ANJUMAN-I-ISLAM'S
AIKTC KALSEKAR TECHNICAL CAMPUS
INNOVATIVE TEACHING · EXUBERANT LEARNING

School of Architecture

School of Engineering & Technology

School of Pharmacy

Knowledge Resource & Relay Centre (KRRC)

AIKTC/KRRC/SoET/ACKN/QUES/2017-18/ **Date:** _____

School: SoET-CBSGS **Branch:** MECH. ENGG. **SEM:** III

To,
Exam Controller,
AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following **Semester/Unit Test-I/Unit Test-II (Reg./ATKT)** question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format		No. of Copies
			SC	HC	
1	Applied Mathematics- III	MEC301			
2	Thermodynamics	MEC302			
3	Strength Of Materials	MEC303			
4	Production Process-I	MEC304			

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

60

SE-sem-III – CBSGS – ~~Civil~~/ Mech-AM-III

8/5/13

Q. P. Code: 25569

(3hours) [Total marks: 80]

N.B. 1) Question No. 1 is compulsory.
2) Answer **any Three** from remaining
3) Figures to the right indicate full marks

1. a) State Cauchy Reimann equation in polar form. Use them to find p if $f(z) = r^2 \cos 2\theta + i \sin p\theta$ is analytic. 5

b) Find Laplace transform of $f(t) = te^{-3t} \sin t$. 5

c) Find half-range sine series for $f(x) = \frac{\pi}{4}$ in $(0, \pi)$. Hence, show that 5

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots$$

d) Evaluate $\int_c (z - z^3)\, dz$, where C is left half of the unit circle from $-i$ to i. 5

2. a) Obtain the Taylor's and the Laurent series which represent the function $f(z) = \frac{2}{(z-1)(z-2)}$ in the regions, i) $|z| < 1$ ii) $1 < |z| < 2$ 6

b) Obtain complex form of Fourier series of $f(x) = e^{-x}, -1 < x < 1$ in $(-1, 1)$. 6

c) Using Laplace transform, solve the differential equation, $\frac{dx}{dt} + 2x = \cos\omega t$, with $x(0) = 0$. 8

3. a) Solve $\frac{\partial^2 u}{\partial x^2} - 100\frac{\partial u}{\partial t} = 0$ with $u(0,t) = 0, u(1,t) = 0, u(x,0) = x(1-x)$ taking $h = 0.1$ for three time steps up to $t = 1.5$ by Bender –Schmidt method. 6

b) Find the bilinear transformation which maps the points $z = 0, -1, i$ into the points $w = i, 0, \infty$. 6

c) Obtain Fourier Series of $f(x) = \begin{cases} x, & 0 < x \le \pi \\ 2\pi - x, & \pi \le x < 2\pi \end{cases}$ in $(0, 2\pi)$ 8

Hence, deduce that –

$$\frac{\pi^4}{96} = \frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \cdots$$

[TURN OVER]

4. a) Find the orthogonal trajectory of the family of curves $2x - x^3 + 3xy^2 = c$ 6
   b) Find the Fourier series for $f(x) = 1 - x^2$ in $(-1, 1)$. 6

   c) Find the inverse Laplace transform of:
   i) $F(s) = \frac{1}{s(s^2+9)}$, using Convolution theorem, ii) $F(s) = cot^{-1}(s+1)$. 8

5. a) Solve by Crank –Nicholson simplified formula $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$,

   $u(0,t) = 0$, $u(5,t) = 100$, $u(x,0) = 20$ taking $h = 1$ for one-time step. 6

   b) Find the image of the circle $|z| = 4$ in the z-plane under the transformation $w = z + 2 + 3i$. Draw the sketch. 6

   c) If $v = 3x^2y + 6xy - y^3$, show that v is harmonic and find the corresponding analytic function $f(z) = u + iv$. 8

6. a) Using Residue theorem, evaluate, $\int_0^{2\pi} \frac{d\theta}{5 - 3\cos\theta}$ 6

   b) Using Laplace transform, evaluate $\int_0^\infty e^{-t}(1 + 3t + t^2)H(t-2)dt$ 6

   c) A tightly stretched string with fixed end points $x = 0$ and $x = l$, in the shape defined by $y = kx(l - x)$ where k is a constant, is released from this position of rest. Find $y(x,t)$, the vertical displacement if $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$. 8

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(11) SE-sem-III - CBSGS - Thermo-Mech 16/5/18

Q.P.Code: 21491

(3 Hours) [Total Marks: 80]

1) Question No.1 is compulsory
2) Attempt any three questions out of remaining five questions
3) Figures to right indicate full marks
4) Assume suitable data if necessary
5) Answers to questions should be grouped and written together.
6) Use of steam table is allowed.

Q1. Attempt any four: 5*4 = 20

a) Prove that energy is a property of a system?
b) Derive an expression for heat absorbed or rejected during polytropic process for ideal gas?
c) Explain energy balance for steady flow open system?
d) State the principle of increase of entropy of the universe and discuss anyone application ?
e) Derive an expression for decrease in availability due to heat transfer with finite temperature difference?

Q.2 a) A spherical balloon of 30 cm diameter contains air at a pressure of 1.5 bar. The diameter of the balloon is increased to 40 cm by heating and during the process the pressure is proportional to its diameter. Calculate the work done assuming the process to be quasistatic? 6

Q. 2 b) 0.06 meter cube air at 5 bar and 200 degree celsius expands isentropically until the pressure becomes at 2 bar. It is then heated at constant pressure until the enthalpy increase during the process is 80 kJ. Calculate work done in each process and total work done? 8

Q. 2 c) Write a short note on Joule-Thompson porous plug experiment with its significance? 6

Q.3 a) Show that the efficiency of all reversible heat engines operating between the same temperature limits is same? 5

Q. 3 b) A house is maintained at 23 degree celsius throughout the year. A heat pump is used to cool the house in summer and heat the house in winter. The heat loss is 0.4 kW per degree difference between outside and inside temperatures. The outside temperature in winter and summer is -3 degree celsius and 43 degree celsius respectively. Find power required to drive the heat pump for both cooling and heating ? 8

TURN OVER

Q. 3 c) Show that no heat pump working between two fixed temperature reservoirs have COP greater than that of a reversible heat pump working between the same temperature limits? 7

Q. 4 a) A reversible heat engine operates between three heat reservoirs as shown in figure. The engine receives 4000 kJ/s of heat from reservoir A at temperature 1000 K and produces the work of 1600 kJ/s. Calculate the heat transfer with reservoirs B and C in magnitude and direction using the entropy concept. Hence, calculate the thermal efficiency? 8

Q. 4 b) Derive Maxwell Equations and explain them? 5

Q. 4 c) 2 kg of water at 50 degree celsius is mixed with three kg of water at 100 degree celsius in a steady flow process. Calculating the temperature of the resulting mixture state whether the mixing is isentropic? If no, what is the entropy change and unavailable energy with respect to the surroundings at 50 degree celsius? 7

Q. 5 a) Calculate the volume, density, enthalpy and entropy of 2 kg of steam at 80 degree celsius and dryness fraction of 0.85 ? 6

Q. 5 b) Determine the mass of 0.25 meter cube of steam at 5 bar pressure and 0.85 dryness fraction. Proceed to calculate the heat content 1 meter cube of this steam? 4

Q. 5 c) The power output of a steam turbine is 5 MW. The inlet conditions are 2 Mpa of pressure, 400 degree celsius of temperature, 50 m/s of velocity and 10 m of elevation. The exit conditions are 15 kPa. 0.9 dry qualtiy, 180 m/s and 6 m elevation. Compute 1) The magnitude of delta h, delta ke and delta pe. 2) Work done per kg of steam 3) Mass flow rate of steam. 10

Q. 6 a) Explain the working of vane type blower with the help of neat sketch? 6

Q. 6 b) In a Rankine cycle, the maximum pressure of steam supplied is 6 bar. The dryness fraction is 0.9.The exhaust pressure is 0.7 bar. Find the theoretical work done and Rankine efficiency? 8

Q. 6 c) Derive an expression for efficiency of dual cycle? 6

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SE-sem-III- CBSGS- Mech-50M

22/5/18

Q.P. Code: 27345

Duration: 3 Hours **Total Marks: 80**

N.B.: (1) Question No. **1 is Compulsory**. Answer any **THREE** from the remaining **FIVE** questions.

(2) **All** questions carry **equal** marks.

(3) Assume suitable data wherever necessary.

(4) Figures to the right indicate max. marks.

1. Attempt Any FOUR [20]

(a) What is Eular's theory for long columns? List out the assumptions made in it.

(b) A uniform steel bar of 2 m length and 20 mm diameter is subjected to a pull of 60 kN. Determine the stress, change in length, strain energy stored and resilience in the bar when the pull is applied gradually. Take E= 210 GPa

(c) Draw Stress- Strain curve for ductile material & explain salient points on it.

(d) A hollow circular shaft transmits 250 kW power at 400 RPM. Find the diameter of shaft necessary if the allowable stress is limited to100 N/mm^2. Take ratio of diameters as 0.6

(e) Write assumptions made in simple bending and derive flexural formula.

2. (a) A thin cylindrical shell, 3 m long and 1 m in diameter is subjected to an internal pressure of 1 N/mm^2. If the thickness of the shell is 12 mm, find the circumferential and longitudinal stresses. Find also the maximum shear stress and change in dimensions of the shell. Take E = 210 GPa and 1/m = 0.3. [08]

(b) A rectangular block of 220 mm x 130 mm x 60 mm dimension along x, y and z directions respectively. Find the axial tensile forces P_x and P_y acting on the block causing an increase of 0.20 mm along x-direction and 0.00625 mm along z-direction. Find also the decrease in dimensions along y-direction. Take. Poisson's Ratio= 0.3, E = 210 GPa. No load acts along y-direction. [12]

3. (a) A uniform rigid block weighing 200 kN is to be supported on three bars as shown in fig. no. 1. There is a gap of 3.5 mm between the block and the top of the steel bar. Find the stresses developed in the bars. Take, $E_S = 200 \times 10^3$ N/mm^2 and $E_A = 200 \times 10^3$ N/mm^2. Two Aluminium rods are of 20 mm x 20 mm and steel rod of 25 mm x 25 mm as cross section. [12]

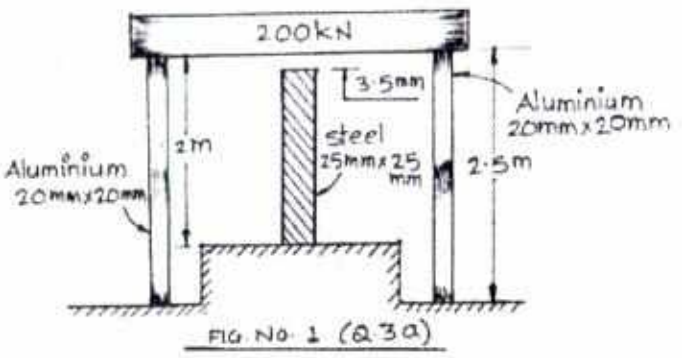
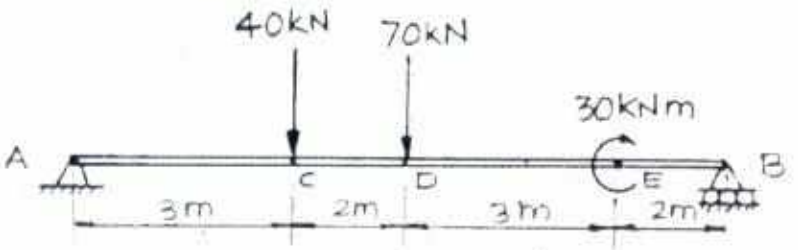


FIG. No. 1 (Q.3 a)

(b) Determine the safe load that the hollow cast iron column having outside diameter 200 mm can carry by Rankine's using formula. The column is 5m long and fixed at both the ends. Take metal thickness = 20 mm, σ_c = 500MPa, E = 94 GPa, 1/a = 1600 and F.O.S. = 4. [08]

4. (a) Calculate maximum deflection at point D, slope at A and maximum deflection in terms of E and I for the beam shown in fig. no 2. [12]



FIGNO. 2 (Q. 4 a)

(b) Find the maximum u.d.l. the simply supported T-beam of span 6 m, as shown in fig. no 3, can carry if the maximum permissible stress is not to exceed 200 MPa. [08]

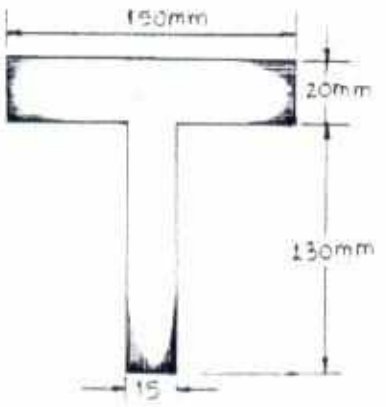


FIG NO 3 (Q.NO 4b)

5. (a) Draw SFD, BMD and axial force diagram for the beam shown in fig. no 4. Also show the point of contraflexure if any. [12]

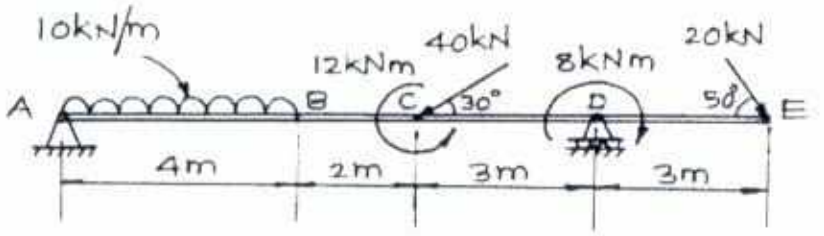


FIG. NO. 4 (Q. NO. 5a)

(b) A simply supported cast iron beam of inverted T section carries u.d.l. of 1500N/m, as shown in fig. no 5. Draw shear stress distribution across the cross section for maximum shear force for the beam. [08]

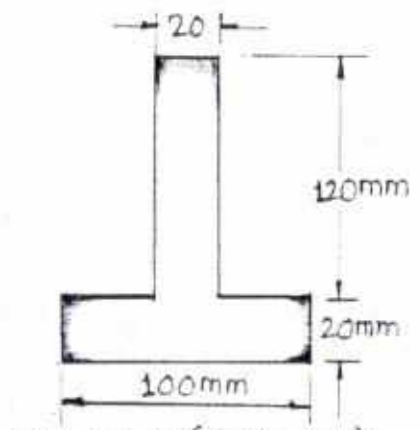


FIG. NO. 5 (Q. NO. 5 b)

6. (a) Draw SFD and BMD for the beam shown in fig. no 6. [10]

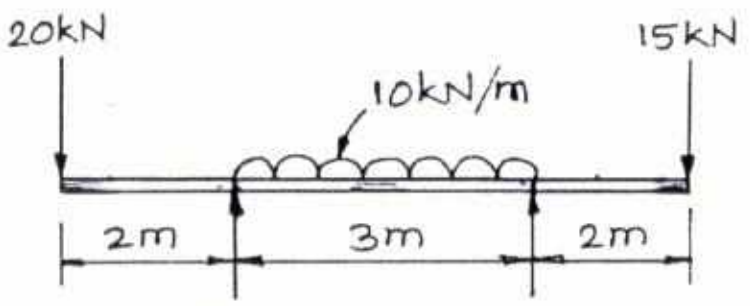


FIG. NO. 6 (Q. NO. 6 a)

(b) Calculate the diameter of shaft if the angle of twist is not to exceed 1^0 in a length of 20 times the diameter of shaft and maximum permissible shear stress is not to exceed 100 N/mm^2. Take, G = 84 GPa. If the shaft is replaced by hollow shaft with the ratio of diameters as 2, find inside and outside diameter of the shaft. A shaft is used to transmit 50 kW at 150 r.p.m [10]

(7) SE-sem-III - CBSGS- Mech - PP-I 2/6/18

Q. P. Code: 50373

(03Hours) **[Total Marks: 80]**

N.B. 1) Question No **1** is **Compulsory**

2) Attempt any **three** out of the remaining **five** questions

3) Figures to the **right** indicate full marks

4) Draw neat **sketches** wherever necessary

Q.1 Differentiate between the following **(Any Four)** [20]

a) TIG and MIG welding
b) Thermoplastics & Thermosetting plastics
c) Hot working& Cold working
d) Open Die Forging & Closed Die Forging.
e) Patterns & Core Boxes

Q.2) a) Write short notes on the following [10]

i) Adhesive Bonding

ii) Extrusion Process

b) Compare Press Forging & Drop Forging. b) Explain Weldability. [10]

3. a) Explain - (i) Principle of gating (ii) Principle of risering. [10]

b) Explain any two non-destructive techniques with sketch. [10]

4. a) What is powder metallurgy? Why gears are manufactured by powder metallurgy? List the advantages of powder metallurgy. [10]

b) Differentiate Welding, soldering and brazing. [10]

5. a) Explain the following welding processes with their applications [10]

i) Resistance welding ii) Submerged arc welding

b) Explain in detail the significance of Production Process-I subject [10]

6. Attempt the following [20]

a) Discuss types of flames in gas welding.
b) Write short note on application of plastics in industries.
c) Describe Ultrasonic testing process with a neat labelled sketch.
d) Discuss Blow Moulding process

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