Total No. of Questions—**8**] [Total No. of Printed Pages—**4+1**

Seat No.	

[5152]-502

S.E. Civil (First Semester) EXAMINATION, 2017
STRENGTH OF MATERIAL
(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4** , Q. **5** or Q. **6**, Q. **7** or Q. **8**

(*ii*) Neat sketches must be drawn wherever necessary.

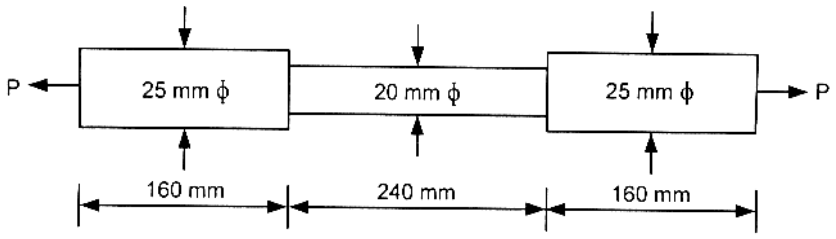
(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

(*v*) Use of electronic pocket calculator is allowed.

(*vi*) Use of cell phone is prohibited in the examination hall.

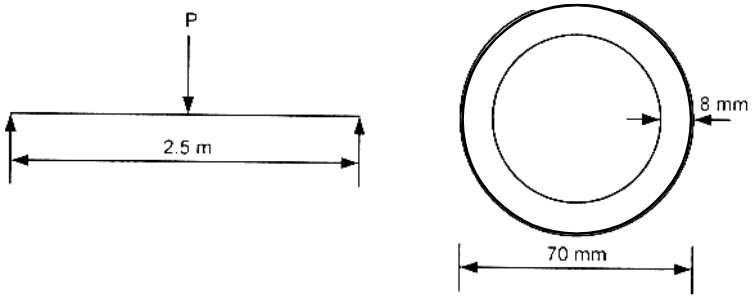
1. (*a*) The bar is tested in a Universal Testing Machine. It is observed that at a load of 40 kN the total extension of the bar is 0.285 mm. Determine the Young's modulus of the bar material. [6]



(*b*) A circular pipe of external diameter 70 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2.5 m. Find the maximum concentrated load that can

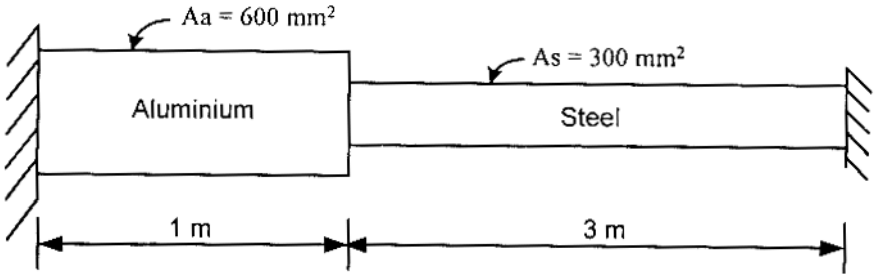
P.T.O.

be applied at the Centre of the span if the permissible stress in the tube is 150 N/mm^2. [6]



Or

2. (*a*) A composite bar is rigidly fitted at the supports A & B as shown in figure. Determine the reactions at the supports when the temperature rises by 20°C. Take E_a= 70 GN/m^2, E_s = 200 GN/m^2, α_a= 11 × 10^{-6}/°C and α_s= 12 × 10^{-6}/°C. [6]



(*b*) A T section 100 mm × 130 mm × 20 mm is subjected to a Shear force of 100 kN. Draw the shear stress distribution and find the maximum shear stress. [6]

3. (*a*) A hollow shaft transmits 100 kW at 120 r.p.m. Allowable shear stress in material is 50 N/mm^2. Shaft shall not twist 2° in 1 m length. Ratio of Internal diameter to external diameter is 0.25. Take G = 80 kN/mm^2. Maximum torque is 15 % more than Mean torque. Calculate maximum external diameter of a shaft. [6]

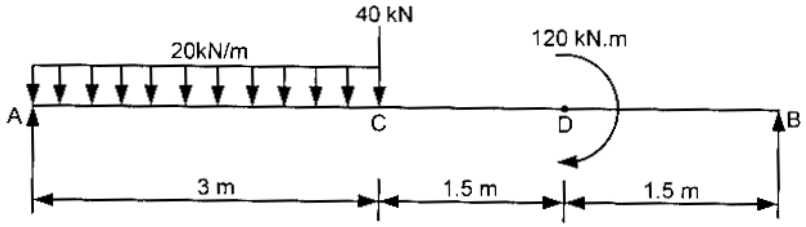
(*b*) At a point in a beam the normal stress along the length is 80 N/mm^2. The stress at that point is positive magnitude of 35 N/mm^2. Find the stresses on a plane whose normal is inclined at 30° to the longitudinal axis. Also find the principal stresses and planes on which they act. [6]

Or

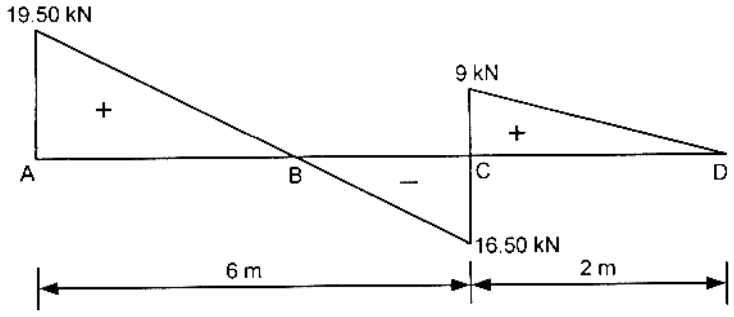
4. (*a*) A load of 500 N falls freely through a height of 150 mm on to a collar attached to the end of a vertical rod of 50 mm diameter and 2 *m* long, the upper end of the rod being fixed to the ceiling. Calculate the maximum instantaneous extension of the bar and also calculate the maximum stress in the bar. Assume E = 200 GPa. [6]

(*b*) What is meant by torque ? State the assumptions made in the determination of shear stress in circular shafts subjected to torsion. [6]

5. (*a*) Draw Shear Force Diagram and Bending Moment Diagram of a simply supported beam as shown in figure. [7]

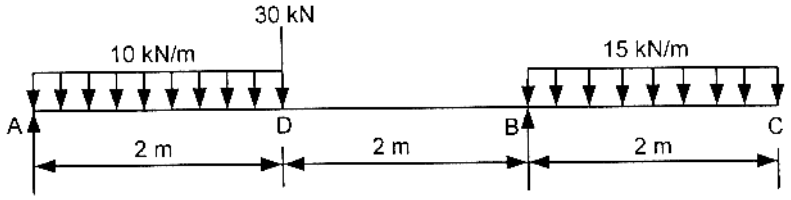


(*b*) Draw the loading diagram and bending moment diagram from the given shear force diagram of a beam. [6]

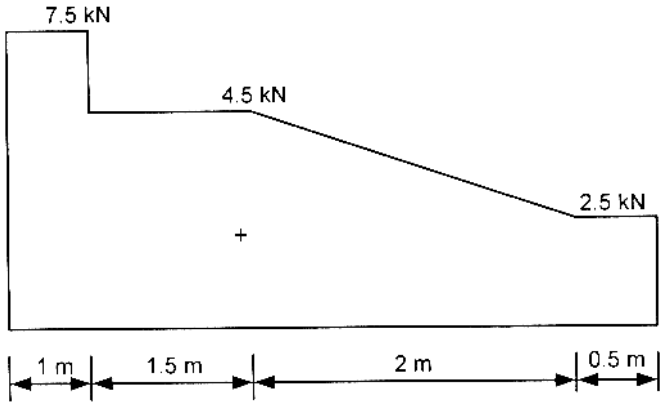


Or

6. (*a*) Draw Shear Force Diagram and Bending Moment Diagram of a simply supported beam as shown in figure. [7]



(*b*) Construct loading diagram for the following shear force diagram for a beam as shown in fig. [6]



7. (*a*) Calculate the safe compressive load on hollow C.I. Column with one end fixed and other end hinged. The column having a 150 mm external diameter and 100 mm internal diameter and 10 m length. Use Euler's Formula with factor of safety 5. Take E = 95 × 10^3 N/mm^2. [6]

(*b*) A hollow C.I. column whose outside diameter is 250 mm has a thickness of 15 mm. It is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety 4. Calculate slenderness ratio & Rankine's critical load. Take σ_c = 550 N/mm^2, $a = \frac{1}{600}$ & Take E = 9.4 × 10^4 N/mm^2. [7]

Or

8. (*a*) A rectangular column of 240 mm × 150 mm is subjected to a vertical load of 10 kN placed at an eccentricity of 60 mm in a plane bisecting 150 mm side. Determine the maximum & minimum stress intensities in the section. [6]

(*b*) A masonry pillar 8 m high is 1.5 m × 2.5 m in section, a horizontal wind pressure of 1.4 kN/m^2 acts on the 2.5 m × 8 m face. Find the maximum and minimum stress intensities induced on the base section. The weight of masonry is 22.5 kN/m^3. [7]

Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

Seat No.	

[5152]-503

S.E. (Civil) (First Semester) EXAMINATION, 2017

GEOTECHNICAL ENGINEERING

(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Answer Q. No. **1** or Q. No. **2**, Q. No. **3** or Q. No. **4**, Q. No. **5** or Q. No. **6**, Q. No. **7** or Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right side indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Explain weathering and distinguish between mechanical and chemical weathering giving examples. [6]

(*b*) Explain in brief *six* factors affecting permeability of soils. [6]

Or

2. (*a*) Define and mention the formulae for the following terms : Void ratio, Porosity, Degree of saturation, Percentage air voids, Water content, Specific gravity. [6]

(*b*) State Darcy's law. Define coefficient of permeability and derive equation for coefficient of permeability used in constant head method. [6]

P.T.O.

3. (*a*) In a standard proctor test the following observations were recorded : [7]

Sample No.	Bulk Density (kg/m^3)	Water Content (%)
1	1310	16.1
2	1515	19.5
3	1875	27.55
4	1860	33.69
5	1775	34.77

Plot the moisture density curve and find MDD and OMC and also draw ZAV line.

(*b*) Explain direct shear test with respect to the drainage and loading conditions [6]

Or

4. (*a*) Write any *four* assumptions made by Boussinesq to evaluate the stress at a point inside the soil mass due to a point load. Also explain in brief stress Isobar. [7]

(*b*) Define total and effective stress. Determine the shear strength in terms of effective stress on a plane within a saturated soil mass at a point where the total normal stress is 200 kN/m^2 and the pore water pressure is 80 kN/m^2. The effective stress shear strength parameters for the soil are c' = 16 kN/m^2 and phi' = 39°. [6]

5. (*a*) Differentiate between Rankine's and Coulomb's theories of earth pressure. [6]

(*b*) Explain Active, Passive Earth Pressure with respect to wall movements with sketches. [6]

Or

6. (*a*) Derive the expression for the active state of pressure at any point for a submerged cohesionless backfill along with pressure diagrams. [6]

(*b*) Discuss Culmann's graphical method for the determination of active earth pressure. [6]

7. (*a*) Write short notes on causes and remedial measures of Landslides. [7]

(*b*) Derive the expression for factor of safety for dry infinite slope and submerged infinite slope in sandy soils. [6]

Or

8. (*a*) Discuss sources and types of ground contamination. [6]

(*b*) Explain how soil acts as a geochemical trap and state the various remediation techniques. [7]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[5152]-504

S.E. (Civil) (I Sem.) EXAMINATION, 2017

SURVEYING

(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat sketches must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

(*v*) Use of electronic pocket calculator is allowed in the examination.

(*vi*) Use of cell phone is prohibited in the examination hall.

1. (*a*) Enlist and explain the function of each of the instruments required for plane table surveying. [6]

(*b*) Following readings were observed during a reciprocal leveling with one level : [6]

Instrument at	**Staff Readings on**		**Remark**
	A	**B**	
A	0.656	2.097	Distance between
B	0.867	2.298	A & B is 950 m

(*i*) Find the true R.L. of B, if R.L. of A = 378.655 m.

P.T.O.

(*ii*) Find the combined correction due to curvature and refraction.

(*iii*) Find the collimation error.

Or

2. (*a*) Correct the bearing of a closed traverse PQRSP for a local attraction if any. [6]

Line	**PQ**	**QR**	**RS**	**SP**
F.B.	S45°30'E	S60°00'E	S5°30'E	N83°30'W
B.B.	N45°30'W	N60°40'W	N3°20'W	S85°00'E

(*b*) Explain the need and procedure of the terms profile levelling and cross-sectioning with sketches in a road project. [6]

3. (*a*) Define the following terms :

Transiting, Telescope normal, Latitude, Face right. [4]

(*b*) A tacheometer was set up at a station A and the following reading were obtained on a vertically held staff. The constants of the instrument were 100 and 0.1. [8]

Station	**Staff station**	**Vertical angle**	**Hair reading (in mtrs)**	**Remarks**
P	B.M.	–4°22'	1.050, 1.103, 1.156	R.L. of B.M.
P	Q	+10°0'	0.952, 1.055, 1.158	is = 1958.300 mtrs.

Find the horizontal distance from P to Q and the reduced level of station Q.

Or

4. (*a*) Determine the missing data for the following table of a closed traverse ABCDA. [8]

Line	**AB**	**BC**	**CD**	**DA**
Length (m)	230.5	250.2	210.8	—
Bearing	N36°45'E	S82°48'E	S10°15'E	—

(*b*) Explain the laboratory method to determine the tacheometric constant. [4]

5. (*a*) Two roads AB & BC meets at an angle of intersection 127° 30' at a chainage of 1280 m. Calculate the necessary data for setting out a curve with radius of 150 m by offset from long chord method. [7]

(*b*) Enlist various linear methods of setting out curves and explain any *one* with sketch. [6]

Or

6. (*a*) What is meant by "transition curve" ? What are the different forms of a transition curve ? Give reasons to introduce the transition curve. [6]

(*b*) Two tangents AB & BC meets at B with deflection angle 40° at a chainage of 1280 m. Calculate the necessary data for setting out a curve with radius of 150 m by One theodolite (with 20" L.C.) method take peg interval of 20 m. [7]

7. (*a*) Write a short note on segments of Space Based Positioning System. [6]

(*b*) Write a note on setting out a building. [7]

Or

8. (*a*) Enlist the limitations of the prevalent survey techniques and so give advantages of Space Based Positioning System. [7]

(*b*) Enlist and explain various stages in road survey project. [6]

Total No. of Questions—**8**] [Total No. of Printed Pages—**8**

Seat No.	

[5152]-505

S.E. (Civil Engg.) (I Sem.) EXAMINATION, 2017

ENGINEERING MATHEMATICS—III

(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** and Q. No. **7** *or* Q. No. **8**.

(*ii*) Draw neat diagram wherever needed.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

(*v*) Use of non-programmable pocket calculator is allowed.

1. (*a*) Solve any *two* of the following : [8]

(*i*) $\frac{d^3y}{dx^3} - 4\frac{dy}{dx} = 2 \cosh 2x$

(*ii*) $(D^2 + 4)\, y = \sec 2x$

(by method of variation of parameters)

(*iii*) $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^4.$

P.T.O.

(*b*) Solve the following equations by using Gauss-elimination method : [4]

$$3x_1 + 4x_2 + x_3 = 3$$

$$3x_1 + 2x_2 - 2x_3 = -2$$

$$x_1 - x_2 + x_3 = 6.$$

Or

2. (*a*) Find the equation of elastic curve of a uniform cantilever beam of length l having a constant weight w kg per foot and determine the deflection of the free end. [4]

(*b*) Use Euler's modified method to find the value of y satisfying the equation :

$$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2};\ y(1) = 1$$

for $x = 1.1$ correct to three decimal places by taking $h = 0.1$. [4]

(*c*) Solve the following system of equations by triangularisation method : [4]

$$3x + 2y + 7z = 4$$

$$2x + 3y + z = 5$$

$$3x + 4y + z = 7.$$

3. (*a*) Find the correlation co-efficient for the following table : [4]

x	y
10	18
14	12
18	24
22	6
26	30
30	36

(*b*) In a certain factory turning out razor blades, there is a small chance of 0.002 for any blade to be defective. The blades are supplied in packets of 10. Use Poisson's distribution to calculate appoximate number of packets containing no defective and one defective respectively in a consignment of 10000 packets. [4]

(*c*) Find the directional derivative of [4]

$$\phi = xy^2 + yz^3$$

at (2, –1, 1), along the line $2(x - 2) = (y + 1) = (z - 1)$.

Or

4. (*a*) The first four moments about a working mean 5, are 7, 70, 140 and 175. Calculate the central moments and hence β_1 and β_2. [4]

(*b*) Prove the following (any *one*) : [4]

(*i*) $\nabla \times \left(\frac{\bar{a} \times \bar{r}}{r^n} \right) = \frac{(2-n)\bar{a}}{r^n} + \frac{n}{r^{n+2}} (\bar{a} \cdot \bar{r})\bar{r}$

(*ii*) $\nabla \cdot \left[r \nabla \left(\frac{1}{r^n} \right) \right] = \frac{n(n-2)}{r^{n+1}}$.

(*c*) Show that

$$\bar{F} = (2xz^3 + 6y)\hat{i} + (6x - 2yz)\hat{j} + (3x^2y^2 - y^2)\hat{k}$$

is irrotational. Find scalar potential ϕ such that $\bar{F} = \nabla\phi$. [4]

5. Attempt any *two* :

(*a*) Evaluate [6]

$$\int_C \bar{F} \cdot d\bar{r},$$

where

$$\bar{F} = 3x^2\bar{i} + (2xz - y)\bar{j} + z\bar{k}$$

along the curve

$$x = t,\ y = t^2,\ z = t^3$$

from (0, 0, 0) to (1, 1, 1).

(*b*) For a closed surface S enclosing the volume V if [6]

$$\iint_S \frac{1}{r^2}\bar{r} \cdot d\bar{S} = \iiint_V \frac{1}{r^2} dV,$$

then evaluate

$$\iint_S \frac{x\bar{i} + y\bar{j} + z\bar{k}}{r^2} \cdot d\bar{S}$$

where S is the sphere

$$x^2 + y^2 + z^2 = a^2 \text{ and } \bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$$

(*c*) Evaluate [7]

$$\iint_S \left(\nabla \times \bar{F}\right) . \hat{n}\, ds,$$

where

$$\bar{F} = (x - y)\bar{i} + 2xz\bar{j} + xy\bar{k}$$

and S is the curved surface of the paraboloid

$$x^2 + y^2 = 2z$$

bounded by the plane $z = 3$.

Or

6. Attempt any *two* :

(*a*) Find the work done by the force [6]

$$\left(x^2 - yz\right)\bar{i} + \left(y^2 - zx\right)\bar{j} + \left(z^2 - xy\right)\bar{k}$$

in taking a particle from (1, 1, 1) to (2, 2, 2) in straight line.

(*b*) Using Stokes' theorem evaluate [6]

$$\iint_S \nabla \times \bar{F} . d\bar{S}$$

for

$$\bar{F} = -y^3\bar{i} + x^3\bar{j},$$

where the boundary of the surface S is given by :

$$C : \frac{x^2}{1} + \frac{y^2}{4} = 1.$$

(*c*) Evaluate [7]

$$\iint_S \bar{F} \cdot d\bar{S},$$

where S is the curve surface of the sphere

$$x^2 + y^2 + z^2 = 4$$

above the plane $z = 0$ and

$$\bar{F} = y^2z^2\bar{i} + z^2x^2\bar{j} + x^2y^2\bar{k}.$$

7. Solve any *two* of the following :

(*a*) A string is stretched and fastened to two points l apart. Motion is started by displacing the string in the form

$$u = a \sin\frac{\pi x}{l}$$

from which it is released at time $t = 0$. Find the displacement $u(x, t)$ from one end. [7]

(*b*) Solve the one dimensional heat flow equation : [6]

$$\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}$$

subject to the following conditions :

(*i*) $u(0, t) = 0$

(*ii*) $u(l, t) = 0$ for all t

(*iii*) $u(x, 0) = \frac{u_0 x}{l}$, $0 < x < l$, u_0 is constant

(*iv*) $u(n, t)$ is bounded.

(*c*) A thin sheet of metal is bounded by the x-axis and the lines $x = 0$ and $x = 1$ and stretching to infinity in y direction and its vertical edges and edge at infinity are maintained at the constant temperature 0°C, while temperature on short edge $y = 0$ is given by [6]

$$u(x, 0) = x, \qquad 0 < x \leq 0.5$$

$$= 1 - x, \quad 0.5 \leq x \leq 1.$$

Find the steady state temperature $u(x, y)$.

Or

8. Solve any *two* of the following :

(*a*) It a string of length l is initially at rest in its equilibrium position and each of its point is given a velocity $v(x)$ such that :

$$v(x) = cx, \qquad 0 < x < \frac{l}{2},$$

$$= c(l - x), \quad \frac{l}{2} \leq x < l.$$

Obtain the displacement $y(x, t)$ at any time t. [7]

(*b*) A homogeneous rod of conducting material of length 100 cm has its ends kept at zero temperature and the temperature initially is :

$$u(x, 0) = x, \qquad 0 \leq x \leq 50$$

$$= 100 - x, \quad 50 \leq x \leq 100.$$

Find the temperature at any time t. [6]

(*c*) An infinitely long metal plate is enclosed between lines $y = 0$ and $y = l$ for $x > 0$. The temperature is zero along the edges $y = 0$ and $y = l$ and at infinity. If the edge $x = 0$ is kept a constant temperature u_0, find the steady state temperature distribution $u(x, y)$. [6]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[5152]-507

S.E. (Civil) (II Sem.) EXAMINATION, 2017
ARCHITECTURAL PLANNING AND DESIGN OF BUILDINGS
(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4** on the answer-sheet.

(*ii*) Solve Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8** on the drawing sheet only.

(*iii*) Assume suitable data, if necessary.

(*iv*) Figures to the right indicate full marks.

1. (*a*) Write a short note on TDR. Who is eligible for TDR and enlist the documents required for TDR ? [7]

(*b*) Write short notes on : [6]

(*i*) Green roofing

(*ii*) Cost effective housing.

Or

2. (*a*) Write a short note on NOC from roads, National and State Highways. Which dicuments are required for application ? [7]

(*b*) Explain the following principle of architectural planning with sketches : [6]

(*i*) Unity

(*ii*) Composition.

P.T.O.

3. (*a*) What do you mean by perspective drawing ? What are the objectives of perspective drawing ? [7]

(*b*) Write short notes on : [6]

(*i*) Reverberation and Sabine's expression

(*ii*) Formation of echoes.

Or

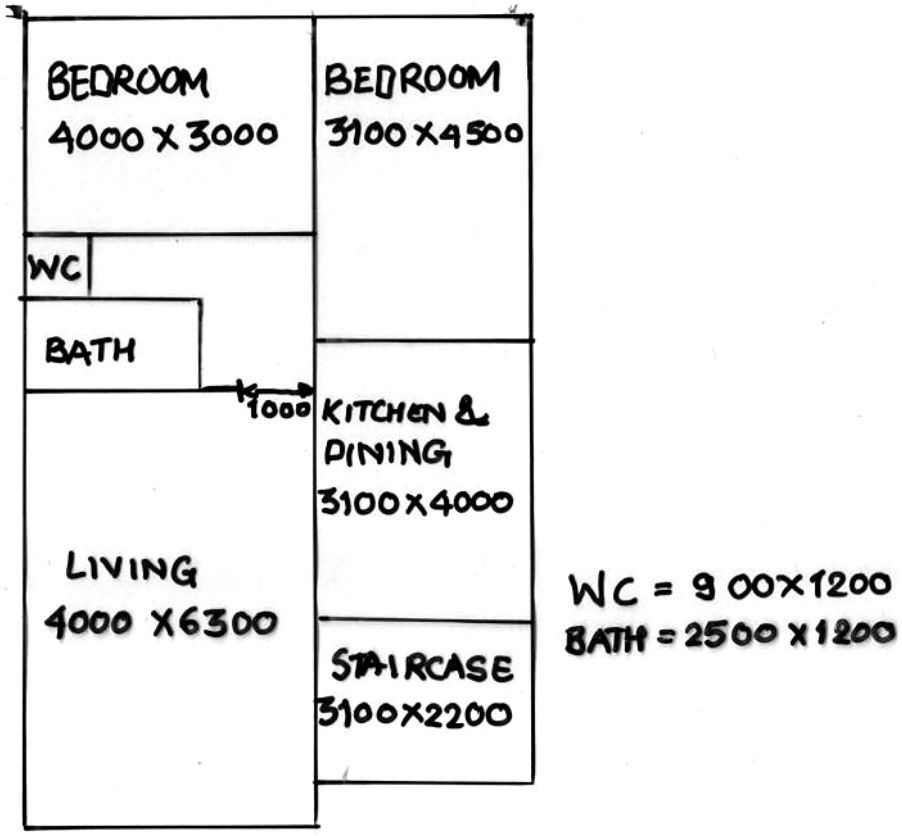
4. (*a*) Write short notes on : [7]

(*i*) Winter air conditioning system

(*ii*) Summer air conditioning system.

(*b*) Write a short note on One pipe system and Two pipe system of plumbing. [6]

5. Draw a detailed plan to a scale of 1 : 50 or suitable for line plan shown in fig. [13]



Refer the following guidelines

(*i*) The structure is RCC framed structure.

(*ii*) Wall thickness : External – 230 mm, Internal – 100 mm

(*iii*) Assume suitable size of doors and windows

(*iv*) Access to the terrace is provided through staircase

(*v*) Floor to floor height – 3240 mm

(*vi*) Plinth height – 600 mm

(*vii*) All the dimensions are in mm

(*viii*) Tread – 250 mm

Riser – 180 mm

Or

6. Draw to a scale 1 : 50 or suitable, detailed plan of a bungalow for the following conditions : [13]

(*i*) Living room 1 no – 18 m^2 approx.

(*ii*) Kitchen cum dining – 12 m^2 approx.

(*iii*) Master bedroom (inclusive of toilet) – 18 m^2 approx.

(*iv*) Guest room – 12 m^2

(*v*) Study room – 12 m^2

(*vi*) 1 separate WC and bath

(*vii*) Passage – 1.2 m wide

(*viii*) Floor to floor height – 3.0 m

(*ix*) RCC framed structure

(*x*) Plinth height – 600 mm

(*xi*) Provide suitable staircase

7. Design a primary school for 5 classrooms, the building is single storied and is RCC framed structure. The following units are be provided : [12]

(*i*) Number of students per classroom – 40

(*ii*) Primary classroom – 50 m^2

(*iii*) Drawing room – 75 m^2

(*iv*) Headmasters room – 15 m^2

(*v*) Administrative office – 30 m^2

(*vi*) Common staff room – 60 m^2

(*vii*) Medical unit – 30 m^2

(*viii*) Book store – 15 m^2

(*ix*) Sanitary block (Ladies and gents) : suitable no.

Draw to a scale of 1 : 50 or suitable, line plan with North line.

Or

8. Design a Rest House for 6 rooms, the building is single storied and RCC framed structure. The following units are to be provided : [12]

(*i*) Bedroom with attached toilet :

(*a*) Bedroom – 12 m^2

(*b*) Toilet – 3 m^2

(*ii*) Circulation space verandah – 2 m wide

(*iii*) Dining hall – 20 m^2

(*iv*) Kitchen – 12 m^2

(*v*) Store – 6 m^2

(*vi*) Office – 12 m^2

(*vii*) Sanitary block (Ladies and gents) – Suitable no.

Draw to a suitable scale line plan with North direction.

Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

Seat No.	

[5152]-510

S.E. (Civil Engineering) (Second Semester)

EXAMINATION, 2017

ENGINEERING GEOLOGY

(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Solve/Write the Answers to any *four* questions in single answer book only.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

1. (*a*) How are sedimentary rocks formed ? Explain types of sedimentary deposits with examples. [6]

(*b*) Write note on INTERIOR of THE EARTH. [6]

Or

2. (*a*) What is Metamorphism ? Describe GNEISSOSE and SCHISTOSE texture with neat sketches. [6]

(*b*) What are CLASTIC and NONCLASTIC secondary rocks ? Describe CLASTIC texture with neat diagram. [6]

3. (*a*) Describe any *three* features developed by RIVER deposition. [6]

(*b*) Why are observations and precautions necessary in the core drilling process ? [6]

P.T.O.

Or

4. (*a*) Write note on ARCHEANS and DHARWARS. [6]

(*b*) How can nature of the rocks be assessed on number of pieces present in one RUN ? [6]

5. (*a*) Describe any *two* geological conditions leading to natural springs ? [7]

(*b*) Write note on feasibility of TUNNELLING through : [6]

(*i*) Anticline

(*ii*) Syncline.

Or

6. (*a*) Explain with appropriate example feasibility of dam alignment across a DYKE. [7]

(*b*) What is seismology ? Explain various seismic waves. Describe CIRCUMPACIFIC RING OF FIRE. [6]

7. (*a*) What are Natural and Artificial causes of Landslides ? Enlist measures to prevent landslide. [7]

(*b*) What Geological studies are required to be carried out in reservoir area of proposed dam site ? [6]

Or

8. (*a*) What are CORE RECOVERY and RQD ? On the basis of the further logging data calculate core recovery and RQD. [7]

Run in meters	Piece No.	Length of each piece in 'cm'	Nature of fracture at lower end	Remark
	1	09	M	Basaltic rocks
	2	10	J	
	3	09	M	
	4	40	J	
	5	20	J	
	6	34	J	
	7	55	J	
	8	42	J	
	9	50	J	
	10	31	J	

(*b*) Describe feasibility of dam in folded areas. Draw neat diagrams. [6]

Total No. of Questions—**8**] [Total No. of Printed Pages—**7**

Seat No.	

[5152]-511

S.E. (Mechanical/Sandwich/Auto.) (I Sem.) EXAMINATION, 2017

ENGINEERING MATHEMATICS—III

(2015 PATTERN)

Time : Three Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

(*v*) *All* questions are compulsory.

1. (*a*) Solve any *two* of the following : [8]

(*i*) $(D^2 + 13D + 36)y = e^{-4x} + \sinh x$

(*ii*) $(D^2 - 2D + 2)y = e^x + \tan x$

(using method of variation of parameter)

(*iii*) $x^2\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 6y = x^5.$

(*b*) Using Fourier integral representation show that : [4]

$$\int_0^\infty \frac{\lambda^3 \sin \lambda x}{\lambda^4 + 4} d\lambda = \frac{\pi}{2} e^{-x} \cos x, \quad x > 0.$$

P.T.O.

Or

2. (*a*) A body of weight 9.8 N is suspended from a spring having constant 4 N/m. Prove that the motion is one of the resonance if a force 16 sin 2*t* is applied and damping force is negligible. Assume that initially the weight is at rest in the equilibrium position. [4]

(*b*) Solve any *one* : [4]

(*i*) Find the Laplace transform of :

$$\cosh\ t \int_0^t e^t\ \cosh(t)\ dt.$$

(*ii*) Find the Inverse Laplace Transform of $\cot^{-1}\left(\frac{s-2}{3}\right)$.

(*c*) Using Laplace transform solve the D.E. : [4]

$$y'' + 2y' + y = te^{-t},\ y(0) = 1,\ y'(0) = -2.$$

3. (*a*) If [4]

$$\Sigma f = 27,\ \Sigma fx = 91,\ \Sigma fx^2 = 359,$$

$$\Sigma fx^3 = 1567,\ \Sigma fx^4 = 7343.$$

Find the first four moments about origin. Also find $\mu_2,\ \mu_3,\ \mu_4$.

(*b*) An unbiased coin is thrown 10 times. Find the probability of getting exactly 6 heads and at least 6 heads using binomial distribution. [4]

(*c*) Find the directional derivative of $xy^2 + yz^3$ at (2, –1, 1) along the line $2(x - 2) = y + 1 = z - 1$. [4]

Or

4. (*a*) Obtain regression lines for the following data : [4]

x	***y***
6	9
2	11
10	5
4	8
8	7

(*b*) Prove the following (any *one*) : [4]

(*i*) $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$

(*ii*) $\nabla \cdot \left[r \nabla \left(\frac{1}{r^3} \right) \right] = \frac{3}{r^4}$.

(*c*) Show that the vector field [4]

$$\bar{F} = (x + 2y + 4z)\bar{i} + (2x - 3y - z)\bar{j} + (4x - y + 2z)\bar{k}$$

is irrotational and hence find scalar function ϕ such that $\bar{F} = \nabla\phi$.

5. (*a*) Evaluate :

$$\int_C \bar{F} \cdot d\bar{r}$$

where

$$\bar{F} = x^2\bar{i} + xy\bar{j}$$

and C is the straight line $y = x$, joining (0, 0) and (1, 1).

(*b*) Prove that : [4]

$$\iint_S (\phi \nabla\psi - \psi \nabla\phi) \cdot d\bar{S} \iiint_V (\phi \nabla^2\psi - \psi \nabla^2\phi) dV .$$

(*c*) Use Stokes' theorem to evaluate : [5]

$$\int_C (4y\bar{i} + 2z\bar{j} + 6y\bar{k}) \cdot d\bar{r}$$

where C is the curve of intersection of
$x^2 + y^2 + z^2 = 2z$ and $x = z - 1$.

Or

6. (*a*) Evaluate : [4]

$$\int_C \bar{F} \cdot d\bar{r}$$

where

$$\bar{F} = xy^2\bar{i} + y\bar{j}$$

and C is curve $x = t$, $y = t^2$, joining $t = 0$ and $t = 1$.

(*b*) Evaluate : [5]

$$\iint_S \bar{F} \cdot d\bar{s}$$

where

$$\bar{F} = yz\bar{i} + zx\bar{j} + xy\bar{k}$$

and S is the upper part of the sphere

$$x^2 + y^2 + z^2 = 1$$

above *xoy* plane.

(*c*) Evaluate : [4]

$$\iint_S \left(\nabla \times \bar{F}\right) \cdot \hat{n}\, ds$$

where

$$\bar{F} = xy^2\bar{i} + y\bar{j} + z^2x\bar{k}$$

and S is the surface of a rectangular lamina bounded by :

$x = 0,\ y = 0,\ x = 1,\ y = 2,\ z = 0.$

7. (*a*) Solve the wave equation [7]

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$

with boundary conditions :

(*i*) $u(0,\ t) = 0,\ \forall t$

(*ii*) $u(l,\ t) = 0,\ \forall t$

(*iii*) $\left(\frac{\partial u}{\partial t}\right)_{t=0} = 0,$

(*iv*) $u(x,\ 0) = a\ \sin\frac{\pi x}{l}$

(*b*) Solve the heat equation [6]

$$\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$$

for the function $u(x,\ t)$, subject to the following conditions :

(*i*) $u(0,\ t) = 0$

(*ii*) $u(l,\ t) = 0,\ \forall t$

(*iii*) $u(x,\ 0) = x,\ 0 \leq x < l$

(*iv*) $u(x,\ \infty)$ is finite.

Or

8. (*a*) Solve the Laplace equation [6]

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$

subject to condition :

(*i*) $u(x,\ 0) = 0$

(*ii*) $u(x,\ l) = 0$

(*iii*) $u(\infty,\ y) = 0,$

(*iv*) $u(0,\ y) = a_0.$

(*b*) Use Fourier transform to solve : [7]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \quad 0 < x < \infty, \quad t > 0$$

where $u(x, t)$ satisties the conditions :

(*i*) $\left(\frac{\partial u}{\partial x}\right)_{x=0} = 0, \quad t > 0$

(*ii*) $u(x, 0) = \begin{cases} x & 0 < x < 1 \\ 0 & x > \end{cases}$

(*iii*) $|u(x, t)| < m.$