

314

28/11/17

Q. P. Code: 25564

(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  $f(t) = te^{-3t} \sin t$ . 5
- b) Obtain Complex form of Fourier series of  $f(x) = e^x$ ,  $-1 < x < 1$  in  $(-1, 1)$ . 5
- c) Does there exist an analytic function whose real part is  $u = k(1 + \cos \theta)$ ? Give justification. 5
- d) The equations of lines of regression are  $3x + 2y = 26$  and  $6x + y = 31$ . Find i) means of  $x$  and  $y$ , ii) coefficient of correlation between  $x$  and  $y$ . 5
2. a) Evaluate  $\int_0^{\infty} e^t \sin 2t \cos 3t dt$ . 6
- b) Find the image of the square bounded by lines  $x = 0, x = 2, y = 0, y = 2$  in the  $z$ -plane under the transformation  $w = (1+i)z + 2 - i$ . 6
- c) Obtain Fourier series of  $f(x) = |x|$  in  $(-\pi, \pi)$ . Hence, deduce that - 8  

$$\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$$
3. a) Find the inverse Laplace transform of  $F(s) = \frac{s}{(s^2+9)(s^2+4)}$ . 6
- b) 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
- c) Using Residue theorem, evaluate

i) 
$$\int_0^{2\pi} \frac{d\theta}{5 + 4\cos \theta}$$

ii) 
$$\int_{-\infty}^{\infty} \frac{dx}{(x^2 + 1)^2}$$

8

[TURN OVER]

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4. 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) Obtain the Taylor's and Laurent series which represent the function

$f(z) = \frac{z}{(z-1)(z-2)}$  in the regions, i)  $|z| < 1$  ii)  $1 < |z| < 2$  6

c) Solve  $(D^2 - 3D + 2)y = 4e^{2t}$  with  $y(0) = -3$ ,  $y'(0) = 5$  where  $D \equiv \frac{d}{dt}$  8

5. a) Find an analytic function  $f(z) = u + iv$ , if  
 $u = e^{-x}\{(x^2 - y^2) \cos y + 2xy \sin y\}$  6

b) Find the Laplace transform of  $f(t) = t\sqrt{1 + \sin t}$  6

c) Obtain half range Fourier cosine series of  $f(x) = x$ ,  $0 < x < 2$ . Using Parseval's identity, deduce that 8

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

6. a) If  $f(a) = \oint_C \frac{3z^2 + 7z + 1}{z - a} dz$ ,  $C: x^2 + y^2 = 4$   
 find the values of  $f(3)$ ,  $f'(1 - i)$  and  $f''(1 - i)$  6

b) Find the coefficient of correlation between height of father and height of son from the following data, 6

Height of father	65	66	67	68	69	71	73
Height of son	67	68	64	68	72	69	70

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



## Q.P. Code: 27303

3 Hours

80 Marks

Q 1 is compulsory. Attempt **any three** questions from the remaining questions.Q.1 Answer **any five** briefly. Each question carries 04 marks. (20)

- Define Surveying. Classify surveying on the basis of the purpose of the survey.
- Differentiate between Whole circle bearing (WCB) and Reduced bearing system. If  $\Theta$  is the WCB, what would be the reduced bearing in all four quadrants?
- Define: i) Chainage ii) Backsight. iii) Intermediate sight. iv) Change point.
- Define contour and contour interval. State any four characteristics of contours.
- Explain the temporary adjustments of a theodolite.
- A tacheometer has a diaphragm with three cross hairs spaced at a distance of 1.20 mm. The focal length of the object glass is 24 cm and the distance of the object glass from the trunnion axis is 10 cm. Calculate the tacheometric constants.

Q.2 (20)

- was conducted round a lake and the bearings as shown aside were obtained. Determine which of the stations are affected by local attraction and give the values of the corrected bearings.

Line	AB	BC	CD	DA
F.B	$74^{\circ} 20'$	$107^{\circ} 20'$	$224^{\circ} 50'$	$306^{\circ} 40'$
B.B	$256^{\circ} 0'$	$286^{\circ} 20'$	$44^{\circ} 50'$	$126^{\circ} 0'$

(20)

08

- Compare: Surveyors Compass and Prismatic Compass. 04
- A road embankment 30 m wide at top with side slope of 2 to 1 have ground levels at 100 metres interval along line PQ as under: P(153.0), 151.8, 151.2, 150.6, (149.2)Q. The formation level at P is 161.4 m with a uniformly falling gradient of 1 in 50 from P to Q. Find volume of earthwork by prismatic formula. Assume the ground to be level in c/s. 08

Q.3 (20)

- Following is the page of a level book. Fill in the missing data. Apply the usual checks.  $\Sigma$  B.S is 8.445. 10

Station	B.S	I.S	F.S	Rise	Fall	RL	Remarks
1	2.150					450.000	<b>BM</b>
2	1.645		?	0.500		?	
3		2.345			?	?	
4	?		1.965	?		?	
5	2.050		1.825		0.400	?	
6		?		?		451.730	
7	(-) 1.690		?	0.120		?	<b>Inverted staff rdg</b>
8	?		2.100		?	?	
9			?	?		499.100	

- Explain reciprocal levelling with its procedure and purpose. 05
- Write a note on different axes of a theodolite and their interrelationships for the instrument to be in perfect adjustment. (Sketch is desirable.) 05

## Q.P. Code: 27303

- Q.4 (20)  
 a List the accessories required for Plane Table Survey. Describe the intersection method of plane table survey with its advantage. 08  
 b Write short notes on : 08  
 i. Gale's traverse table.  
 ii. Measurement of horizontal angle by method of Repetition.  
 c A 20 m chain was found to be 4 cm too long after chaining 1420 m. It was 8 cm too long at the end of day's work after chaining a total distance of 2400 m. If the chain was correct before commencement of the work, find the true distance. 04
- Q.5 (20)  
 a 10  
 Calculate latitudes and departures for the traverse whose details are as shown aside:
- | Line | Length (m) | WCB     |
|------|------------|---------|
| AB   | 89.31      | 45°10'  |
| BC   | 219.76     | 72°05'  |
| CD   | 151.18     | 161°52' |
| DE   | 159.10     | 228°43' |
| EA   | 232.26     | 300°42' |
- b The above perpendicular offsets were taken at 15 m intervals from a survey line AB to an irregular boundary line. Calculate the area using Simpson's Rule. 06
- | Distance | 0 (pt. A) | 15   | 30   | 45   | 60   | 75   | 90   | 105  | 120 (pt. B) |
|----------|-----------|------|------|------|------|------|------|------|-------------|
| Offset   | 2.30      | 3.80 | 4.55 | 6.75 | 5.25 | 7.30 | 8.95 | 8.25 | 5.50        |
- c Write down the procedure of Indirect Ranging with a suitable sketch. 04
- Q.6 (20)  
 a Initially, a staff was held vertically at a distance of 46.2 m and 117.6 m from the centre of a theodolite fitted with stadia hairs and the staff intercepts with the telescope horizontal were 0.45 m and 1.15 m respectively. The instrument was then set over a station P having RL as 150 m, the height of instrument axis being 1.38 m. The stadia hair readings on a staff held vertically at a station Q with instrument at P were 1.200, 1.930 and 2.650 m respectively, while the vertical angle (depression) was  $-9^{\circ}30'$ . Find RL of Q & dist. PQ. 08  
 b In a 2 plane method exercise, points P and Q are two instrument stations and point R is the point whose elevation is to be known. The values of included angles  $\Theta_P$  &  $\Theta_Q$  are  $64^{\circ}30'$  &  $58^{\circ}15'$  respectively. The values of vertical angle  $\alpha_P$  &  $\alpha_Q$  are  $20^{\circ}43'20''$  &  $19^{\circ}44'55''$  respectively. The height of instrument at P and Q are 1.450 and 1.550 m respectively while the backsights taken on benchmark (RL = 100.125 m) from P & Q are 1.625 and 1.125 m respectively. Distance PQ is 180 m. Determine the ground elevations of both the instrument station and elevation of point R. 08  
 c Explain tie line, check line, base line and main survey line with neat sketch. 04

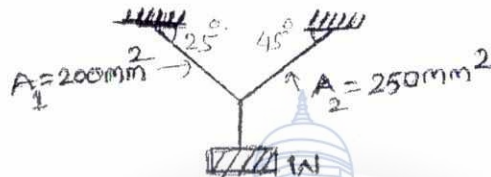


[Time: 3 Hours]

[ Marks: 80]

- 1) Question no.1 is compulsory
- 2) Attempt any three question from remaining five
- 3) Assume any suitable data if required

Q1 a) Determine the maximum weight  $W$  that can be supported by two wires as shown in fig. if the stress in each wire is not to exceed  $120 \text{ N/mm}^2$  (20)



b) A cantilever beam of solid circular section and 3m long carries a concentrated load of 25kN at its free end. If the max bending stress in tension and compression are not to exceed  $100 \text{ N/mm}^2$  and  $60 \text{ N/mm}^2$  calculate the diameter of the beam required.

c) A 230mm x 350 mm simply supported beam carries a UDL of 20kN/m over a span of 8M. Determine the maximum shear stress at a section 2m from the support.

d) A rectangular column of 230mm x 350mm and 4M long used as a column. If one end is hinged and other is fixed, find the safe load the column can carry if FOS-2.5. use Euler's formula.

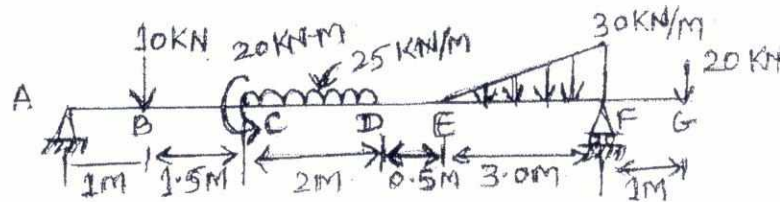
e) Derive the expression for strain energy due to gradually applied axial load.

Q.2 a) An unknown weight falls through 15mm on a collar rigidly attached at the lower end of the bar 4m long and  $800 \text{ mm}^2$  in area. If the maximum instantaneous elongation is 3 mm, find the corresponding stress and the value of unknown weight. Take  $E = 210 \text{ kN/mm}^2$  (06)

B) A circular rod ABC is subjected to axial compressive load of 50kN. The part AB is hollow circular with outer diameter of 25mm and inner diameter of 10mm and length of 200mm. The part BC is solid circular with diameter of 25mm and length of 300mm. Calculate total decrease in length of the bar. Take  $E = 210 \text{ kN/mm}^2$  (04)

c) Draw the shear force and bending moment diagram for the beam loaded as shown in fig. (10)

Turn Over



Q3 a) Explain with the help of neat sketch concept of equivalent section use in flitched beam (04)

b) A hollow circular column of 2.8m long is fixed at one end and free at other end, has to support a load of 500kN. The internal diameter is 0.8 times external diameter. Calculate the external diameter with FOS=4. Take  $\sigma_c=330 \text{ N/mm}^2$   $\alpha=1/7500$  (08)

c) A inverted T beam having web 20mm x 100mm and flange 120mm x 20mm, has a span of 5m and is simply supported at ends. Find the maximum load the beam can carry if the compressive and tensile stress not to exceed  $60 \text{ kN/mm}^2$  and  $75 \text{ kN/mm}^2$  (08)

Q4 a) A flitched beam consist of wooden joist 150mm wide and 300mm deep strengthen by steel plate

Of 10 mm thick at bottom. Find the moment of resistance by using transformed area concept. permissible stress in wooden joist is  $8 \text{ N/mm}^2$ . Take  $E_s = 15E_w$  (08)

b) A beam of square section of size 200mm x 200mm is placed with one of it's diagonal horizontal and it carries a shear force of 80kN. Draw the shear stress distribution diagram. (08)

c) Derive the relation between SF, BM and rate of loading W (04)

Q5 a) A cylindrical shell is 3m long and 1.2m in diameter and 12mm thick is subjected to internal pressure of  $1.8 \text{ N/mm}^2$  calculate change in length of shell. Take  $E= 210 \text{ kN/mm}^2$   $\nu=0.3$  (08)

b) At a point in a strained material the stresses on two mutually perpendicular plane are  $120 \text{ kN/mm}^2$  and  $80 \text{ kN/mm}^2$  both are tensile. Find the normal, tangential and resultant stress at a plane inclined  $30^\circ$  to the major principal plane. (08)

c) determine the area of core section for rectangular section of size 230mm x 350mm. (04)

Q6 a) A hollow circular steel shaft of 5m length has to transmit 150KW power at 120rpm. If internal diameter is 0.6 times external diameter, total angle of twist not to exceed  $3^\circ$  and shear stress is limited to  $50 \text{ N/mm}^2$ . Determine the diameter of shaft. Take  $G= 84 \text{ kN/mm}^2$  (08)

b) In the rectangular section 400mm wide and 300mm deep is subjected to compressive load of 80kN at an eccentricity of 40mm and 75 mm from centroidal xx and yy axis. Find stress at each corner. (06)

c) a rod of 300mm long and 20mm in diameter is heated through  $100^\circ\text{C}$  and at the same time pulled by force P. If the total elongation is 0.4mm. What is the magnitude of P Take  $E= 210 \text{ kN/mm}^2$  and  $\alpha=12 \times 10^{-6}$  (06)

**Subject:** Correction : T0933 / T71 - Strength of Materials QP code: 27315

**From:** University of Mumbai (support@muapps.in)

**To:** controllerkrc@yahoo.com;

**Date:** Thursday, 7 December 2017 4:55 PM



University of Mumbai

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Correction : T0933 / T71 - Strength of Materials QP code: 27315

Question No. 1(d): Take value of  $E=2 \times 10^5 \text{ N/mm}^2$

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## (REVISED COURSE)

(3 Hours)

[Total Marks:80]

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

(2) Attempt any four questions out of remaining six.

(3) Draw sketches wherever necessary.

(4) Figures to the right indicate full marks.

1. (a) With the help of the following properties identify the minerals. 05
- (i) Fibrous form, Lustre – Silky, Splintery fracture.
- (ii) Massive form, Colour – lead grey, Streak – lead grey, Lustre – Metallic, Sp.Gravity 7.4 -7.6, Chemical composition – PbS .
- (iii) Lamellar form, Colour – Black, Lustre – Pearly, Cleavage – Basal Pinacoid.
- (iv) Banded form, mostly found with haematite, Lustre – Waxy, Cleavage – Absent, Hardness – 7 .
- (v) Granular pisolitic form, Crystal System – Amorphous, Lustre – Dull, Fracture – Uneven, Chemical Composition  $Al_2O_3 \cdot 2H_2O$
- (b) (i) What are the various types of metamorphism? 05
- (ii) Name the parent rock of marble and quartzite.
- (iii) What do you mean by acidic and basic rock?
- (iv) What do you mean by exfoliation?
- (v) State the relationship between dip and strike?
- (c) Write the names and draw rough sketch of each of the following. 10
- (i) Core between normal and inverted limbs with horizontal axis.
- (ii) Group of synclines and anticlines with parallel axes.
- (iii) Isolated water table held by small extension of impervious rock within previous tract.
- (iv) The structure with bands of platy minerals alternate with granular minerals.
- (v) Two normal faults forming wedge shaped block mountain.
2. (a) Explain with suitable diagrams different types of texture found in igneous rocks. 10
- (b) Describe two land forms each created by erosive action of wind and glaciers. 10
3. (a) State the terminologies of fault. Explain various types of faults with suitable diagrams. 10
- (b) State the engineering considerations of weathering. What are the different types of weathering? 06
- (c) Explain concentric fold and similar fold. 04
4. Explain the following in brief.(any four) 20
- (a) Various products erupted during volcanic activities.
- (b) Water bearing qualities of rock.
- (c) Properties of good building stones.
- (d) Various types of plate boundaries.
- (e) Use of seismic waves in understanding the interior of the Earth.

Turn Over



5. (a) In a limestone quarry, a bed has 75m true thickness and it shows a vertical thickness of 98m. All the beds are dipping southwards. Determine its amount of inclination and width of outcrop on a level ground. 06
- (b) Write the lithology and classification of Deccan trap. 06
- (c) Write short notes on the following 08
- (i) Solifluction and soil creep. (ii) Non conformity and disconformity
- (iii) Fold axis and axial plane of fold. (iv) Lacolith and batholith.
6. (a) Write different geological considerations in the selection of dam site 10
- (b) Explain the importance of core recovery and RQD 04
- Calculate the same from the given data and mention your opinion. 06
- Run is 3 mtrs.

No of samples	Length of sample (in cm)	Nature of joints
1	12	N
2	04	M
3	03	N
4	17	M
5	03	M
6	07	M
7	29	N
8	05	N
9	08	N
10	06	N
11	42	N
12	35	N
13	05	N
14	03	M
15	04	N

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QP Code :27402

(3 hours)

Note:

Max. Marks: 80

Question no.1 is compulsory

Solve any 3 questions out of remaining

Assume data wherever necessary and clearly mention the assumptions made.

Draw neat figures as required.

1. Answer any 4 of the following. 20
- Write Euler's equation of motion along a stream line and integrate it to obtain Bernoulli's equation and list the assumptions made.
  - Explain Surface tension & obtain the expression between surface tension and pressure inside the liquid droplet in excess of outside pressure.
  - Find the gauge pressure and absolute pressure in  $N/m^2$  at a point 4 m below the free surface of a liquid of sp. gr. 1.2, if atmospheric pressure is equivalent to 750 mm of mercury.
  - Explain Flow past a Rankine Oval Body.
  - Derive the expression for discharge over a rectangular weir in terms of head of water over the crest of the weir.
2. a. The following data relates to venturimeter fitted to an inclined pipe in which water is flowing. Diameter of the pipe = 300 mm; Throat diameter = 150 mm; Specific gravity of liquid used in U tube manometer = 0.8; Reading of manometer = 400 mm; Loss of head between the inlet and throat =  $0.3 \times$  kinetic head of the pipe. Find the discharge. 10
- b. Derive the expression for Metacentric Height. 10
3. a. If for a two dimensional potential flow, the velocity potential is given by  $\phi = x(2y - 1)$ ; determine the velocity at the point (4, 5). Determine also the value of stream function at that point? 10
- b. A circular plate of 1m 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

[TURN OVER

4. a. An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of shaft is 0.5 m and it rotates at 200 rpm. Calculate the power lost in the oil for a sleeve length of 100 mm. The thickness of the oil film is 1.0m. 10
- b. A convergent-divergent mouthpiece is fitted into the vertical side of a tank containing water. Assuming that there are no losses in the convergent part of the mouthpiece, and that the losses in the divergent part are equivalent to 0.2 times the velocity head at exit and that the maximum absolute pressure head at the throat is 2.44m of water for a barometric pressure of 760 mm of mercury, determine the throat and exit diameters of the mouthpiece when the discharge is 4.25 lit/sec, for a head of 1.52 m. 10
5. a. A cylindrical vessel 15 cm in diameter and 40 cm long is completely filled with water. The vessel is open at the top. Find the quantity of water left in the vessel, when it is rotated about the vertical axis with a speed of 300 rpm. 10
- b. Explain Rotameter and Pitot tube. 05
- c. Show that the error of 1% in measuring H (height of liquid surface above the sill of notch or weir) will produce 1.5% error in discharge over a rectangular notch or weir. 05
6. a. A U-tube differential manometer connects two pressure pipes A and B. pipe A contains Carbon tetra chloride having a specific gravity 1.594 under a pressure of 11.772 N/cm<sup>2</sup> and pipe B contains oil of specific gravity 0.8 under a pressure of 11.772 N/cm<sup>2</sup>. The pipe A lies 2.5m above pipe B. find the difference of pressure measured by mercury as fluid filling U-tube. 10
- b. Derive the expression for maximum discharge over broad crested weir. 10



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Correction : T0933 / T73 - Fluid Machanics-I Q.P.Code 27402



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Correction : T0933 / T73 - Fluid Machanics-I Q.P.Code 27402

Q.4 a. Given: Thickness of oil film 1.0m ....Please read as thickness of oil film 1.0 mm.

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