaft by a belt. The diameters of the engine pulley and the shaft pulley are 500mm and 250mm respectively. Another pulley of 700mm diameter on the same shaft drives a pulley 280m in diameter of the follower. If the engine runs at 180 revolution per minute. Find the speed of the follower.

i. Define maximum and minimum equilibrium speeds.

j. For a governor, each ball has a mass of 4kg and mass on the sleeve is 45kg and the height of the governor is 0.287m for 1 per cent speed change. Find the power of the governor. Take $q = 0.904$.

**Part – B** (5 X 14 =70 Marks)

***Answer any five of the following***

2. A screw jack has a square thread of 75mm mean diameter and 15mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05. (i) Find the tangential force to be applied to the jack at 360mm radius, so as to lift a load of 6kN weight.
   (ii) State whether the jack is self-locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending.

   (14 Marks)

3. a) Two bodies A and B of masses 800kg and 600kg are attached at the ends of a flexible rope. The rope passes over a pulley of 800mm diameter. The pulley has a mass of 100kg with a radius of gyration as 400mm about its axis of rotation. Find the torque, which must be applied to the pulley to raise the 800kg body with an acceleration of $1m/s^2$. Neglect friction of the spindle. (8 Marks)

   b) A flywheel of an engine has a mass of 6.5 tonnes and radius of gyration 1.8 meters. If maximum and minimum speeds of the flywheel are 120r.p.m. and 118r.p.m.respectively.Find the fluctuation of energy (6 Marks)

4. A simple pendulum of amplitude $4^0$ performs 24 oscillations in one minute. Find (14 Marks)

   (a) length of the pendulum
   (b) Maximum acceleration of the bob
   (c) Maximum linear velocity of the bob; and
   (d) Maximum angular velocity of the bob.

5. A laminated belt 8mm thick and 150mm wide drives a pulley of 1.2m diameter at 180 r.p.m. The angle of lap is $190^0$ and mass of the belt material is 1000 $kg/m^3$. If the stress in the belt is not to exceed 1.5 $N/mm^2$ and the coefficient of friction between the belt and the pulley is 0.3, determine the power transmitted when the centrifugal tension is (a) considered, and (b) Neglected. (14 Marks)

6. A vehicle moving on a rough plane inclined at $10^0$ with the horizontal at a speed of 36km/h has a wheel base 1.8metres. The centre of gravity of the vehicle is 0.8 meter from the rear wheels and 0.9 meter above the inclined plane. Find the distance travelled by the vehicle before coming to rest and the time taken to do so when (a) The vehicle moves up the plane, and (b) The vehicle moves down the plane.
The brakes are applied to all the four wheels and coefficient of friction is 0.5.
(14 Marks)

7. A loaded porter governor has a four links each 250mm long, two revolving masses each of 3kg and a central dead weight of mass 20kg. All the links are attached to respective sleeves at radial distances of 40mm from the axis of rotation. The masses revolve at a radius of 150mm at minimum speed and at a radius of 200mm at maximum speed. Determine the range of speed. (14 Marks)

8. Explain the terms and derive expression for 'effort' and 'power' of a porter governor.
(14 Marks)

*********

## INDIAN MARITIME UNIVERSITY
**(A Central University, Government of India)**

**December 2016 End Semester Examinations**
**B.Tech. (Marine Engineering) Second Semester**

**Engineering Mechanics - II (UG11T1206/ UG11T2206)**

**Date : 11.01.2017** | **Maximum Marks: 100**
**Time: 3 Hrs** | **Pass Marks : 50**

---

### PART - A (3 X10=30)
### Compulsory Questions

1.

a) What are angle of friction and angle of repose?

b) Explain radial and transverse components of acceleration in case of a curvilinear motion.

c) What is a compound pendulum?

d) What do you understand by open and crossed belt pulleys?

e) What is dynamic equilibrium and D'Alembert's principle?

f) Explain 'periodic motion', 'time period' and 'amplitude'.

g) Explain the function of a governor.

h) What is a simple band brake?

i) What is the moment of inertia and radius of gyration?

j) What is centrifugal tension in a belt and how it affects the power transmitted?

k)

### PART B (5 X 14 = 70 Marks)
### Answer Any Five of the following

2. A load of 20 KN is raised by means of a screw jack, having a square threaded screw of 12 mm pitch and a mean diameter of 50 mm. If a force of 200 N is applied at the end of a lever to raise the load, what should be the length of the lever used? Take coefficient of friction =0.15. What is the mechanical advantage obtained? State whether the screw is self-locking.

**(14 MARKS)**

3. A small flywheel of mass 85 kg is suspended in a vertical plane as a compound pendulum. The distance of centre of gravity from the knife edge support is 100 mm and the time period of the compound pendulum is 1.0227 times of the time period of a simple pendulum whose length is 0.5 m. Find the time period, equivalent length and radius of

gyration of the compound pendulum. Also find the moment of inertia of the flywheel about an axis passing through the centre of gravity of the compound pendulum.

**(14 MARKS)**

4. Two pulleys, one 600 mm diameter and other 300 mm diameter are 2.0 m apart from centre to centre and are connected by a cross belt. The larger pulley is running at 200 r.p.m. What is the r.p.m. of the smaller pulley? What is the length of the belt? If the connection was open belt connection then what was the length of the belt? If the coefficient of friction between the belt and the pulley is 0.25, angle of lap is $160^{\circ}$ and maximum tension in the belt is 2500 N, calculate the power transmitted by the belt.

**(14 MARKS)**

5. A particle, moving with simple harmonic motion, performs 10 complete oscillation per minute and it's speed is 60% of the maximum speed when it is at a distance of 8 cm from the centre of oscillation. Find the amplitude, maximum acceleration of the particle. Also find the speed of the particle, when it is 6 cm from the centre of the oscillation.

**(14 MARKS)**

6. A band brake acts on the ¾ th of the circumference of a drum of 500 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 250 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 110 mm from the fulcrum. If the operating force is applied at 510 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the counter clockwise direction. **(14 Marks)**

7. The arms of a Porter Governor are each 260 mm long and pivoted on the governor axis. The mass of each ball is 7 kg and the mass of the central sleeve is 32 kg. The radius of rotation of the balls is 160 mm when the sleeve begins to rise and reaches a value of 210 mm for maximum speed. Determine the speed range of the Governor.

**(14 MARKS)**

8. A horizontal bar 1.5 m long and of small cross-section rotates about vertical axis through one end. It accelerates uniformly from 1200 r. p. m. to 1500 r p. m. in an interval of 5 seconds. What is the linear velocity at the beginning and end of the interval? What are the normal and tangential components of the acceleration of the mid-point of the bar after 5 seconds after the acceleration begins.

**(14 MARKS)**

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2\text{x}10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY

**(A CENTRAL UNIVERSITY, GOVT. OF INDIA)**

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 2206)**

**(AY 2013-14 batch onwards)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. a) Define co-efficient of friction and angle of friction. (3)
   b) Explain an open and closed belt pulley. (3)
   c) Define the terms Amplitude, Phase difference in S.H.M. (3)
   d) What is radius of gyration? (3)
   e) What is D'Alembert's e principle? (3)
   f) do you understand by 'open belt and crossed belt pulley? (3)
   g) What is the rise of a governor? How does a governor differ from that of flywheel? (3)
   h) What is a simple band brake? When it becomes self locking? (3)
   i) What is the moment of inertia? Why it is important in curvilinear motion? (3)
   j) What is centrifugal tension in a belt and how it affects the power transmitted? (3)

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A thrust shaft of a marine ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 KN. If the co-efficient of friction is 0.12 and speed of the engine is 90 R.P.M., find the power absorbed in friction at the thrust block, assuming
   a) Uniform pressure   b) Uniform wear. (14)

3. Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 R.P.M., if the maximum permissible tension in the belt is 1.0 KN and the coefficient of friction between the belt and pulley is 0.25? (14)

4. A point moves with SHM and when this point is 0.85 m from the mid path it's velocity is 15 m/s and when 2.5 m from the centre of its path its velocity is 5m/s. Find its angular velocity, amplitude, time period and maximum acceleration. (14)

5. A simple band brake operates on a drum of 600 mm in diameter that is rotating at 200 R.P.M. as shown in the figure 1. The coefficient of friction is 0.25. The brake band has a contact of 270°, one end is fastened to a fixed pin and the other end to the brake arm 125 mm from the fixed pin. The straight brake arm is 750 mm long and placed perpendicular to the diameter that bisects the angle of contact. (14)

   a) What is the pull necessary on the end of brake arm to stop the wheel if 35 KW is being absorbed? What is the direction of the minimum pull?
   b) What width of steel band of 2.5 mm thick is required for this brake if the maximum tensile stress is not to exceed 50 N/mm$^2$?

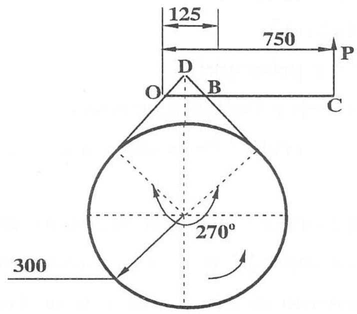



Fig. 1, All Dimensions are in mm.

6. In a marine engine governor of the porter type, the upper and lower arms are 200 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of the central load is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 24 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30° and 40°, find, (14)
   a) Without friction
   b) With friction, the range of the speed of the governor.

7. A Proell governor has equal arms of length 300 mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150 mm and 200 mm. The mass of the each ball is 15 kg and the mass of the central load is 100 kg. Determine the range of the speeds. (14)

8. The rotation of a rod OA about O is defined by the relation, $\theta = 2.0t^2$, where $\theta$ is expressed in radians and $t$ in seconds. Collar B slides along the rod in such a way that it's distance from $O$ is $r = 260t^2 - 20t^3$, where $r$ is in mm and $t$ in seconds. When $t = 1$ determine (14)

a) The velocity of the collar
b) The total acceleration of the collar
c) The acceleration of the collar w.r.t. the rod.

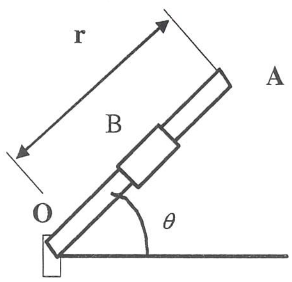



Fig.2

9. a) A body resting on a rough horizontal plane required a pull of 180 N inclined at 30° to the plane just moves it. It was found that a push of 220 N inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. (7)

b) Show that the time period of a compound pendulum is given by

$$T = 2\pi\sqrt{\frac{\frac{k^2}{a} + a}{g}}$$

, where, $T$ is the time period, $a$ is the distance of centre of gravity from the point of suspension and $k$ is the radius of gyration, $g$ is the acceleration due to gravity. (7)

********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

13 (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
    (i) the maximum speed and
    (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
    (a) angular acceleration of the wheel; and
    (b) no. of revolutions made by this wheel in 30 seconds.
    (14)

*********

# INDIAN MARITIME UNIVERSITY

## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2 \times 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{o}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{o}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**<u>ENGINEERING MECHANICS - II (T 1206)</u>**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** (3 X10 = 30 Marks)

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2 \times 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** (5 X14 = 70 Marks)

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY

## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2 \times 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^\circ$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^\circ$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** — **Max Marks : 100**
**Date: 30.06.2014** — **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

 (b) What is *non-reversible* machine? Give one example.

 (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

 (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

 (e) For a body in simple harmonic motion what is amplitude?

 (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

 (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

 (h) Give one example of a band brake used on a ship

 (i) What is functional difference between a governor and a flywheel?

 (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds. (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**<u>ENGINEERING MECHANICS - II (T 1206)</u>**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** (3 X10 = 30 Marks)

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2 \times 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** (5 X14 = 70 Marks)

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{o}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{o}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY

## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs**
**Date: 30.06.2014**

**Max Marks : 100**
**Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** (3 X10 = 30 Marks)

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** (5 X14 = 70 Marks)

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY

**(A CENTRAL UNIVERSITY, GOVT. OF INDIA)**

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

## ENGINEERING MECHANICS - II (T 1206)

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

(b) What is *non-reversible* machine? Give one example.

(c) The mean torque in a propeller shaft is $2\text{x}10^5$ Nm when running at 140 rev/min. Find the power transmitted.

(d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

(e) For a body in simple harmonic motion what is amplitude?

(f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

(g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

(h) Give one example of a band brake used on a ship

(i) What is functional difference between a governor and a flywheel?

(j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

(b) What is *non-reversible* machine? Give one example.

(c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

(d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

(e) For a body in simple harmonic motion what is amplitude?

(f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

(g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

(h) Give one example of a band brake used on a ship

(i) What is functional difference between a governor and a flywheel?

(j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** — **Max Marks : 100**
**Date: 30.06.2014** — **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2 \times 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^\circ$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^\circ$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY

(A CENTRAL UNIVERSITY, GOVERNMENT OF INDIA)

**B.TECH (MARINE ENGINEERING)**

DECEMBER2014/JANUARY END SEMSTER EXAMINATION

III SEMESTER

**APPLIED THERMODYNAMICS - II (T 2303 / T 1303)**

Time: 03.00 Hrs
Date:27-12-2014

Max. Marks: 100
Pass Marks: 50

**PART- A (3 × 10 = 30 Marks)**

**Compulsory Questions**

1.

a) Define Calorific value of fuel.

b) What is compounding of Steam turbine?.Draw pressure – velocity compounding.

c) Define conduction, convection and radiation.

d) Define "one Tonne of Refrigeration".

e) Define thermal conductivity. Derive the unit thermal conductivity.

f) In an impulse turbine the pressure drop takes place in the nozzle only.True/false?. Comment.

g) Define nozzle.Enumerate types of nozzles.

h) Define Heat Exchanger. Draw direct transfer type heat exchanger.

i) Write any three Combustion equations

j) Draw parallel flow and counter flow heat exchangers.

**PART-B (5 × 14 = 70 Mark)**

**Answer any five of the following**

2. a) A gas consists of 14.2% $CH_4$, 5.9% $CO_2$, 36% CO, 40.5%$H_2$, 0.5%$O_2$, 2.9%$N_2$. Determine the stoichiometric volume of air for the complete combustion of $1m^3$ of this gas and also the products of combustion both in $m^3/m^3$ of gas and as a percentage. [ 10 marks]

b) Define Fuel, complete combustion, incomplete combustion, Stoichiometric Air fuel ratio [4 marks]

3. Steam enters a group of convergent-divergent nozzles at a pressure of $2.2 MN/m^2$ and with a temp. of 260°C. equilibrium expansion through the nozzles is to an exit pressure of 0.4 MN/m2. Up to the throat of the nozzles the flow can be considered as frictionless. But from throat to exit there is an efficiency of expansion of 85%. The rate of steam flow through the nozzles, is 11kg/s. using the enthalpy-entropy chart for steam, determine:

a) the throat and exit velocity
b) the throat and exit area. [14 marks]

4. Two rows of a velocity compounded impulse turbine have a mean blade speed of 150 m/s and with nozzle velocity of 675m/s and nozzle angle of 20°. The exit angles of the first moving row, the fixed row and the second row of moving blades are 25°, 25°, 30°, respectively. There is a 10% loss of velocity due to friction in all blades. The mass flow rate is 4.5kg/s. Draw the velocity diagram to suitable scale and determine:

a) the power output of the turbine
b) the diagram efficiency [14 marks]

5 4. a) Draw and explain the reversed carnot cycle with p-v and T-s diagrams. [6 marks]

b) A refrigerator has working temperatures in the evaporator and condenser coils of -30 and $32^0$ respectively. What is the maximum COP possible? If the actual refrigerator has a COP of 0.75 of the maximum calculate the required power input for a refrigerating effect of 5 kW. [8 marks]

6 5. Explain three types of compounding done in steam turbine. Define fixed blade, moving blade and nozzle. Also draw the pressure velocity variations of all the three types of compounding. [14 marks]

7 6. a) The inner surface of a plane brick wall is at 40°C and the outer surface is at 20°C. calculate the rate of heat transfer per unit area of wall surface; the wall is 250mm thick and the thermal conductivity of the brick is 0.52 W/mk. [6 marks]

b) Derive a relation for heat transfer through a hollow sphere. [4 marks]

c) Define Fourier's law of conduction. Explain the relevance of negative sign in it. [4 marks]

8. a) Derive the expression for heat flow ~~fluid~~ to fluid through wall. [6 marks]

b) A mild steel tank of wall thickness 10mm contains water at 90°C when the atmosphere temperature is 15°C. The thermal conductivity of mild steel is 50 W/mK, and the heat transfer coefficients for the inside and outside of the tank are 2800 and 11 $W/m^2k$ respectively. Calculate:

i) The rate of heat loss per unit area of tank surface;
ii) The temperature of the outside surface of the tank. [8 marks]

# INDIAN MARITIME UNIVERSITY

**(A Central University, Government of India)**

**December 2016 End Semester Examinations**
**B.Tech. (Marine Engineering) Third Semester**

**Applied Thermodynamics - II (UG11T1303/ UG11T2303)**

**Date : 19.12.2016** **Maximum Marks: 100**
**Time: 3 Hrs** **Pass Marks : 50**

## PART- A

(10×3=30)

**(Answer the compulsory question)**

1.a) Define Calorific value of fuel.

b) Give some examples for solid, liquid and gaseous fuels.

c) Define the following terms:
Speed ratio and axial thrust of the rotor.

d) What is the necessity of compounding of steam turbine?

e) State the function of fixed blade and moving blade.

f) Define the term C.O.P in refrigeration.

g) What is perfect intercooling.

h) Define one tonne of refrigeration.

i) What do you mean by convection in heat transfer?

j) State fourier law of heat conduction.

## PART-B

(5×14=70)

**(Answer any five of the following)**

2. A sample of dry anthracite has the following composition by mass.

C – 90% , H -3% ,O -2.5% ,N-1% ; S – 0.5% ,ash – 3%

Calculate

a) the stoichiometric A/F ratio.

b) the A/F ratio and the dry and wet analysis of the products of combustion by mass and by volume, when 20% excess air is supplied. (14 marks)

3. The wall of a cold room is composed of 3 layers. The outer layer is brick 20cm thick. The middle layer is 10 cm thick, the inside layer is cement 5 cm thick. The temperature of the outside air is $25^0$C and on the inside air is $-20^0$C.The heat transfer coefficientfor outside air

and brick is 45.4 $W/m^2$ K. Heat transfer coefficient for inside air and cement is 17 $W/m^2K$.find heat flow rate.

K for brick =3.45 W/mK

K for middle layer =0.04 W/mK

K for cement = 0.294 W/mK (14 marks)

4. a) Give the difference between impulse turbine and reaction turbine. (6 marks)

b) Steam coming from the nozzles of a delaval turbine with a velocity of 1000m/s. The nozzle angle is $20^0$.mean blade velocity is 400 m/s. The blades are symmetrical, the mass flow rate is 1000 kg/hr.friction factor is 0.8, $\eta_{nozzle} = 0.95$ ,

determine a)blade angles b)axial thrust on the rotor c)work done per kg of steam d)power developed e)blade efficiency f)stage efficiency. (8 marks)

5. Air at 8.6 bar and $190^0C$ expands at the rate of 4.5 kg/s through a convergent divergent nozzle into space at 1.03 bar. Assuming that the inlet velocity is negligible. Calculate the throat and the exit cross sectional areas of the nozzle. (14 marks)

6. a) A refrigeration machine working on reversed carnot cycle consumes 6 KW for producing refrigeration effect of 1000 kj/min for maintaining a region at $-40^0C$.compute a)higher temperature of the cycle b)COP of the refrigeration c)What will be the heat delivered if the device is used as heat pump. (8 marks)

b) A carnot refrigerator requires 1.5 kW per tonne of refrigeration to maintain the temperature of $-30^0C$.find a)COP of the cycle b)temperature of the sink (hot body) c)heat rejected to the sink d)COP when it is used as heat pump. (6 marks)

7. An ammonia refrigerator works between the pressure limits of 55 bar and 22 bar.the gas is dry at the end of compression and there is no under cooling. Determine a)COP of the cycle b)capacity of the refrigerator if the fluid flows at the rate of 4 kg/min.the properties of ammonia are given below. (14 marks)

| P(bar) | Saturation $T^0C$ | Enthalpy (h) kj/kg | | Entropy (s) kj/kg K | |
|---|---|---|---|---|---|
| | | Liquid $h_f$ | Vapour $h_g$ | Liquid $s_f$ | Vapour $s_g$ |
| 55 | $20^0C$ | 60.2 | 200.3 | 0.182 | 0.684 |
| 22 | $-15^0C$ | -19.1 | 228.2 | -0.072 | 0.824 |

8. Explain forced convection of heat transfer and arrive at the expression for nusselt, prandtl and Reynolds number. (14 marks)

****

Back Paper

# INDIAN MARITIME UNIVERSITY

**(A Central University, Govt.of India)**

**May/June 2015 End Semester Examinations**

**SEMESTER – III, B.TECH ( MARINE ENGINEERING)**

**APPLIED THERMODYNAMICS - II (T 2303 / T 1303)**

**Date:13.06.2015** | **Max.Marks:100**
**Time:-3 Hrs** | **Pass Marks:50**

---

**PART – A** **(3 x10 = 30 Marks)**

**(Compulsory Questions)**

1. a) What is Mach Number and its value for subsonic, sonic and supersonic flow?

b) What is Stoichiometric Air Fuel ratio and Excess air?

c) What is velocity and Pressure Compounding in Turbine?

d) With the help of a Reversed carnot cycle, derive an expression for the $COP_{ref}$ and $COP_{heatpump}$.

T.O.E.

e) What is fourier law of heat conduction?

f) Define higher and lower calorific value.

g) What are the difference between a nozzle and a diffuser.

h) What is diagram efficiency of a Turbine ?

i) What is one tonne refrigeration?

T.O.E.

j) What is Prandtl Number and Nusselt Number?

**PART – B** **(5 x14 = 70 Marks)**

**(Answer any five of the following)**

2. The analysis of a supply of gas is as follows: $H_2$ 49.4% ; CO 18% : $CH_4$ 20% ; $C_4H_8$ 2% ; $O_2$ 0.4% ; $N_2$ 6.2% ; $CO_2$ 4% calculate (14)

i) The Stoichiometric A/F ratio

ii) The wet and dry analysis of the products of combustion if the actual mixture is 20% weak

3. a) A refrigerator has working temperatures in the evaporator and condenser coils of -30°C and 32°C respectively. What is the maximum COP possible? If the actual refrigerator has COP of 0.75 of the maximum calculate the required power input for a refrigerating effect of 5 KW. (7)

b) What are the effect of decrease of evaporator pressure and increase of condenser pressure in a vapour compression refrigeration cycle (7)

4. a) What are the difference between impulse and reaction turbine?

b) The velocity of steam leaving the nozzles of an impulse turbine is 900 m/sec and the Nozzle is 20°. The blade velocity is 300 m/sec and the blade velocity co-efficient is 0.7. Calculate for a mass flow rate of 1 kg/s, the symmetrical blading-
i) The blade inlet angle. ii)The driving force on the wheel.
iii)The axial thrust iv )The diagram power v) The diagram efficiency.

**(4+10)**

5. a) Derive an expression for heat flow through a cylinder.

b) For a dimensionless group prove that Nusselt Number(Nu) is a function of Pandte Number(Pr) and Reynolds number(Re).

**(4+10)**

6. a) What is nozzle efficiency?

b) Dry saturated steam at a pressure of 11 bar enters a convergent divergent nozzle and leaves at a pressure at 2 bar. If the flow is adiabatic and friction less determine
i) The exit velocity of steam. ii)Ratio of cross section at exit and at the throat.
Assume the index of adiabatic expansion to be 1.135

**(2+12)**

7. a) With a neat sketch describe the vapour compression refrigeration cycle.

b) A vapour compression refrigerator works between the pressure limits of 60 bar and 5 bar. The working fluid is just dry at the end of compression and there is no under cooling of the liquid before the expansion valve. Determine:
1) C.O.P. of the cycle; and
2) Capacity of the refrigerator if the fluid flow is at the rate of 5 kg/min.

| Pressure (bar) | Saturation temp (K) | Enthalpy (kJ/kg) | | Entropy (kJ/kg K) | |
|---|---|---|---|---|---|
| | | Liquid | Vapour | Liquid | Vapour |
| 60 | 295 | 151.96 | 293.29 | 0.554 | 1.0332 |
| 25 | 261 | 56.32 | 322.58 | 0.226 | 1.2464 |

**(4+10)**

8. a) Classify Heat Exchangers .

   b) A cold room has one of the walls 5mx2.5m made of bricks12cm thick insulated externally by cork slabbing 8cm thick .cork is protected externally by2.5cm wood. Estimate the heat filtration through the walls in 24 hours, if the interior of the cold room is maintained at a temp of o0c and the outside temp is 200c.Thermal conductivities of brick, cork and wood are 0.93, 0.044 and 0.175W/mk. What will be the interface temperature?

**(4+10)**

9. Write short notes on the following **(4X3 ½)**

   i) Mixture strength

   ii) Methods of improving COP.

   iii) Difference between convection and conduction.

   iv) Thermal conductivity of insulating materials.

********

# INDIAN MARITIME UNIVERSITY

(A CENTRAL UNIVERSITY, GOVERNMENT OF INDIA)

**B.TECH (MARINE ENGINEERING)**

DECEMBER2014/JANUARY END SEMSTER EXAMINATION

III SEMESTER

**APPLIED THERMODYNAMICS - II (T 2303 / T 1303)**

Time: 03.00 Hrs
Date:27-12-2014

Max. Marks: 100
Pass Marks: 50

**PART- A (3 × 10 = 30 Marks)**

**Compulsory Questions**

1.

a) Define Calorific value of fuel.

b) What is compounding of Steam turbine?.Draw pressure – velocity compounding.

c) Define conduction, convection and radiation.

d) Define "one Tonne of Refrigeration".

e) Define thermal conductivity. Derive the unit thermal conductivity.

f) In an impulse turbine the pressure drop takes place in the nozzle only.True/false?. Comment.

g) Define nozzle.Enumerate types of nozzles.

h) Define Heat Exchanger. Draw direct transfer type heat exchanger.

i) Write any three Combustion equations

j) Draw parallel flow and counter flow heat exchangers.

**PART-B (5 × 14 = 70 Mark)**

**Answer any five of the following**

2. a) A gas consists of 14.2% $CH_4$, 5.9% $CO_2$, 36% CO, 40.5%$H_2$, 0.5%$O_2$, 2.9%$N_2$. Determine the stoichiometric volume of air for the complete combustion of $1m^3$ of this gas and also the products of combustion both in $m^3/m^3$ of gas and as a percentage. [ 10 marks]

b) Define Fuel, complete combustion, incomplete combustion, Stoichiometric Air fuel ratio [4 marks]

3. Steam enters a group of convergent-divergent nozzles at a pressure of $2.2 MN/m^2$ and with a temp. of 260°C. equilibrium expansion through the nozzles is to an exit pressure of 0.4 MN/m2. Up to the throat of the nozzles the flow can be considered as frictionless. But from throat to exit there is an efficiency of expansion of 85%. The rate of steam flow through the nozzles, is 11kg/s. using the enthalpy-entropy chart for steam, determine:

a) the throat and exit velocity

b) the throat and exit area. [14 marks]

4. Two rows of a velocity compounded impulse turbine have a mean blade speed of 150 m/s and with nozzle velocity of 675m/s and nozzle angle of 20°. The exit angles of the first moving row, the fixed row and the second row of moving blades are 25°, 25°, 30°, respectively. There is a 10% loss of velocity due to friction in all blades. The mass flow rate is 4.5kg/s. Draw the velocity diagram to suitable scale and determine:

a) the power output of the turbine

b) the diagram efficiency [14 marks]

4. a) Draw and explain the reversed carnot cycle with p-v and T-s diagrams. [6 marks]

b)A refrigerator has working temperatures in the evaporator and condenser coils of -30 and $32^0$ respectively. What is the maximum COP possible? If the actual refrigerator has a COP of 0.75 of the maximum calculate the required power input for a refrigerating effect of 5 kW. [8 marks]

5. Explain three types of compounding done in steam turbine. Define fixed blade, moving blade and nozzle. Also draw the pressure velocity variations of all the three types of compounding. [14 marks]

6. a) The inner surface of a plane brick wall is at 40°C and the outer surface is at 20°C. calculate the rate of heat transfer per unit area of wall surface; the wall is 250mm thick and the thermal conductivity of the brick is 0.52 W/mk. [6 marks]

b) Derive a relation for heat transfer through a hollow sphere. [4 marks]

c) Define Fourier's law of conduction. Explain the relevance of negative sign in it. [4 marks]

8. a) Derive the expression for heat fluid to fluid through wall. [6 marks]

b) A mild steel tank of wall thickness 10mm contains water at 90°C when the atmosphere temperature is 15°C. The thermal conductivity of mild steel is 50 W/mK, and the heat transfer coefficients for the inside and outside of the tank are 2800 and 11 $W/m^2k$ respectively. Calculate:

i) The rate of heat loss per unit area of tank surface;

ii)The temperature of the outside surface of the tank. [8 marks]

# INDIAN MARITIME UNIVERSITY

## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**<u>ENGINEERING MECHANICS - II (T 1206)</u>**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2 \times 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

**INDIAN MARITIME UNIVERSITY**
**(A CENTRAL UNIVERSITY, GOVT. OF INDIA)**

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

 (b) What is *non-reversible* machine? Give one example.

 (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

 (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

 (e) For a body in simple harmonic motion what is amplitude?

 (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

 (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

 (h) Give one example of a band brake used on a ship

 (i) What is functional difference between a governor and a flywheel?

 (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY

## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)

   (i) the maximum speed and

   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

**INDIAN MARITIME UNIVERSITY**
**(A CENTRAL UNIVERSITY, GOVT. OF INDIA)**

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**<u>ENGINEERING MECHANICS - II (T 1206)</u>**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** **Max Marks : 100**
**Date: 30.06.2014** **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

(b) What is *non-reversible* machine? Give one example.

(c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

(d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

(e) For a body in simple harmonic motion what is amplitude?

(f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

(g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

(h) Give one example of a band brake used on a ship

(i) What is functional difference between a governor and a flywheel?

(j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** **Max Marks : 100**
**Date: 30.06.2014** **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2x10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A Central University, Govt.of India)

### May/June 2015 End Semester Examinations

### SEMESTER – II, B.TECH ( MARINE ENGINEERING)

### MATHEMATICS II (T 2202 / T 1202)

**Date:08.06.2015** **Max.Marks:100**
**Time:-3 Hrs** **Pass Marks:50**

---

**PART – A** **(3 x10 = 30 Marks)**
**(Compulsory Questions)**

1. a) Find the Fourier coefficients $a_1$ and $b_1$ for the function

$$f(t)=\begin{cases}\sin t, 0\le t\le \pi\\ 0, \pi\le t\le 2\pi\end{cases}$$

b) Use unit step functions to evaluate the Laplace transform of the following function: $f(t)=\begin{cases}t, 0<t<2\\ 2, t>2\end{cases}$

c) Solve the differential equation $\dfrac{dy}{dx}=e^{2x-3y}+4x^2e^{-3y}$.

d) Evaluate $L^{-1}\left\{\dfrac{1}{2}\log\dfrac{s^2+b^2}{s^2+a^2}\right\}$.

e) Calculate the PI for the differential equation $(D^2-16)u=2e^{4x}$.

f) Find only the integrating factor for the non-exact equation $(x^2y^3-y)dx+(x^3y^2+x)dy=0$.

g) In a Binomial distribution the mean is 4 and the variance is 8/3. Find the mode of the distribution.

h) Find the value of $k$ if $f(x)=\begin{cases}kx^2, 0<x<3\\ 0, otherwise\end{cases}$, is a probability density function.

i) If a random variable has a Poisson distribution such that P(1)=P(2), find (i) the mean of the distribution and (ii) P(4).

j) Find the orthogonal trajectory to the family of curves $y=ax^2$.

**PART – B** **(5 x14 = 70 Marks)**

**(Answer any five of the following)**

2. a) Find the half range cosine series for the function $f(t)=\begin{cases} t, 0<t<2 \\ 4-t, 2<t<4 \end{cases}$

b) Find the Fourier series for the function $f(x)=\begin{cases} -1, -\pi<x<-\pi/2 \\ 0, -\pi/2<x<\pi/2 \\ 1, \pi/2<x<\pi \end{cases}$

**(7+7)**

3. a) Use Convolution theorem to calculate the inverse Laplace transform

$$L^{-1}\left[\frac{1}{(s+2)^2(s-2)}\right]$$

b) Solve the initial value problem $\frac{d^2x}{dt^2}+2\frac{dx}{dt}+5x=e^{-t}\sin t$, $x(0)=0, x'(0)=1$

**(6+8)**

4. a) Solve the equation $y(xy+2x^2y^2)dx+x(xy-x^2y^2)dy=0$

b) Find the complete solution (CS) for the differential equation $(D^2+4D+3)y(x)=e^{-x}\sin x+xe^{3x}$

**(6+8)**

5. a) Solve by the method of variation of parameters $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=\frac{e^{3x}}{x^2}$

b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current $i$ amperes at time $t$ is given by $L\frac{di}{dt}+Ri=E$. Use method of integrating factor to find $i(t)$ with $E=10\sin t$, while the initial condition is $i(t)=0$ at $t=0$

**(7+7)**

6. a) A problem in mathematics is given to three students whose chances of solving the problem are 1/2, 1/3, and 1/4. What is the probability that the problem is solved

b) There are three bags; the first containing 1 white, 2 red and 3 green balls; the second containing 2 white, 3 red and 1 green balls and the third bag containing 3 white, 1 red and 2 green balls. Two balls are drawn from a bag chosen at random. They are found to be 1 white and 1 red. Find the probability that the balls so drawn came from the second bag and the first bag.

**(6+8)**

7. a) Show that the Poisson's distribution is a limiting case of binomial distribution When $n$ is very large and $p$ is very small in such a way that $np \to \lambda$.

b) Out of 800 families with five children each, how many families would be expected to have

i) three boys and two girls (ii) two boys and three girls

iii) at the most two girls, under the assumption that the probabilities for boys and girls are equal.

**(6+8)**

8. a) Derive the recurring relation for the moments of binomial distribution

$\mu_{r+1} = pq\left[nr\mu_{r-1} + \frac{d\mu_r}{dp}\right]$ where symbols have their usual meanings.

b) Use method of undetermined coefficients to solve the differential equation

$$\frac{d^2u}{dx^2} + 4u = 2\sin 2x$$

**(7+7)**

9. a) The Fourier series $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$ is not always convergent. Write down the conditions (Dirichlet's) of a convergent Fourier series. If $f(x)$ is discontinuous at $x = c$, what value of the function should be used at the point of discontinuity, for all practical purpose.

b) Calculate the Laplace transform of the periodic function

$$f(t) = \begin{cases} A, 0 < t < a \\ -A, a < t < 2a \end{cases}$$

where $A$ is a constant and $f(t) = f(t + 2a)$.

**(6+8)**

********

# INDIAN MARITIME UNIVERSITY

**(Central University, Government of India)**

**May/June 2016 End Semester Examinations**
**B.Tech. (Marine Engineering)**

**Second Semester – Strength of Materials – I (UG11 T2204/T1204)**

**Date : 15.06.2016** **Max Marks: 100**
**Time: 3 Hrs** **Pass Marks: 50**

---

**Part-A** **(3 x 10 = 30 Marks)**
**Compulsory Question**

1. a) Define Poisson's ratio.
   b) Define Point of Contrafluxure.
   c) Draw the sheer force and bending moment diagram for a cantilever beam subjected to uniformly distributed load.
   d) Calculate the bursting pressure for cold drawn seamless steel tubing of 60mm inside diameter with 2mm wall thickness. The ultimate strength of steel is $300MN/m^2$.
   e) What is stiffness of a closed-coil Helical spring?
   f) What is neutral axis and why there is no stress at this section?
   g) What is hoop stress and Longitudinal Stress of a thin cylinder under internal Pressure?
   h) A steel rod having cross-section 15 X 25 $mm^2$ is to carry an axial load of 200 KN (tensile). Calculate the length of the steel rod if the extension of the rod is 0.069 mm. Given the modulus of Elasticity, $E=2.14 \times 10^8$ $KN/m^2$.
   i) What is 'load factor' and what is 'impact factor'?
   j) Define the term 'polar modulus'. Find the expressions for the polar modulus for a solid shaft and a hollow shaft.

**<u>Part-B</u>** **(14 x 5 =70 Marks)**
**Answer any Five Questions**

2) a. Define Hooke's law.
   b. A rigid bar is supported by three rods in the same plane and equidistant. The outer rods are of the brass and of length 600mm and diameter 30mm. the central rod is of steel is 900mm length and of 37.5mm diameter. Calculate the forces in the bars due to an applied force P, if the bar remains horizontal after the load has been applied. Take $\mathbf{E_s / E_b=2}$ (4+10)

3) A compound bars made of a central steel plate 60mm wide and 10mm thick to which copper plates 40mm wide by 5mm thickness are connected rigidly on each side. The length of the bar at normal temperature is 1m. If the temperature is raised by $80^0$C, determine the stresses in each metal and the change in length.
   Take Es=$200GN/m^2$ Ec=$100GN/m^2$
   $\alpha s= 12x10^{-6}/^0C$ $\alpha c= 17x10^{-6}/^0C$ (14)

4) A cylindrical shell 3m long which is closed at the ends has an internal diameter of 1m and a wall thickness of 15mm. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shells if it subjected to an internal pressure of $1.5MN/m^2$.Take $E=200GN/m^2$ and 1/m=0.3. (14)

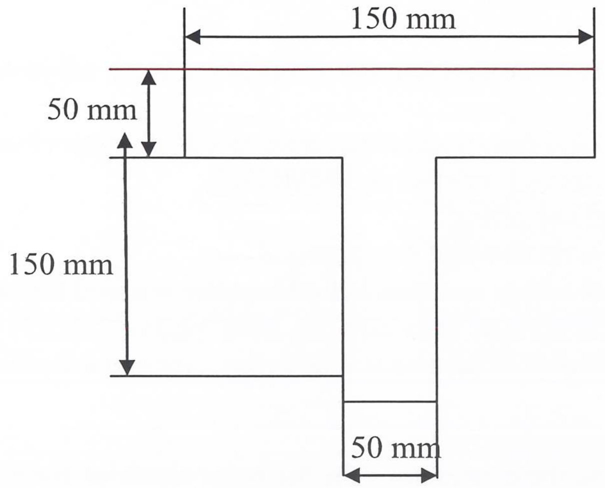
5) a) Prove that $\frac{T}{J}=\frac{\tau}{r}=\frac{G\theta}{L}$ in case of torsion of a cylindrical shaft. Notions have their usual meaning

b) A solid steel shaft has to transmit 100KW at 160 rpm. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceed the mean by 20%. (6+8)

6) a) Derive an expression of strain energy under gradual loading.

b) Calculate the strain energy stored in a Bar 2 m long 50 mm wide and 40 mm thick. When it is subjected to tensile load of 60 KN. Take Young Modulus as 200 GPa. (6+8)

7) A Beam having cross-section as shown below in the figure 3, is subjected to a bending moment of 3.5 KNm. Find the Tensile and the compressive stresses (at extreme fibres) developed in the beam. What will be the bending stress at a distance of 10 mm from the neutral axis? (14)

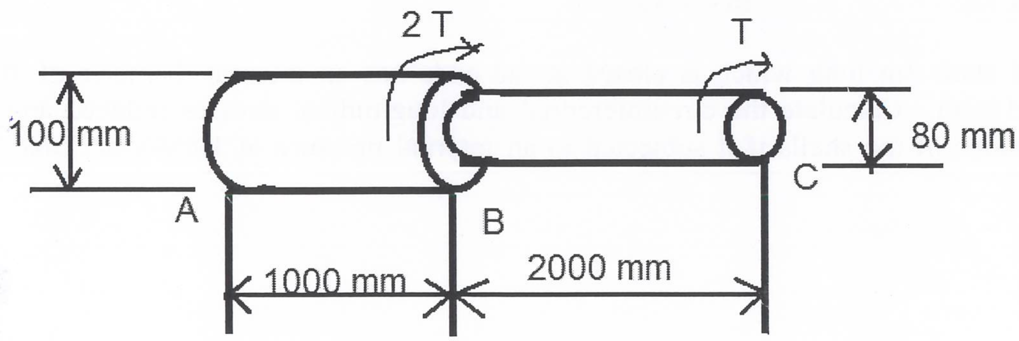



8) a) A beam 10 m long and simply supported at each end, has a uniformly distributed load of 1000 N/m extending from the left end up to the centre of the beam. There is also an anti-clockwise couple of 15 KNm at a distance of 2.5 m from the right end. Draw the S.F and B.M diagrams.

b) How will you draw the S.F and B.M diagrams for a beam which is subjected to inclined loads? (10+4)

9) a) Internal diameter of a hollows shaft is two-third of its external diameter. Compare its resistance to torsion with that of a solid shaft of the same weight and material.

b) A stepped steel shaft is subjected to a torque T at the free end and a torque 2T at the junction of the two sizes as shown in figure. Find the total angel of twist at the free end, if the maximum shear stress in the shaft material is limited to 70 N/mm2. Take the modulus of rigidity as $0.8 \times 10^5$ N/mm$^2$. (7+7)




*****

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Government of India)**

**SHIP STRUCTURE AND CONSTRUCTION**
**SEMESTER – IV, B.TECH(MARINE ENGINEERING): DEC/JAN 2013-14**
**SUBJECT CODE: T 1401**
**(AY 2009-10 to 2012-13 batches only)**

**Date: 12.12.2013**

**Time: 3 Hrs**
**Maximum Marks:100**
**(Weightage 70%)**

## SECTION - A

*Answer ALL questions* 10 x 3 = 30 marks

1. (a) Differentiate Light weight and Dead weight.

(b) Differentiate Bulb angle and Bulb plate.

(c) Which floors are stronger- Solid floors or Bracket floors, Why?

(d) Where do you fit beam knees in a ship?

(e) What are corrugated bulkheads?

(f) What is a Stem bar? where do you find it?

(g) How many types of "Stern" you know?

(h) Explain what is a mould loft?

(i) What is a Dynamic Positioning Vessel?

(j) Name the statutory certificates you know and state the purpose for which they have been issued.

## SECTION - B

*Answer any FIVE questions* (5 X 14 = 70 marks)

2. Draw the midship section of a Bulk carrier and label all parts.

3. Discuss various Global stresses experienced by a ship.

4. Explain the plating system for the shell of a ship with a sketch.

5. Draw a Collision bulkhead and explain its significance for the ship's operation.

6. What is the role of a classification surveyor when building a ship.

7. Discuss various types of Gas tankers you know with sketches.

8. Explain the process of registering a ship.

*******

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs**
**Date: 30.06.2014**

**Max Marks : 100**
**Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**

**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2 \times 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

P. (34)

**INDIAN MARITIME UNIVERSITY**
**(A Central University, Government of India)**

B.Tech. (Marine Engineering )
Semester – II – December 2015 End Semester Examinations

Mathematics - II
Subject Code: UG11T2202/UG11T1202

Time: 3 Hours | Max Marks: 100
Date: 10.12.2015 | Pass Marks: 50

## PART –A

**Compulsory question** **(3 x 10=30 Marks)**

1 (a) Find the Fourier coefficients $a_0$ for the function

$$f(x) = |\sin x|$$

(b) Use first shifting property to find the Laplace transform of the following function:

$$f(t) = e^{2t} \sin 3t$$

(c) Solve the separable equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$.

(d) Find inverse Laplace transform of $\frac{2s-3}{s^2+4s+13}$.

(e) Calculate the complimentary function for the differential equation

$$(D^2 - 7D + 12)u(x) = 0.$$

(f) Derive the conditions for the equation $Mdx + Ndy = 0$ to be exact.

(g) Let A and B are two mutually exclusive events of an experiment. If $P(\overline{A}) = 0.65$, $P(AUB) = 0.65$ and $P(B) = p$, find $p$.

(h) A random variable x has the following probability function

| x: | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| P(x): | 0.1 | k | 0.2 | 2k | 0.3 | k |

Find the value of k and calculate the mean.

(i) If a random variable has a Poisson distribution such that P(1)=P(2), find (i) the mean of the distribution.

(j) Write down the Pearson's constants $\beta_1, \beta_2, \gamma_1, \gamma_2$ for Binomial distribution in terms of $n, p, q$.

## PART – B

**Answer any five questions** **(5 x 14=70 Marks)**

2 (a) Expand the Fourier series for the following function

$$f(t) = \begin{cases} 0, -\pi \le t < 0 \\ 1, 0 < t \le \pi \end{cases}.$$

(b) Find the Fourier series for the function $f(x) = e^{-x}, 0 < x < 2\pi$ (7+7 Marks)

3 (a) Use Laplace transform to evaluate the integral $\int_0^{\infty} e^{-3t} t \sin t dt$

(b) Solve the initial value problem $\frac{d^2x}{dt^2} - 6\frac{dx}{dt} + 9x = t^2 e^{-3t}$, $x(0) = 2, x'(0) = 6$

( 6+8 Marks)

4 (a) Solve the differential equation $(x^4 + y^4)dx - xy^3 dy = 0$

(b) Find the complete solution (CS) for the differential equation

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = x^2 e^{3x}$$

( 6+8 Marks)

5 (a) Solve by the method of variation of parameters

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$$

(b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current $i$ amperes at time $t$ is given by $L\frac{di}{dt} + Ri = E$. Use method of integrating factor to find $i(t)$ with $E = 10\sin t$, while the initial condition is $i(t) = 0$ at $t = 0$.

(8+6 Marks)

6 (a) A married couple appeared for interview for two vacencies. The probability of husband's selection is 1/6 and that of wife's selection is 2/5. What is the probability that (i) both of them be selected (ii) only one of them selected (iii) none of them will be selected.

(b) An item is manufactured by three factories A, B, and C. The number of such items produces by the three factories are 2x, x, and x respectively. It is known that 2% of the items produced by A and B are defective while 4% of the items produced by C are defective. All these units are put together in one stockpile and one unit is chosen at random from this stockpile. It is found that the item is defective. Calculate the probabilities of this defective unit came from A, B, or C.

(6+8 Marks)

7 (a) Obtain the moment generating function for

$$f(x) = \begin{cases} x, 0 \le x < 1 \\ 2 - x, 1 \le x < 2 \\ 0, otherwise \end{cases}$$

(b) The probability that a bomb dropped from a fighter jet will strike the target is 1/5. If six bombs are dropped, find the probability that (i) exactly two will strike the target and (ii) at least two will strike the target.

(7+7 Marks)

8 (a) The probability density $p(x)$ of a continuous random variable is given by $p(x) = y_o e^{-|x|}, -\infty < x < \infty$. Find $y_0$, mean and the variance of the distribution.

(b) The mortality rate for a certain disease is 6 per 1000. What is the probability for just four deaths from that disease in a group of 400 ?

(7+7 Marks)

*****

# INDIAN MARITIME UNIVERSITY

(A CENTRAL UNIVERSITY, GOVT. OF INDIA)

## SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS

## MATHEMATICS - II (T 2202)

**(AY 2013-14 batch onwards)**

**Time:- 3 Hrs** **Max Marks : 100**
**Date: 20.06.2014** **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. a) Find the Fourier Coefficients $a_0$ $a_n$ of the function. $f(x) = \begin{cases} 0, & -5<x<0 \\ 3, & 0<x<5 \end{cases}$

   b) A random variable X has the following pdf. $f(x) = \begin{cases} cx^2, & 0\le x\le 1 \\ 0,, & elsewhere \end{cases}$

   Find (i) C, (i) P $(0 \le x \le \frac{1}{2})$

   c) If 20% of the articles produced by a machine are defective, determine the probability that out of the 4 articles chosen at random less than 2 articles will be defective.

   d) If the chance of being killed by flood during a year is $\frac{1}{3000}$, use Poisson distribution to calculate probability that out of 3000 persons living in a village, at least one will die in flood in a year.

   e) If f(t) = $\begin{cases} 1 & if\ 0<t<2 \\ 2 & if\ t>2 \end{cases}$ Find the Laplace transform of f(t)

   f) $If\ L\{f(t)\} = \frac{p^2 - p + 1}{(2p+1)^2(p-1)}$, apply the change of scale property to show that $L\{f(2t)\} = \frac{p^2 - 2p + 4}{4(p+1)^2(p-2)}$

   g) Find $L^{-1}\left(\frac{1}{4s^2+9}\right)$

   h) Solve : $(x^2 + y^2 + 2x)dx + xydy = 0$

   i) Find the particular integral of the differential equation $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = x^2e^{3x}$

   j) Find the wronskian of the differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \frac{e^x}{1+e^x}$ in course of solving it by method of variation of parameters.

**PART - B** **(5 X14 = 70 Marks)**

**Answer Any Five of the following**

2. a) Find the Fourier Series for the function f(x) if

$$f(x) = -\pi, -\pi < x < 0$$
$$= x, 0 < x < \pi$$

Deduce that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+ \ldots\ldots = \frac{\pi^2}{8}$

b) Find the Fourier series of $f(x) = |x|$ in $-\pi < x < \pi$ Deduce that

$$\frac{1}{1^4}+\frac{1}{3^4}+\frac{1}{5^4}+\ldots+\frac{1}{(2n-1)^4}+\ldots\ldots to\,\infty = \frac{\pi^4}{96}$$ (6+8)

3. a) Three identical boxes I, II and III contain respectively 4 white and 3 red balls, 3 white and 7 red balls, 2 white and 3 red balls. A box is chosen at random and a ball is drawn out of it. If the ball is found to be white, what is the probability that box II is selected.

b) A continuous r.v. x has the p.d.f.

$$f(x)=\frac{x}{2},\quad 0\le x\le 1$$
$$=\frac{1}{2},\quad 1<x\le 2$$
$$=\frac{3-x}{2},\quad 2<x\le 3$$

Find (i) mean of x (ii) variance of x. (7+7)

4. a) A discrete r.v.x has the mean 6 and variance 2. Assuming the distribution is Binomial, find the probability that $5 \le X \le 7$.

b) the length of the life of a tyre manufactured by a company follows a continuous distribution given by the density function. $f(x)=\begin{cases}\frac{k}{x^3}, & 1000\le x\le 1500\\ 0, & elsewhere\end{cases}$

Find K and find the probability that a randomly selected tyre would function for at least 1200 hrs. (6+8)

5. a) Find the Laplace transform of a periodic function f(t) given by

$$f(t) = t \ for\ 0 < t < c$$
$$= 2c - t \ for\ c < t < 2c$$

b) Find the Laplace transform of $\int_0^t \int_0^t \int_0^t (u \sin u)\, du\, du\, du$ (6+8)

6. a) Find the inverse Laplace transform of $\dfrac{1}{(s-1)^2(s-2)^3}$ by Convolution theorem.

b) Solve by Laplace transform the equation $y''(t) + y(t) = 8 \cos t,$ where $y(0) = 1, \quad y'(0) = -1$ (6+8)

7. a) Solve the following differential equation (Any three)

(i) $\dfrac{dy}{dx} + \dfrac{y \log y}{x} = \dfrac{y(\log y)^2}{x^2}$

(ii) $(1+x)^2 \dfrac{d^2y}{dx^2} + (1+x)\dfrac{dy}{dx} + y = Sin2\{\log(1+x)\}$

(iii) $(D^2 - 4D + 3)y = 2xe^{3x} + 3e^x \cos 2x$

(iv) $x(x-y)\, dy + y^2 dx = 0$

b) Apply the method of variation of parameters to solve the equation

$D^2 - 2D + 1)y = e^x \log x \ \ where D \equiv \dfrac{d}{dx}$ (3x3+5)

8. a) Solve the equation $L\dfrac{di}{dt} + Ri = E_0 Sin\ wt$ Where L, R, $E_0$ are constants and discuss the case when t increases indefinitely.

b) Solve : $(x^7 y^2 + 3y)dx + (3x^8 y - x)dy = 0$ (7+7)

9. a) Expand $f(x) = x \sin x$ in Fourier series in the interval $0 < x < 2\pi$

b) The overall percentage of failures in a certain examination is 40. What is the probability that out of a group of 6 candidates at least 4 passed the examination. (8+6)

*********

# INDIAN MARITIME UNIVERSITY
## (A Central University)
## B.TECH (MARINE ENGINEERING)
## DEC 2014 / JAN 2015 SEMESTER EXAMINATIONS
## II SEMESTER
# MATHEMATICS II (T 2202 / T 1202)

Time: 03.00 Hrs

Date: 06-12-2014

Max Marks: 100

Pass Marks: 50

**PART –A (3 x 10=30 Marks)**
**(Compulsory questions)**

1 (a) Find the Fourier coefficient $a_0$ for the function $f(t) = t - t^2, -\pi \le t \le \pi$.

(b) Show that $L[t^2 f''(t)] = s^2 F''(s) + 4sF'(s) + 2F(s)$, where $L[f(t)] = F(s)$.

(c) Transform the following equation into variable separable form

$(x+1)\frac{dy}{dx} + 1 = 2e^{-y}$ and find its solution.

(d) Evaluate $L^{-1}\left\{\frac{s^2 + 3s + 7}{s^3}\right\}$.

(e) Calculate the Fourier coefficient $b_1$ of the function $f(x) = e^{-x}, 0 < x < 2\pi$.

(f) Using Laplace transform evaluate the integral $\int_0^\infty e^{-2t}\cos 3t\,dt$.

(g) A can hit a target 3 times in 5 shots, B can hit 2 times in 5 shots and C can hit 3 times in 4 shots. They fired a volley. What is the probability that 2 shots hit?

(h) A discrete random variable X has the probability density function $p(x) = 2^{-x}$, $x = 1,2,3,\ldots$ calculate its moment generating function.

(i)The probability that a pen manufactured by a company will be defective is 1/10. If 12 Such pens are manufactured, find the probability of at least two will be defective.

(j) Solve the differential equation $\frac{d^2y(t)}{dt^2} - 6\frac{dy(t)}{dt} + 9y(t) = 0$.

**PART – B (5 x 14 = 70 Marks)**
**(Answer any five questions)**

2 (a) Develop the Fourier series for $f(x) = x\,Sin(x),\ 0 < x < 2\pi$.

(b) Find the *cosine series* for the function $f$ defined by

$$f(x) = \begin{cases} x, 0 \le x \le L/2 \\ L - x, L/2 \le x \le L \end{cases}$$ 7+7

3 (a) Use Convolution theorem to calculate the inverse Laplace transform, $L^{-1}\left[\frac{1}{s^2(s-2)}\right]$

(b) Solve the initial value problem $\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^t,\ x(0) = 2, x'(0) = -1$ 7+7

4 (a) Solve the equation $y(xy + 2x^2y^2)dx + x(xy - x^2y^2)dy = 0$
(b) In an LCR circuit, an inductance L of one Henry, resistance of 6 ohm, and condenser of 1/9 Farad have been connected through a battery of emf $E = Sin(t)$. If the current I, and the charge Q are both zero at $t = 0$, find the charge Q and the current I. 6+8

5 (a) Solve by the method of variation of parameters, $\frac{d^2y}{dx^2} - y = \frac{2}{(1 + e^x)}$
(b) Use method of undetermined coefficients to solve the following differential Equation $\frac{d^2u(x)}{dx^2} + u(x) = x^2$. 8+6

6 (a) Solve the non-homogeneous equation $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{-2x}\sin 2x$
(b) There are four sections in a class (sections I, II, III and IV). The percentage of weak students in four sections are 12, 20, 13, and 17 respectively. A school inspector, on a visit to the school, choose one of the sections at random. What is the probability that he choose a weak student? If the inspector choose a weak student what are the probabilities that the student belongs to individual sections? 7+7

7 (a) The probability that an entering student will graduate is 0.4. Calculate the probability that out of 5 students (a) none (b) one (c) at least one will graduate.
(b) A random continuous variable X has the following probability density function:

$$f(x) = \begin{cases} ax(2 - x), 0 \le x \le 2 \\ 0, otherwise \end{cases}$$

Calculate the values of $a$, mean, mode, median and $\sigma^2$. 5+9

8 (a) If the probability of a bad reaction from certain injection is 0.001, determine the probability that out of 2,000 individuals more than two will get a bad reaction (use Poison's distribution).
(b) A die is tossed thrice. A success is "getting 1 or 6" on a toss. Find the mean and variance of the number of success. 7+7

9 (a) A random discrete variable X has the following probability function

| X : | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| P(X): | 0 | k | 2k | 2k | 3k | $k^2$ | $2k^2$ | $7k^2+k$ |

Find (i) the value of k (ii) the probabilities P(X<6) and P(X$\geq$ 6).
(b) Use second shifting property and unit step functions to calculate the Laplace transform of the function

$$f(t) = \begin{cases} 0, 0 < t < 1 \\ t^2, 1 < t < 2 \\ 0, t > 2 \end{cases}$$

7+7

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs** | **Max Marks : 100**
**Date: 30.06.2014** | **Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

   (b) What is *non-reversible* machine? Give one example.

   (c) The mean torque in a propeller shaft is $2 x 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

   (d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

   (e) For a body in simple harmonic motion what is amplitude?

   (f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

   (g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

   (h) Give one example of a band brake used on a ship

   (i) What is functional difference between a governor and a flywheel?

   (j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY
## (A CENTRAL UNIVERSITY, GOVT. OF INDIA)

**SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS**

**ENGINEERING MECHANICS - II (T 1206)**

**(AY 2009-10 to 2012-13 batches only)**

**Time:- 3 Hrs**
**Date: 30.06.2014**

**Max Marks : 100**
**Pass Marks : 50**

---

**PART - A** **(3 X10 = 30 Marks)**
**Compulsory Questions**

1. (a) State the laws of sliding friction

(b) What is *non-reversible* machine? Give one example.

(c) The mean torque in a propeller shaft is $2 \times 10^5$ Nm when running at 140 rev/min. Find the power transmitted.

(d) If a rolling wheel is moving at $v$ m/s and rotating at $\omega$ rad/s; what is the total kinetic energy?

(e) For a body in simple harmonic motion what is amplitude?

(f) The tension in the two sides of a belt are 500 N and 400 N respectively. If the speed of the belt is 50 m/s, find the power transmitted by the belt.

(g) For a belt drive where = , what is $\mu$ ? And what is $\beta$ ?

(h) Give one example of a band brake used on a ship

(i) What is functional difference between a governor and a flywheel?

(j) Find the height (vertical distance between the center of a flyball and pivot) of a Watt governor running at 100 rpm.

**PART - B** **(5 X14 = 70 Marks)**
**Answer Any Five of the following**

2. A rectangular block of mass M rests on a floor. The coefficient of friction between the block and floor is $\mu$. What is the highest position for a horizontal force P that would permit it to just move the block without tipping? (14)

3. The radius of gyration of the flywheel of a shearing machine is 0.46 m and its mass is 700 kg. Find the kinetic energy stored in it when running at 120 rpm. If the speed falls to 100 rpm during the cutting stroke, find the kinetic energy given out by the wheel (14)

4. A 5 kg mass is hung on the end of a helical spring and is set vibrating vertically. The mass makes 2 oscillations per second. Determine the stiffness of the spring. (14)

5. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 200 rpm. The coefficient of friction between the pulley is 0.2, angle of lap $160^{\circ}$ and the maximum tension in the belt is 2.5 KN. (14)

6. The torque to overcome frictional and other resistance of a turbine is 320 Nm, and may be considered as constant for all speeds. The mass of the rotating parts is 1.6 t and the radius of gyration is 0.7 m. If the gas is cut off when the turbine is running free of load at 1900 rpm, find the time it will take to come to rest and the number of revolutions turned during that time. (14)

7. The links of a Porter governor are each 240 mm long. The mass of the central load and sleeve is 15 kg and the mass of each bob is 2 kg. When the governor rotates at a maximum speed the links make an angle of $60^{\circ}$ to the vertical. Calculate (14)
   (i) the maximum speed and
   (ii) the change in height when the speed falls to 200 rpm.

8. A wheel increases its speed from 50 rpm to 100 rpm in 30 seconds. Find
   (a) angular acceleration of the wheel; and
   (b) no. of revolutions made by this wheel in 30 seconds.
   (14)

*********

# INDIAN MARITIME UNIVERSITY

**(A Central University)**

**B.Tech (MARINE ENGINEERING)**

**DEC 2014 / JAN 2015 SEMESTER EXAMINATIONS**

**II SEMESTER**

**STRENGTH OF MATERIALS - I( T -2204 / T 1204)**

**Time: 03.00Hrs** **Max Marks: 100**

**Date: 11-12-2014** **Pass Marks: 50**

## Part - A ($3\times10=30$ Marks)

### Compulsory Question

1. a) What is Modulus of Rigidity?

   b) Explain Shear Stress and Shear Strain.

   c) Write down the bending equation and explain its terms.

   d) Explain Poisson's Ratio.

   e) What is point of contra flexure?

   f) What is Proof Resilience and Modulus of Resilience?

   g) What is Bulk Modulus of elasticity?

   h) What is stiffness of a closed-coil Helical spring?

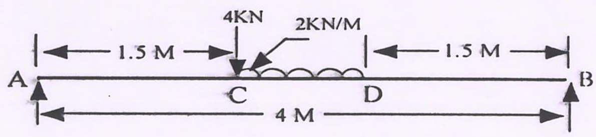
   i) What is neutral axis and why there is no stress at this section?

   j) What is hoop stress and Longitudinal Stress of a thin cylinder under internal Pressure?

## Part - B ($5\times14=70$ Marks)

### Answer Any Five of the following

2. Determine a relation between Modulus of elasticity and Modulus of Rigidity. Derive a relation for the volumetric strain of a body.
3. A simply supported beam AB, 4m long is carrying load as shown in the diagram. Draw shear force and bending moment diagram for the beam.




4. a) Prove that $\dfrac{T}{J}=\dfrac{\tau}{r}=\dfrac{G\theta}{L}$ in case of torsion of a cylindrical shaft. Notions have their usual meanings.

b) A solid steel shaft has to transmit 100KW at 160 rpm. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceed the mean by 20%. 6

5. a) Derive an expression of strain energy under gradual loading. 7

b) Calculate the strain energy stored in a Bar 2 m long 50 mm wide and 40 mm thick. When it is subjected to tensile load of 60 KN. Take Young Modulus as 200 GPa. 7

6. a) Write down the advantages and disadvantages of welded joints. Explain the various types of welded joints. 7

b) What do understand by the term strength of a welded joint? Give the relation for the same. 7

7. a) Prove that $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$. Notions have their usual meaning. 7

b) A copper wire of 2 mm diameter is required to be wound around a drum. Find the minimum radius of the drum, if the stress in the wire is not to exceed 80 MPa. Take modulus of elasticity of copper as 100 GPa. 7

8. a) Derive an expression of spring stiffness of a closely coiled helical spring subjected to axial load. 7

b) Draw the shear force and bending moment diagram of a cantilever beam subjected to a concentrated load at the free end. 7

==========================================================================

**PART – B** **(5 x 14 = 70 Marks)**

**Answer Any Five of the following**

2. a) A circular bar of metal has a diameter $d_1$ at one end which tapers uniformly to a diameter $d_2$ at the other end. Find the elongation of the bar under an axial pull P. Take the length of the bar as L and the modulus of elasticity as E. (7M)

b) A steel bar 25 mm diameter is rigidly attached to two parallel supports 8m apart. Find the pull exerted by the bar on the support when the temperature is increased by $100^0$C. (a) If he support do not yield (b) if the yielding of both supports is 2.5 mm.

$\alpha_s = 12 \times 10^{-6} \,/^{\circ}c$ $E_s = 210\ GPa$ (7M)

3.a) A steel rod 20 mm is passed through a brass tube 25 mm internal diameter and 30 mm external diameter. The tube is 800 mm long and is closed by thin rigid washers and fastened by nuts, screwed to the rod. The nuts are lightened until the compressive force in the tube is 5 KN. Calculate the stresses in the rod and in the tube.

Take $E_s$ = 200 GPa and $E_b$= 80 GPa. (7M)

b) An unknown weight falls through a height of 10mm on a collar rigidly attached to the lower end of a vertical bar 5000 mm long and 600 $mm^2$ section. If the maximum extension of the rod is to be 2 mm. What is the corresponding stress and magnitude of the unknown weight? Take E = 2.0 x $10^5 N/mm^2$. (7M)

4. a) A beam 10 m long and simply supported at each end, has a uniformly distributed load of 1000 N/m extending from the left end up to the centre of the beam. There is also an anti-clockwise couple of 15 KNm at a distance of 2.5 m from the right end. Draw the S.F and B.M diagrams. (10M)

b) How will you draw the S.F and B.M diagrams for a beam which is subjected to inclined loads? (4M)

5. a) Define expression for circumferential stress and the longitudinal stress for a thin steel subjected to an internal pressure. (7M)

b) The air vessel of a torpedo is 530 mm external diameter and 10 mm thick, the length being 1830 mm. Find the change in the external diameter and the length when charged to 10.5 $N/mm^2$ internal pressure. Take E = 2.1 x $10^5$ $N/mm^2$ and Poisson's ratio = 0.3. (7M)

# INDIAN MARITIME UNIVERSITY

B.Tech (MARINE ENGINEERING)
June 2013 Examinations

SECOND SEMESTER

## STRENGTH OF MATERIALS I

**Old Subject Code: UG/ME/BS/T/124** **QP Code: T0511204**
**Date: 15.06.2013** **Max. Marks: 100**
**Time: 3 Hrs**

**PART- A** **(3 x 10 = 30 Marks)**

**Compulsory Question**

1)

(a) State Hooke's Law. Sketch the typical stress strain curve for ductile material.

(b) Define resilience, proof resilience and modulus of resilience.

(c) Obtain the relationship between load intensity, shear force and bending moment.

(d) Draw the S.F and B.M diagrams cantilever of length L carrying a uniformly distributed load of per m length over its entire length.

(e) Why the wire winding of thin cylinders is used?

(f) Define thin cylinders. Name the stresses set up in a thin cylinder?

(g) Find the expression for the strength of a simple lab weld joint. What do you mean by simple bending?

(h) Sketch the variation of bending stress in a rectangular section.

(i) Show that the shear stress varies linearly from the axis to the surface, when a circular shaft is subjected to torsion.

(j) Define the term 'polar modulus'. Find the expressions for the polar modulus for a solid shaft and a hollow shaft.

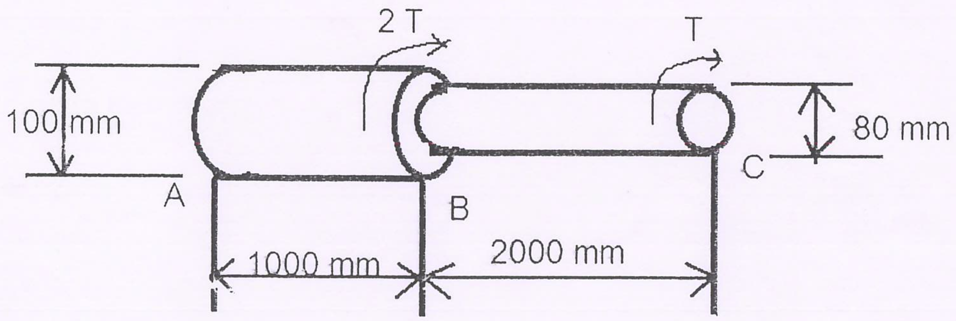
7

6. a) State the assumptions made in the theory of simple bending. (4M)

b) Define the expression for the bending stress and the radius of curvature for a straight beam subjected to pure bending. 10 M)

7. a) Internal diameter of a hollows shaft is two-third of its external diameter. Compare its resistance to torsion with that of a solid shaft of the same weight and material. (7M)

b) A stepped steel shaft is subjected to a torque T at the free end and a torque 2T at the junction of the two sizes as shown in figure. Find the total angel of twist at the free end, if the maximum shear stress in the shaft material is limited to 70 N/mm2. Take the modulus of rigidity as $0.8 \times 10^5$ N/mm$^2$. (7M)




8. a) Find the expression for strain energy stored in a body due to torsion. (7M)

b) A closely coiled helical spring of mean diameter 20 mm is made of 30 mm diameter rod has 16 turns. A weight of 3KN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 180 mm. Take C = $8 \times 10^4$ N/mm$^2$. (7M)

*****

# INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

## STRENGTH OF MATERIALS - I
SEMESTER – II, B.TECH(MARINE ENGINEERING): DEC/JAN 2013-14
SUBJECT CODE: T 1204
(AY 2009-10 to 2012-13 batches only)

Date: 06.01.2014

Time: 3 Hrs
Maximum Marks:100
(Weightage 70%)

## SECTION - A

**Compulsory Questions** (3 X10=30)

1.

a. Explain 'Factor of Safety' and 'Poisson's Ratio'. **(3 Marks)**

b. A steel rod having cross-section 15 X 25 $mm^2$ is to carry an axial load of 200 KN (tensile). Calculate the length of the steel rod if the extension of the rod is 0.069 mm. Given the modulus of Elasticity, $E=2.14 \times 10^8$ $KN/m^2$. **(3 Marks)**

c. Explain the 'Point of Inflexion'. **(3 Marks)**

d. Write the Bending stress equation and explain the terms. What is Neutral Axis (N.A.)? **(3 Marks)**

e. Draw the S.F. and B.M. diagrams for a simply supported beam of length 'l' having a load 'p' applied at the midpoint of the length. **(3 Marks)**

f. Show that the Hoop stress is twice the Meridional stress in a thin cylinder? **(3 Marks)**

g. A tube made of steel has a diameter of 80 mm and thickness 2.5 mm. Calculate the maximum internal pressure if the allowable stress of steel is 380 $MN/m^2$. **(3 Marks)**

h. A 6 mm diameter Aluminum wire is twisted through one complete revolution without exceeding a shearing stress of 43$MN/m^2$. Find it's modulus of rigidity if the length is 12.30m. **(3 Marks)**

i. What is 'load factor' and what is 'impact factor'? **(3 Marks)**

j. A steel bar 10 cm X 10 cm cross-section, 16 m long is subjected to an axial load of 150 KN. Taking E= 210 GN/m$^2$ calculate the strain energy.

**(3 Marks)**

## SECTION – B

**Answer any five of the following** **(14 X 5 =70 Marks)**

2. A mild steel bar of section 20 X 40 mm and length 400 mm is subjected to an axial tensile load of 120 KN as shown in the figure 1. If E=208 GN/m$^2$, what will be the changes in length, breadth and thickness of the bar? Given the Poisson's ratio=0.3. **(14 Marks)**

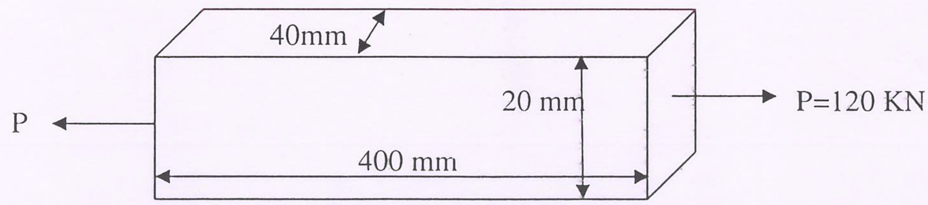



Fig. 1.

3. A uniform rod has a cross-section of 10 cm$^2$ and length of 3m with elastic limit 160 MN/m$^2$. What will be its proof resilience? Determine also the maximum value of an applied load which may be suddenly applied without exceeding elastic limit. Calculate the value of gradually applied load which will produce the same extension as that produced by the suddenly applied load above.

**(14 Marks)**

4. A Cantilever of length 4m is loaded as shown in the figure 2. Find the bending moment at B and A. Draw the S.F. and B.M. diagrams for the same.

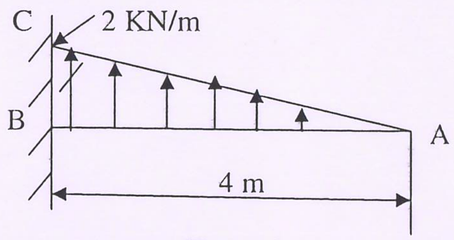


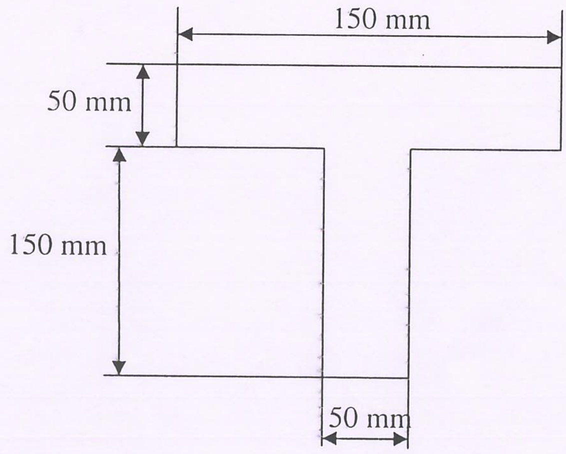

Figure 2

5. A Boiler shell is to be made of 25 mm thick plate having an allowable tensile stress of 120 MN/m$^2$. Determine :
   a) Maximum permissible diameter of the shell for an internal pressure of 2.2 MN/m$^2$ when the circumferential and longitudinal efficiencies are 100 % for the joints.

b) Permissible intensity of internal pressure when the shell diameter is 2.5 m. The circumferential efficiency is 45 % while the longitudinal efficiency is 85 % for the joints. **(14 Marks)**

6. Two shafts of the same material and same length are subjected to the same torque. If the first shaft is of a solid circular section and the second shaft is a hollow circular section whose internal diameter is 2/3 of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the two shafts. **(14 Marks)**

7. A Beam having cross-section as shown below in the figure 3, is subjected to a bending moment of 3.5 KNm. Find the Tensile and the compressive stresses (at extreme fibres) developed in the beam. What will be the bending stress at a distance of 10 mm from the neutral axis? **(14 Marks)**




8. A cylindrical shell is 2.5 m long, internal diameter is 0.8 m wall thickness 12 mm has an internal fluid pressure 1.5 $MN/m^2$. Calculate the Hoop stress and Meridional stress. Also calculate the change in length, diameter and Volume. Given $E=200\ GN/m^2$, Poission's Ratio 0.3. **(14 Marks)**

********

# INDIAN MARITIME UNIVERSITY

**(A Central University)**
**B.Tech (MARINE ENGINEERING)**
**DEC 2014 / JAN 2015 SEMESTER EXAMINATIONS**
**II SEMESTER**

**STRENGTH OF MATERIALS - I( T -2204 / T 1204)**

**Time: 03.00Hrs** **Max Marks: 100**

**Date: 11-12-2014** **Pass Marks: 50**

## Part - A ($3\times10=30$ Marks)

### Compulsory Question

1. a) What is Modulus of Rigidity?

   b) Explain Shear Stress and Shear Strain.

   c) Write down the bending equation and explain its terms.

   d) Explain Poisson's Ratio.

   e) What is point of contra flexure?

   f) What is Proof Resilience and Modulus of Resilience?

   g) What is Bulk Modulus of elasticity?

   h) What is stiffness of a closed-coil Helical spring?

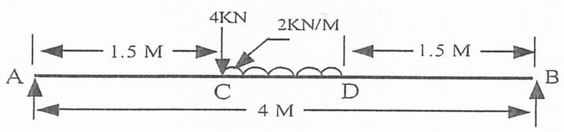
   i) What is neutral axis and why there is no stress at this section?

   j) What is hoop stress and Longitudinal Stress of a thin cylinder under internal Pressure?

## Part - B ($5\times14=70$ Marks)

### Answer Any Five of the following

2. Determine a relation between Modulus of elasticity and Modulus of Rigidity. Derive a relation for the volumetric strain of a body.
3. A simply supported beam AB, 4m long is carrying load as shown in the diagram. Draw shear force and bending moment diagram for the beam.




4. a) Prove that $\frac{T}{J}=\frac{\tau}{r}=\frac{G\theta}{L}$ in case of torsion of a cylindrical shaft. Notions have their usual meanings. 8

b) A solid steel shaft has to transmit 100KW at 160 rpm. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceed the mean by 20%. 6

5. a) Derive an expression of strain energy under gradual loading. 7

b) Calculate the strain energy stored in a Bar 2 m long 50 mm wide and 40 mm thick. When it is subjected to tensile load of 60 KN. Take Young Modulus as 200 GPa. 7

6. a) Write down the advantages and disadvantages of welded joints. Explain the various types of welded joints. 7

b) What do understand by the term strength of a welded joint? Give the relation for the same. 7

7. a) Prove that $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$. Notions have their usual meaning. 7

b) A copper wire of 2 mm diameter is required to be wound around a drum. Find the minimum radius of the drum, if the stress in the wire is not to exceed 80 MPa. Take modulus of elasticity of copper as 100 GPa. 7

8. a) Derive an expression of spring stiffness of a closely coiled helical spring subjected to axial load. 7

b) Draw the shear force and bending moment diagram of a cantilever beam subjected to a concentrated load at the free end. 7

==================================================================

**INDIAN MARITIME UNIVERSITY**

**(A Central University, Government of India)**

**East Coast Road, Uthandi, Chennai-600 119.**

**B.Tech. (MARINE ENGINEERING)**

**December 2012 Examinations**

**SECOND SEMESTER EXAMINATION**

**Mathematics -II**

**Old Sub Code: UG/ME/BS/T/122** **QP Code: T0511202**

**Date: 22.12.12** **Max Marks: 100**

**Time : 3 Hrs**

**PART- A ($3 \times 10 = 30$ Marks)**

**Compulsory Question**

1) (a) Find $a_0$ for the Fourier series expansion of the following function

$$f(x)=\begin{cases}0, -\pi \le x \le 0\\ \sin x, 0 \le x \le \pi\end{cases}$$

(b) Calculate $b_1$ of the Fourier series expansion for the following function $f(x) = x\sin x\ ,\ 0 < x < 2\pi$.

(c) Find the Laplace transform of the following function $f(t) = t^2 e^{-2t}$

(d) Find the inverse Laplace transform of $\dfrac{3s}{s^2+2s-8}$

(e) Solve the differential equation $\left(x^2 - yx^2\right)\dfrac{dy}{dx} + \left(y^2 + xy^2\right) = 0$

(f) Evaluate the P.I. $y_p = \dfrac{1}{D^2-5D+6}e^{3x}$.

(g) Check the exactness of the equation $\left(x^2 - 4xy - 2y^2\right)dx + \left(y^2 - 4xy - 2x^2\right)dy = 0$ and solve the equation.

(h) A bag contains 8 white and 6 red balls. Find the probability of drawing two white balls.

(i) Find the value of $k$ when a random variable $x$ has the following probability function :

| Values of $x$ | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| $p(x)$ | 0.1 | k | 0.2 | 2k | 0.3 | k |

(j) The probability that a pen manufactured by a company will be defective is 0.1. If 12 such pens are manufactured, find the probability that exactly two will be defective.

**PART-B ($5 \times 14 = 70$ Mark)**
**Answer any five of the following**

2) (a) Find the *cosine series* for the function $f$ defined by

$$f(x) = \begin{cases} x, 0 \le x \le L/2 \\ L - x, L/2 \le x \le L \end{cases}$$

(b) Find the Laplace transform form of $f(t) = te^{3t} \sin t$ (8+6)

3) (a) Expand in Fourier series the function $f$ defined by

$$f(x) = \begin{cases} 0, -\pi \le x < 0 \\ 1, 0 \le x \le \pi \end{cases}$$

and hence deduce the series $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \cdots = \frac{\pi}{4}$.

(b) Use Laplace transform to solve the following differential equation

$$\frac{d^2 y}{dt^2} + 2\frac{dy}{dt} + 5y = e^{-t} \sin t, y(0) = 0, y'(0) = 1$$ (7+7)

4) Solve the following differential equations :

(i) $3e^x \tan y dx + (1 - e^x)\sec^2 y dy = 0$ (ii) $(3x^2 + 6xy^2)dx + (6x^2 y + 4y^3)dy = 0$

(iii) $(x+1)\frac{dy}{dx} - y = e^{3x}(x+1)^2$ (iv) $x^2 \frac{du}{dx} - u = 2\sin(1/x)$ $\left(4 \times 3\frac{1}{2}\right)$

5) (a) Solve the differential equation $\frac{d^2 y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{-2x} Sin2x$.

(b) Using method of variation of parameters to solve the following equation

$$\frac{d^2 y(x)}{dx^2} - 6\frac{dy(x)}{dx} + 9y(x) = \frac{e^{3x}}{x^2}$$ (7+7)

6) (a) In a bolt factory, machines A, B and C manufactured 25%, 35% and 40% of the total. Of their output 5%, 4% and 2% are defective bolts. A bolt is drawn at random from the product and is found defective. What are the probabilities that it was manufactured by the machines A, B or C ?

(b) A continuous probability distribution function is defined as

$f(x) = ax(2-x), 0 \le x \le 2$

Calculate the values of $a$, the mean, mode and the median of the distribution. (7+7)

7) (a) Obtain the moment generating function for

$$f(x) = \begin{cases} x, 0 \le x < 1 \\ 2 - x, 1 \le x < 2 \\ 0, otherwise \end{cases}$$

(b) In a Binomial distribution, $P(x) = {}^nC_x p^x q^{n-x}$, derive the recurrence relation

$$P(x+1) = \left(\frac{n-x}{x+1}\right)\left(\frac{p}{q}\right)P(x)$$

(7+7)

8) (a) Five unbiased coins are tossed and number of heads are noted. The experiments are done 64 times and the following frequency distributions are obtained :

| No. of heads | 0 | 1 | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|---|---|
| Frequencies | 3 | 6 | 24 | 26 | 4 | 1 | 64 |

Find the corresponding Binomial frequency distribution.

(b) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poison distribution with mean 1.5. Calculate the proportion of days (i) on which there is no demand and (ii) on which demand is refused. (7+7)

*******

(d) $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$ ( 3 ½ + 3 ½ + 3 ½ + 3 ½ Marks)

6. In a bolt factory, machines A,B and C manufacture 25%, 35% and 40% of the total. Of their output 5%, 4% and 2% are defective bolts. A bolt is drawn at random from the product and is found to be defective what the probabilities that it was manufacture are by machines A, B or C. (14 Marks)

7. A continuous distribution of a variable x in the range (-3, 3) is defined as

$$\begin{aligned} f(x) &= \frac{3}{16}(3+x)^2 \qquad -3 \le x < -1 \\ &= \frac{3}{16}(2-6x^2) \qquad -1 \le x < 1 \\ &= \frac{3}{16}(3-x)^2 \; 1 \le x \le 3 \end{aligned}$$

Verify that the area under the curve is unity. Show that the mean is zero (14 Marks)

8 a. A sortie of 20 aeroplanes is sent on an operational flight. The chances that an aeroplane fails to return are 5%. Find the probability that (i) One Plane does not return (ii) at most 5 planes do not return.

b. A certain screw making machine, produces on an average of 2 defective screws out of 100, and packs them in boxes of 500. Find the probability that a box contains 15 defective screws. (7+7 Marks)

6 a. Solve $x^4 \frac{dy}{dx} + x^3 y + \text{Cosec}(xy) = 0$

b. Solve $\left(1 + e^{\frac{x}{y}}\right) dx + e^{\frac{x}{y}}\left(1 - \frac{x}{y}\right) dy = 0$ (7+7 marks)

7 a. In a test, an examinee either guesses, or copies or knows the answer to multiple choice questions with four choices. The probability that he makes a guess is 1/3 and the probability that he copies the answer is 1/6. The probability that his answers is correct, given that he copied it is 1/8. Find the probability that he knew the answer to the question given that he correctly answered.

(7marks)

b. Find the probability distribution of the number of green balls drawn when three balls are drawn on by one without replacement from a bag containing three greens and five white balls.

(7marks)

8 a. The probability density p (x) of a continuous random variable is given by

$p(x) \quad = \quad y_o e^{-|x|} \; -\infty < x < \infty$

Prove that $y_o = \frac{1}{2}$. Find the mean and variance of the distribution.

b. A die is lossed thrice. A success is getting 1 or 6 on a toss. Find the mean and variance of the number of success.

(7+7 marks)

******************

# INDIAN MARITIME UNIVERSITY

(A CENTRAL UNIVERSITY, GOVERNMENT OF INDIA)

**B.TECH (MARINE ENGINEERING)**

DECEMBER2014/JANUARY END SEMSTER EXAMINATION

II SEMESTER

**COMPUTER SCIENCE (T 2205 / T 1205)**

Time: 03.00 Hrs | Max. Marks: 100

Date: 13-12-2014 | Pass Marks: 50

**Part A ($3 \times 10 = 30$ Marks)**

**Compulsory Questions**

1.

a) Differentiate between data and information.

b) What do you understand by secondary memory?

c) Subtract using 2's complement method

(i) 10101011 – 01111; (ii) 01111 – 10101011

d) What is booting? In very brief discuss boot-up sequence.

e) What is network topology? Discuss any one key network topology.

f) What are header files? Briefly discuss any one header files?

g) What will be the length of a variable if it is declared as int, float, double, char

h) How is an array represented in memory?

i) What will be output

```
Main()
{
        int  arr[ ] = {1,2,3,4,5};
        int *ptr, i;
        ptr = arr + 4;
        for (i=4; i>=0; i- -)
          printf("\n %d", *(ptr – i));
}
```

j) Find the out put

```
main( )
{       int i,j;
        clrscr();
        for(i=0;i<5;i++)
        {       printf("\n*");
                for(j=0;j<5;j++)
                {       if(i==0 || i==4)
                          printf("*");
                        else if(j==4)
                                printf("*");
```

```
else
        printf(" ");
    }
  }
}
```

**Part B (5×14 = 70 Marks)**

**Answer Any Five of the following**

2.
   a. Write a short note on the characteristics of a computer. 7
   b. How are signed numbers represented in the binary form? 7

3.
   a. How application software differs from system software? 7
   b. Differentiate between a MAN and a WAN 7

4.
   a. Define an algorithm. How is it useful in the context of software development? 7
   b. Write an pseudo code to count number of vowels in a text. 7

5.
   a. Write a short note on memory card 7
   b. What are optical input devices? Where are they used and for what purpose? 7

6
   a. Write a program to calculate simple interest and compound interest. (simple interest =(p*r*n)/100 & compound interest= ((p*(1+(r/100))t ; p = principal, r = rate, n& t = year) 7
   b. Explain the difference between declaration and definition 7

7.
   a. Define a function. Why they are needed. Differentiate between function declaration and function definition. 7
   b. Write a program to test if a given number is power of 2. 7

8.
   a. Write a program using pointers to insert a value in an array 10
   b. What is a null pointer? Give one example 4

9.
   a. Differentiate between structure and union 7
   b. Write a short note on memory hierarchy in computer system 7

# INDIAN MARITIME UNIVERSITY
(A Central University, Govt.of India)

May/June 2015 End Semester Examinations

SEMESTER – II, B.TECH ( MARINE ENGINEERING)

## SEAMANSHIP, ELEMENTARY NAVIGATION & SURVIVAL AT SEA (T 2201 / T 1201)

Date:04.06.2015 Max.Marks:100
Time:-3 Hrs Pass Marks:50

Note : 1. Section "A" Compulsory carry 10 X 3 = 30 marks answer any five questions.
2. Section "B" answer any **Five** questions carry equal marks (5 X 14 = 70 marks.)

**PART – A** **(3 x10 = 30 Marks)**
**(Compulsory Questions)**

01. Explain the following Terms :

| | | |
|---|---|---|
| (a) | Nautical Mile | (3) |
| (b) | Knot | (3) |
| (c) | Derrick | (3) |
| (d) | Bow | (3) |
| (e) | Chain / Cable | (3) |
| (f) | Storn | (3) |
| (g) | Free board | (3) |
| (h) | Mast | (3) |
| (i) | Cranes | (3) |
| (j) | Keel | (3) |

**PART – B** **(5 x14 = 70 Marks)**
**(Answer any five of the following)**

2. How do you man a vessel with crew / offices ? (14)

3. How is t he globe is divided with international time, what is GMT ? (14)

4. What is speed log ? Explain any one. (14)

5. Sketch and describe an "Anchor". (14)

6. With simple sketch describe various parts of a vessel. (14)

7. What do you understand by Navigation Bridge ? Describe any two Nautical instruments. (14)

8. What is Life Boat. Name various parts of a Life Boat. (14)

9. What is Rope work on a vessel ? Describe : (i) Moorings (ii) Heaving Line (iii) Pilot Ladder. (14)

**********

## INDIAN MARITIME UNIVERSITY

**(A Central University)**

## DEPARTMENT OF MARINE ENGINEERING

## B.TECH-MARINE ENGINEERING

## SEMESTER EXAMINATION-June 2011

**Course code:UG/ME/BS/T/123** **Sub.name: APPLIED THERMODYNAMICS-I**

**TIME : 3 hours** **Max.marks:100**

*Part A (3 × 10 = 30 Marks)*

***Answer all the Questions***

1.a)State Kelvin planck statement of second law of thermodynamics.

b) State carnot's theorem.

c) What is the function of Feed water heaters in the regenerative cycle with bleeding?

d) List the advantages of Reheating?

e)What do you mean by Hypothetical indicator diagram?

f)Define Clearance ratio.

g) What do you mean by perfect inter cooling in Compressors?

h) Why clearance is necessary and what is its effect on the performance of reciprocating compressor?

i)Define dew point temperature.

j)State Dalton's law of partial pressure.

*Part B (14 × 5 = 70 Marks)*

*Answer any five of the following*

2. A) Dry saturated steam at 100 bar expands isothermally and reversibly to a pressure of 10 bar. Calculate the heat supplied and the work done per kilogram of steam during the process. (8 Marks)

   B) Steam at 100 bar, 375$^0$C expands isentropically in a cylinder behind a piston to a pressure of 10 bar. Calculate the work done per kilogram of steam. (6 Marks)

3. A) Explain with block diagram and T-S diagram, the process of regenerative rankine cycle and how the efficiency of that cycle could be improved. (8 Marks)

   B) Dry saturated steam is supplied to a steam turbine at 12 bar and after the expansion its condenser pressure is 1 bar.Find the Rankine cycle efficiency, specific steam consumption. Neglect feed pump work. (6 Marks)

4. A) Explain modified Rankine cycle in steam engines. (7 Marks)

   B) Consider a steam power plant operating on an ideal reheat rankine cycle, the steam enters the H.P turbine at 30 bar and 350$^0$C.after expansion to 5 bar,the steam is reheated to 350$^0$C and then expanded the L.P turbine to the condenser pressure of 0.075 bar.determine the thermal efficiency of the cycle and the quality of the steam at the outlet of the L.P turbine. (7 Marks)

5. A) An air compressor receives air at 1.05 bar and 16$^0$c and compresses it to 9 bar. calculate the heat removed and work done per m$^3$ of air taken in the

cylinder when the air is compressed adiabatically,isothermally and polytropically ($PV^{1.3}$=C). (8 Marks)

B) Derive the expression for volumetric efficiency in compressors. (6 Marks)

6. A) A single acting air compressor compresses air from 1 bar to 7 bar,the clearance volume is 2 litres, the compression and expansion follows the law $PV^{1.3}$ = C. if the volumetric efficiency of a compressor is 85%.find the stroke volume and the cylinder dimensions. Assume diameter of the piston is equal to stroke. (8 Marks)

B) Explain Multi stage reciprocating air compressor with intercooler.(6 Marks)

7. Atmospheric air at 760 mm of Hg barometric pressure has 25°C dry bulb temperature and 15°C wet Bulb temperature.with the help of psychometric chart ,determine a)relative humidity b)humidity ratio c)dew point temperature d)enthalpy of air per kg of dry air e)partial pressure of vapour f)saturation pressure corresponding to dry bulb temperature of 25°C g)saturation pressure corresponding to the wet bulb temperature of 15°C h)volume of air/kg of dry air. (14 Marks)

8. An air conditioned room is to be maintained at 18°C, percentage saturation 40%,the fabric heat gains are 3000 W and there are a maximum of 20 people in the room at any time. Neglecting all other heat gains or losses, calculate the required volume flow rate of air to be supplied to the room and its percentage saturation when the air supply temperature is 10°C. (14 Marks)

# INDIAN MARITIME UNIVERSITY

(A Central University)

B.TECH (MARINE ENGINEERING)

DEC 2014 / JAN 2015 SEMESTER EXAMINATIONS

II SEMESTER

APPLIED THERMODYNAMICS – I (T-2203 / T 1203)

Time: 03.00 Hrs | Max. Marks: 100

Date: 09-12-2014 | Pass Marks: 50

## Part - A (3 x 10 = 30 Marks)

**ANSWER THE COMPULSORY QUESTION**

1. (a) State the different statements of Second Law of Thermodynamics..

(b) A reversible process should not leave an evidence to show that the process had ever occurred. Explain.

(c) All spontaneous processes are irreversible. Explain

(d) Define specific steam consumption or steam rate of an ideal Rankine cycle.

(e) State Amagat's Law of partial volume and Gibb's Dalton Law.

(f) Explain Regenerative feed heating in a steam cycle.

(g) What is perfect inter cooling in a multistage compressor?

(h) Explain free air Delivery of a compressor.

(i) What is Dry Bulb Temperature and Wet Bulb Temperature. Explain with a rough sketch of a psychrometric chart.

(j) Explain relative humidity and percentage saturation with respect to atmospheric air.

## Part – B (14 x 5 = 70 Marks)

**ANSWER ANY 5 FROM THE FOLLOWING QUESTIONS**

2. (a) Establish the general expression for the change in entropy of an ideal gas from the first law of thermodynamics (i) in terms of Volume and Absolute Temperature (ii) in terms of Pressure and Volume . (6Marks)

b) A mass of 5 kg air is compressed from.9 Bar , 32 $^{o}$ C to 6 bar in a polytrophic process $PV^{1.3}$ = Constant. Find the change in Entropy. (8Marks)

3. In a reheat cycle steam at550 $^0$C expands in an HP turbine till it becomes saturated vapour. It is reheated at constant pressure to 400 $^0$C and then expands in a LP turbine to 40 $^0$C. If the moisture content at turbine exhaust is given to be 14.67% , Find (a) the reheat pressure (b) the pressure of steam at inlet to the h.p. Turbine (c) the net work output/ kg and (d) the cycle efficiency. Assume all Processes to be ideal. (14Marks)

4. A quantity of steam at a pressure of 2.1 MN/m$^2$ and 0.9 dry occupies a volume of 0.427 m$^3$. It is expanded according to the law $PV^{1.25}$= Constant to a pressure of 0.7 MN/m$^2$. Determine
(a) the mass of steam present (b) the work transfer (c) the change in Internal Energy
(d) the heat exchange between the stem and the surroundings stating the directions of transfer. (14Marks)

5. The intake conditions of a single acting two stage air compressor running at 300 rpm are 0.98 bar and 305K. The delivery pressure is 20 bar. The intermediate pressure is 5 bar and the clearance volume of the low pressure compressor is 4 % of the stroke volume. The compressor delivers 3 m$^3$/min at bar, 25$^o$ C. Determine
(a) the power required to drive the compressor.
(b) the low pressure cylinder dimensions if L=D, and
(c) isothermal efficiency when the inter cooling is perfect and the index n=1.3 for compression and expansion in both the cylinders. (14Marks)

6. A rotary compressor has a pressure compression ratio of 5 to 1. It compresses air at the rate of 10 Kg/sec . The initial pressure and temperature are 100 KN/m$^2$ and 20$^0$ C respectively. The isentropic efficiency of the compressor is 0.85. Take $^{\gamma}$ = 1.4 and $C_p$ = 1.005 KJ/kgK.
Determine (a) the final pressure and temperature.
(b) the energy in Kilowatts required to drive the compressor (14 Marks)

7. A mixture is made up of 25% $N_2$, 35 % $O_2$ , 20 % $CO_2$ and 20 % CO by volume. Calculate
(a) the molar mass of the mixture.
(b) $C_p^{\sim}$ and $C_v^{\sim}$ for the mixture
(c) ẏ for the mixture
(e) the partial pressure of each constituent when the total pressure is 1.5 Bar
(f) the density of the mixture at 1.5 bar and 15$^0$ C (14Marks)

8. Moist air at a temperature of 25 $^0$C has a relative humidity of 60% . Barometric pressure is at 101.3 KN$^2$/m . For the moist air, determine
( a) the specific humidity
(b)the Dew point
(c) the degree of superheat of the super heated vapour. (d) the mass of condensate formed per kg of dry air , if the moist air is cooled to12 $^0$ C. (14Marks)

---

Ex/MRN/21/58/2005

# B. MARINE ENGG. EXAMINATION, 2005

( 2nd Semester )

## SOCIOLOGY / PSYCHOLOGY / POLITICAL SCIENCE

Time : Three hours Full Marks : 100

( 50 marks for each part )

Use a separate answer-script for each part.

## PART—I

*One* mark for neatness.

Answer Q. No. 1 and any *three* from the rest.

1. Pick out the correct answer from the bracket and write the complete sentence (Answer any 5) : $2 \times 5 = 10$

   (a) The caste system is considered to be a distinctive and conservative feature peculian to Indian Society. (Yes/No)

   (b) Today there is hardly any race which has remained pure. (True/False)

   (c) The two important principles underlying the social structure are (i) the principle of apprecia-tion and (ii) the principle of self-preservation. (True/False)

   (d) Facism glorifies war. (True/False)

   (e) Community denotes a community of interests. (Right/Wrong)

[ Turn over

(f) One of the great event of the eighteenth century was the —— Revolution. (French/Russian)

(g) Poverty and unemployment are —— (separable/ inseparable.)

2. What do you mean by Religion ? Explain the relation between Religion and Secularism. $6+7=13$

3. What is the nature of the 'Law' ? Mention the sources of 'Law'. $8+5=13$

4. What do you mean by social stratification ? Discuss in brief the social function of stratification. $5+8=13$

5. Write short notes on :

(a) Russian Revolution.

(b) Social Democracy. $6\frac{1}{2}+6\frac{1}{2}=13$

6. What are the principal causes of Poverty in India ? 13

## PART—II

Answer any *five* questions.

7. Define the following concepts :

state, sovereignty, unitarism, federalism.

$3+3+2+2=10$

8. Answer the following questions :

(a) Distinguish between the state and civil society.

(b) State the process of acquiring citizenship by naturalisation. $5+5$



9. Attempt to classify liberal-political system and authoritarian political system. $5+5$

10. Point out the basic characteristics of the following structures :

(a) Federal structure of a system of government.

(b) Caucus structure of a political party. $5+5$

11. Write a note on the evolution of organizational behaviour. 10

12. Write a brief note on the Marxian concept of class struggle. 10

13. Write a brief note on Indo-Pak relations. 10

14. What are the objectives of Ninth Five Year Plan. 10

Ex/MRN/21/58/2005

# B. MARINE ENGG. EXAMINATION, 2005

( 2nd Semester )

## SOCIOLOGY / PSYCHOLOGY / POLITICAL SCIENCE

Time : Three hours                                                  Full Marks : 100

( 50 marks for each part )

Use a separate answer-script for each part.

## PART—I

*One* mark for neatness.

Answer Q. No. 1 and any *three* from the rest.

1. Pick out the correct answer from the bracket and write the complete sentence (Answer any 5) : $2 \times 5 = 10$

   (a) The caste system is considered to be a distinctive and conservative feature peculian to Indian Society. (Yes/No)

   (b) Today there is hardly any race which has remained pure. (True/False)

   (c) The two important principles underlying the social structure are (i) the principle of apprecia-tion and (ii) the principle of self-preservation. (True/False)

   (d) Facism glorifies war. (True/False)

   (e) Community denotes a community of interests. (Right/Wrong)

[ Turn over

(f) One of the great event of the eighteenth century was the —— Revolution. (French/Russian)

(g) Poverty and unemployment are —— (separable/inseparable.)

2. What do you mean by Religion ? Explain the relation between Religion and Secularism. 6+7=13

3. What is the nature of the 'Law' ? Mention the sources of 'Law'. 8+5=13

4. What do you mean by social stratification ? Discuss in brief the social function of stratification. 5+8=13

5. Write short notes on :

(a) Russian Revolution.

(b) Social Democracy. $6\frac{1}{2}+6\frac{1}{2}=13$

6. What are the principal causes of Poverty in India ? 13

PART—II

Answer any *five* questions.

7. Define the following concepts :

state, sovereignty, unitarism, federalism.

3+3+2+2=10

8. Answer the following questions :

(a) Distinguish between the state and civil society.

(b) State the process of acquiring citizenship by naturalisation. 5+5



9. Attempt to classify liberal-political system and authoritarian political system. 5+5

10. Point out the basic characteristics of the following structures :

(a) Federal structure of a system of government.

(b) Caucus structure of a political party. 5+5

11. Write a note on the evolution of organizational behaviour. 10

12. Write a brief note on the Marxian concept of class struggle. 10

13. Write a brief note on Indo-Pak relations. 10

14. What are the objectives of Ninth Five Year Plan. 10

———