



AIKTC/KRRC/SoET/ACKN/QUES/2018-19/

Date: \_\_\_\_\_

School: SoET-CBSGS

Branch: CIVIL ENGG.

SEM: III

To,  
 Exam Controller,  
 AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following <sup>✓</sup>Semester/<sup>✓</sup>Unit Test-I/<sup>✓</sup>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	CE-C301		✓	02
2	Surveying- I	CE-C302			
3	Strength of materials	CE-C303		✓	02
4	Building materials and construction	CE-C304			
5	Engineering geology	CE-C305		✓	02
6	Fluid mechanics- I	CE-C306		✓	02

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)  
 Librarian, AIKTC

4. a) Find the orthogonal trajectory of the family of curves,  $x^3y - xy^3 = c$ , where  $c$  is a constant. 6
- b) Obtain Fourier Series of  $f(x) = |x|$  in  $(-\pi, \pi)$  6
- c) Find the inverse Laplace transform of :-
- i)  $F(s) = \frac{1}{s(s^2+4)}$ , using Convolution theorem, ii)  $F(s) = \frac{e^{-3s}}{(s-2)^4}$ . 8
5. a) Solve by Crank -Nicholson simplified formula  $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$ ,  
 $u(0, t) = u(1, t) = 0, u(x, 0) = 200(x - x^2)$   
 taking  $h = 0.25$  for one-time step. 6
- b) Find an analytic function  $f(z) = u + iv$ , if  
 $u = e^{-x}\{(x^2 - y^2) \cos y + 2xy \sin y\}$   
 ... 6
- c). Obtain Fourier series of  $f(x) = x^2$  in  $(0, 2\pi)$ . Hence, deduce that - 8  
 $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots$
6. a) Using Residue theorem, evaluate,  $\int_{-\infty}^{\infty} \frac{x^2}{(x^2+1)(x^2+4)} dx$  6
- b) Find the Laplace transform of  
 $f(t) = \begin{cases} t, & 0 < t < 1 \\ 0, & 1 < t < 2 \end{cases}$  and  $f(t+2) = f(t)$  for  $t > 0$ . 6
- c) A string is stretched and fastened to two points distance  $l$  apart. Motion is started by displacing the string in form  $y = a \sin(\pi x / l)$  from which it is released at a time  $t = 0$ . If the vibrations of a string is given by  $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$  show that the displacement of a point at a distance  $x$  from one end at time  $t$  is given by  $y(x, t) = a \sin(\pi x / l) \cos(\pi c t / l)$ . 8

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8/5/19

SE - Sem III - CBSE - Civil / Mech

(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) Find Laplace transform of  $f(t) = e^{-9t} \int_0^t u \sin 3u \, du$ . 5
- b) Verify Laplace equation for  $u = \left( r + \frac{a^2}{r} \right) \cos \theta$ . 5
- c) Show that  $\{\sin nx, n = 1, 2, 3 \dots\}$  is a set of orthogonal function over an interval  $(-\pi, \pi)$ . 5
- d) Evaluate  $\int_0^{3+i} |z|^2 \, dz$  along the line  $3y = x$ . 5
2. a) Obtain two distinct Laurent's series for  $f(z) = \frac{2z-3}{z^2-4z+3}$  indicating the region of convergence. 6
- b) Find complex form of Fourier series of  $f(x) = \cosh 2x$  in  $(-3, 3)$ . 6
- c) Using Laplace transform, solve the differential equation  $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 1$  where  $y(0) = 0, y'(0) = 1$  8
3. a) Solve  $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$  with  $u(0, t) = 0, u(5, t) = 0, u(x, 0) = x^2(25 - x^2)$  taking  $h = 1$  up to  $t = 3$  seconds 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 half range Cosine Series of  $f(x) = \sin x$  in the interval  $(0, \pi)$ . Use Parseval's identity to prove that - 8
- $$\frac{1}{1^2 \cdot 3^2} + \frac{1}{3^2 \cdot 5^2} + \frac{1}{5^2 \cdot 7^2} + \dots = \frac{\pi^2 - 8}{16}$$

[TURN OVER]

(3 Hours)

[Total Marks: 80]

N.B: (1) Question No. 1 is compulsory.

(2) Attempt any **Three** questions out of remaining five questions.

(3) Assume suitable data wherever required and state it clearly.

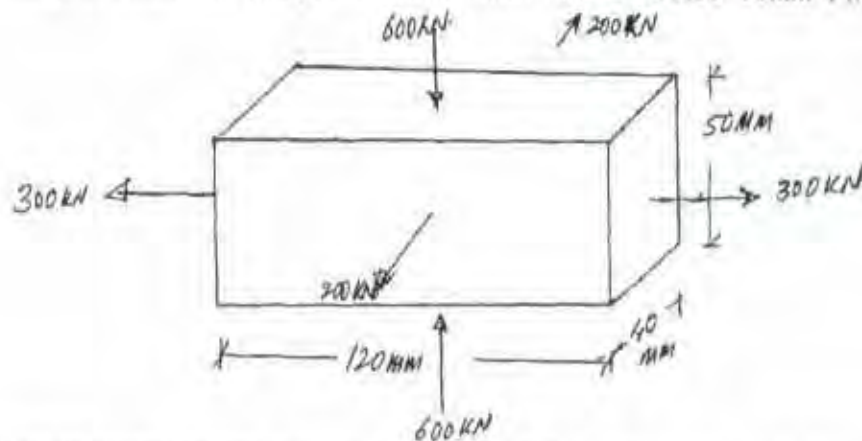
(4) Illustrate your answers with neat component sketches wherever required.

1. Attempt the following
  - a. State assumptions made in pure bending. 04
  - b. Derive the expression for core section of hollow circular section 04
  - c. Explain angle of oblique plane and angle of obliquity. 04
  - d. Derive the relation between shear force and rate of loading 04
  - e. Draw the SFD and BMD for cantilever beam of length 'L' carrying concentrated load 'W' at mid length. 04
  
2.
  - a. A simply supported beam of span 10 m carries central point load of 150 kN. The cross section of beam consist of 'T' section having overall depth 125 mm, flange 140 mm wide and 20 mm. thick and web thickness 20 mm. Draw shear stress distribution diagram. 08
  - b. Explain flitched beam. 04
  - c. A flitched beam consist wooden joist 200 mm X 350 mm is strengthened by two steel plates each 8 mm thick and 350 mm depth attached on either side of wooden joist symmetrically. Calculate maximum UDL supported by flitched beam over a simply supported span of 6 m. Permissible stresses in wood and steel are 7 MPa and 125 MPa respectively 08
  
3. a. Draw Shear force, Bending moment and Axial force diagram for beam shown. 12
 

$10 \text{ kN/m}$       $60 \text{ kN}$       $20 \text{ kN}$   
 $4 \text{ m}$       $2 \text{ m}$       $3 \text{ m}$       $1 \text{ m}$
  
- b. What is core section ? Determine the dimension of core section for hollow rectangular section having External dimension are twice the internal. 08
  
4.
  - a. A hollow rectangular steel column of size 100 mm X150 mm, externally and thickness 10 mm. The length of column is 4.5 m. Both ends of column are rigidly fixed. Find safe load carried by column using Eulers and Rankines theory. Take  $E = 200 \text{ GPa}$ ,  $\alpha = 1/1600$ ,  $\sigma_c = 330 \text{ MPa}$   $E = 200 \text{ Gpa}$ . Factor of safety 1.5. 08
  - b. At a point in a strained material the stresses on two mutually perpendicular plane are 100 MPa (tensile) and 60 MPa (compressive) accompanied with shear stress 40 MPa Find magnitude and direction of resultant stress on oblique plane which makes an angle of  $60^\circ$  with plane of 60MPa stress. Use Mohr's circle method. 08
  - c. State the assumption made Euler's theory of column. 04
  
5.
  - a. A shell 3.5 m. long, 1m diameter and 10 mm thick are subjected to internal pressure  $1.00 \text{ N/mm}^2$ . Find change in dimension of shell, Take  $E = 2 \times 10^5 \text{ N/mm}^2$ ,  $1/m = 0.3$  06

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- b. A steel block is subjected load on three mutually perpendicular planes as shown. Find change in volume and change in each dimension. Take  $E = 2 \times 10^5 \text{ N/mm}^2$ ,  $\nu = 0.3$  07



- c. A hollow square masonry chimney of size 2.4 m X 2.4 m (External) and thickness 40 mm subjected to horizontal wind pressure  $1.2 \text{ kN/m}^2$  along one of the diagonal. The cross section of chimney is uniform. Find safe height of chimney. Weight of masonry  $24 \text{ kN/m}^3$  07
6. a. A hollow shaft, having an internal diameter 40 % of its external diameter, transmits 562.5 kW power at 100 rpm. Determine diameter of shaft if shear stress not to exceed  $60 \text{ N/mm}^2$  and a twist in a length of 2.5 m should not exceed  $1.3^\circ$ . Assume maximum torque is 1.25 times the mean torque. Take  $G = 9 \times 10^4 \text{ N/mm}^2$  08
- b. Derive the expression for deformation of solid conical tapering bar. 08
- c. A steel rod 30 mm diameter and 5 m, long is connected is fixed in support at temperature of  $95^\circ \text{C}$ , determine the stress when temperature falls  $30^\circ \text{C}$  if support yields by 1.2 mm. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $\alpha_s = 12 \times 10^{-6} / ^\circ \text{C}$  04

[Time : 3 Hours]

[Total Marks : 80]

- N.B.** 1. Question No. 1 is compulsory  
2. Attempt any **Three** questions out of remaining **Five** questions.  
3. Draw neat **labelled diagrams** wherever necessary.  
4. All the parts of a question should be **grouped together**.  
5. Figures to the **right** indicate marks

- Q.1a Write the identifying properties and economic use of the following minerals- 5  
(i) Rosy quartz  
(ii) Muscovite  
(iii) Talc  
(iv) Galena  
(v) Gypsum
- Q.1b Define the following terms- 5  
(i) Exfoliation  
(ii) Talus slope  
(iii) Mantle  
(iv) Yardang  
(v) Magma
- Q.1c Answer the following - 5  
(i) What is engineering Geology?  
(ii) What is amygdaloidal basalt?  
(iii) What is Laccolith?  
(iv) What are the agents responsible for metamorphism?  
(v) What is hanging valley?
- Q.1d Name the following - 5  
(i) Boundary between crust and Mantle.  
(ii) Product of volcano  
(iii) The point of origin of earthquake  
(iv) The type of metamorphism where temperature plays the dominant role  
(v) A metamorphic rock
- Q.2(a) Describe various landforms created by river. 10  
(b) What are the agents of weathering, briefly describe mechanical weathering? 5  
(c) Briefly describe the layered structure of Earth. 5
- Q.3(a) Describe the inequigranular texture of igneous rocks. 5  
(b) Describe various types of metamorphism 5  
(c) Describe any two structures of sedimentary rocks. 5  
(d) Describe geological properties of building stones 5
- Q.4(a) What are Folds? Give a brief account of various types of Folds in the rocks. 10  
(b) Give economic importance of Deccan Traps. 5  
(c) Describe any two laws of stratigraphy 5

- Q.5(a) Describe the water bearing properties of rocks. 5  
(b) Describe the favourable and unfavourable geological structures for dam. 10  
(c) Write the principle and use of electrical resistivity method of geophysical investigation. 5
- Q.6 Differentiate between any 5 of the following- 5X4=20  
(i) Dip and strike  
(ii) Angular unconformity and Nonconformity  
(iii) Pot hole and cirque  
(iv) Confined and unconfined aquifer  
(v) P-Wave and S-wave  
(vi) Normal and Reverse fault

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SF - sem - III - CBSE - Civil

6/6/19

Paper / Subject Code: 49206 / FLUID MECHANICS-I

(3 Hours)

[Total Marks 80]

Note:

1. Question no.1 is compulsory
2. Solve any 3 questions out of remaining
3. Assume data wherever necessary and clearly mention the assumptions made.
4. Draw neat figures as required.

1. Answer any 4 questions out of following 20
- a. Define- density, Specific Volume, Specific Gravity and Viscosity
  - b. Explain Cipolletti Weir
  - c. Derive Pascal's Law
  - d. Explain Steady, Unsteady Flow & Uniform, Non Uniform Flow.
  - e. Explain Borda's Mouthpiece
  - f. State Bernoulli's Equation & Derive it from Eulers Equation also mention assumptions made
2. a. A flat plate weighing 0.45 KN has a surface area of  $0.1 \text{ m}^2$ . It slides down an inclined plane at  $30^\circ$  to the horizontal, at a constant speed of 3 m/s. If the inclined plane is lubricated with an oil of viscosity  $0.1 \text{ Ns/m}^2$ . find the thickness of the oil. 10
- b. An orificemeter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter give readings of  $14.715 \text{ N/cm}^2$  and  $9.81 \text{ N/cm}^2$  respectively. Find the rate of flow of water through the pipe in litres/s. Take  $C_d = 0.6$  10
3. a. State Condition of equilibrium for floating body. 05
- b. An oil of specific gravity 0.85 is contained in a vessel. At a point the height of oil is 35 m. Find the corresponding height of water at the point. 05
- c. A jet of water issues from a circular orifice 25 mm diameter, under a constant head of 1 m. it falls 35 mm vertically down and strikes the ground at a distance of 350 mm from the center of the vena contracta. If the discharge through the jet is 1.35 liters/s, find Coefficient of discharge, Coefficient of velocity and Coefficient of Contraction 10



4. a. A circular plate of 1 m diameter is immersed in water in such a way that its plane makes an angle of  $30^\circ$  with the horizontal and its top edge is 1.25 m below the water surface. Find the total pressure on the plate and the point, where it acts. 10
- b. Derive the equation for discharge through large rectangular orifice 10
5. a. For the following stream functions calculate velocity at a point (1,2) 06  
1)  $\Psi = 3xy$  2)  $\Psi = 3x^2y - y^3$
- b. Explain Stream function and Velocity Potential Function 04
- c. A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The reading of differential manometer connected to inlet and throat is 10 cm of mercury. Determine the rate of flow. Take  $C_d = 0.98$  10
6. a. A solid cylinder 3 m in diameter and 4 m high is floating in water with its axis vertical. If its specific gravity is 0.6, find the metacentric height. Also state whether the equilibrium is stable or unstable. 10
- b. Derive the equation for discharge through Venturimeter. 10
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