ASSIGNMENT 1: GATE 2008
GG : Geology and Geophysics

EE25BTECH11003 -Adharvan Kshathriya Bommagani

1) The planet having density less than 1.0 gm/cm^3 is
(GATE GG 2008)

a) Jupiter b) Neptune c) Saturn d) Uranus

2) Which mineral in a metamorphic rock indicates high grade metamorphism?
(GATE GG 2008)

a) Chlorite
b) Muscovite
c) Serpentine
d) Sillimanite

3) Which of the following landforms is formed by organisms?
(GATE GG 2008)

a) Atoll b) Drumlins c) Outwash d) Point bar

4) The age of the sandstone reservoir in Cambay basin is
(GATE GG 2008)

a) Cretaceous b) Eocene c) Holocene d) Jurassic

5) Due to Coriolis effect, the ocean currents will be deflected towards the right in
(GATE GG 2008)

a) Antarctica
b) Equator
c) Southern Hemisphere
d) Northern Hemisphere

6) The age of the Precambrian - Cambrian boundary (in million years) is close to
(GATE GG 2008)

a) 250 b) 550 c) 1550 d) 2550

7) Which of the following minerals is harder than a knife blade?
(GATE GG 2008)

a) Calcite b) Fluorite c) Gypsum d) Quartz

8) Choose a Proterozoic stratigraphic unit from the following
(GATE GG 2008)

a) Cuddapah Super Group
b) Dharwar Super Group
c) Gondwana Super Group
d) Iron Ore Group

9) The correct pair of naturally occurring fissile isotope of Uranium is
(GATE GG 2008)

a) U^{236} and U^{237}
b) U^{235} and U^{236}
c) U^{235} and U^{238}
d) U^{236} and U^{238}

10) In the plate tectonic theory, the "ring of fire" around the Pacific ocean is related to
(GATE GG 2008)

a) convergent plate boundary
b) divergent plate boundary
c) hot spots
d) transform fault

11) The shear wave is
(GATE GG 2008)

a) longitudinal
b) dilatational
c) irrotational
d) equivoluminal

12) The liquid used in the sensor of a Proton Precession Magnetometer should be rich in
(GATE GG 2008)

a) carbon b) hydrogen c) nitrogen d) oxygen

13) The dominant process of heat transport in the lithosphere is
(GATE GG 2008)

a) advection
b) conduction
c) convection
d) radiation

14) The shape of a vertical electric sounding curve over a three layer sequence comprising moist soil (top), fresh water saturated coarse sand (middle) and clay (bottom) is
(GATE GG 2008)

a) A-type b) H-type c) K-type d) Q-type

15) The geophysical method that provided a convincing evidence of sea floor spreading is
(GATE GG 2008)

a) gravity b) magnetic c) electric d) seismic

16) The difference in the gravity value (in mgal) between the equator and pole is close to
(GATE GG 2008)

a) 3786 b) 4586 c) 5186 d) 5986

17) With respect to the Earth-Moon axis, the tidal deformation of the Earth produced by the Moon has the shape of
(GATE GG 2008)

a) oblate ellipse
b) oblate ellipsoid
c) prolate ellipse
d) prolate ellipsoid

18) A successful combination of geophysical methods for exploration of kimberlite pipe is
(GATE GG 2008)

a) gravity and radiometric
b) magnetic and electromagnetic
c) radiometric and magnetic
d) radiometric and seismic

19) Liquid outer core is evidenced by shadow zone for direct P-wave in the epicentral distance of
(GATE GG 2008)

a) $92^{\circ} - 132^{\circ}$
b) $92^{\circ} - 142^{\circ}$
c) $102^{\circ} - 132^{\circ}$
d) $102^{\circ} - 142^{\circ}$

20) Rift valleys are bounded by
(GATE GG 2008)

a) normal faults
b) reverse faults
c) strike-slip faults
d) transform faults

21) The composition of a sandstone is as follows: Quartz: 55%, Feldspar: 25%, Rock fragments: 1% and Matrix: 19%. Petrographically, the sandstone is classified as
(GATE GG 2008)

a) arkose
b) arkosic wacke
c) lithic arenite
d) quartz wacke

22) Match the sedimentary structures in Group I with the geological processes in Group II.
(GATE GG 2008)

Group I	**Group II**
P. Load casts	1. Turbulent scour
Q. Cross bedding	2. Melting ice
R. Flutes	3. Soft sediment deformation
S. Dropstones	4. Biogenic
	5. Migration of mega ripples

a) P-3, Q-2, R-1, S-4
b) P-2, Q-1, R-5, S-4
c) P-3, Q-5, R-1, S-2
d) P-1, Q-4, R-5, S-2

23) The phyllodes developed in echinoids to
(GATE GG 2008)

a) increase efficiency in food collection
b) protect it from sinking in muddy substratum
c) burrow deep into the sediments
d) protect it from predators

24) Two rock samples, P and Q, are characterized by the following well-preserved fossil assemblages:
P: abundance of planktonic foraminifera and radiolaria
Q: abundance of spore, pollen and vertebrate fossils
Which of the following statements is true about the palaeoenvironmental conditions of the rocks?
(GATE GG 2008)

a) P is estuarine and Q is deep marine
b) P is inter-tidal and Q is terrestrial
c) P is terrestrial and Q is shallow marine
d) P is deep marine and Q is terrestrial

25) The evidence of Turonian marine transgression in Peninsular India is

(GATE GG 2008)

a) Bagh Beds
b) Niniyur Formation
c) Patcham Formation
d) Umaria Marine Bed

26) Match the stratigraphic units of India with their age:

(GATE GG 2008)

Stratigraphic Units	**Age**
P. Sargur Schist	1. Oligocene
Q. Kopili Shales	2. Eocene
R. Damuda Group	3. Permian
S. Kolhan Group	4. Carboniferous
	5. Proterozoic
	6. Archaean

a) P-5, Q-3, R-4, S-1
b) P-4, Q-3, R-1, S-5
c) P-6, Q-1, R-2, S-5
d) P-6, Q-2, R-3, S-5

27) In the following depth - temperature profile the broken lines indicate geothermal gradients. The zone in which oil and gas are likely to be generated and trapped is

(GATE GG 2008)

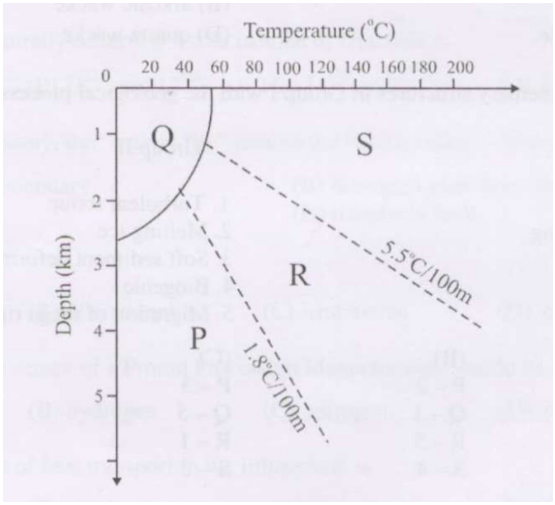

Fig. 27

a) P
b) Q
c) R
d) S

28) If a horizontal mirror plane is added to a pyramid having three-fold symmetry, the resultant symmetry of the c-axis will be

(GATE GG 2008)

a) 3m
b) $\overline{3}$
c) $\overline{6}$
d) $6/m$

29) Dodecahedron and trapezohedron faces are observed in

(GATE GG 2008)

a) beryl b) chalcopyrite c) fluorite d) garnet

30) The crystal system of biotite is

(GATE GG 2008)

a) hexagonal b) monoclinic c) orthorhombic d) tetragonal

31) The (0001) section of a uniaxial mineral can be distinguished from an isotropic mineral in thin section by

(GATE GG 2008)

a) extinction angle
b) pleochroism
c) relief
d) interference figure

32) Match the landforms in Group I with geomorphic processes in Group II

(GATE GG 2008)

Group I	**Group II**
P. Paired terrace	1. Glacial erosion
Q. Cirque	2. Glacial deposition
R. Barchan	3. River rejuvenation
S. Kames	4. Wind erosion
	5. Wind deposition

a) P-4, Q-2, R-5, S-3
b) P-2, Q-3, R-4, S-1
c) P-3, Q-2, R-5, S-4
d) P-3, Q-1, R-5, S-2

33) Match the ore/mineral deposits in Group I with genetic processes in Group II

(GATE GG 2008)

Group I	**Group II**
P. Kyanite	1. Chemical sedimentation
Q. Laterite	2. Chemical weathering
R. Banded iron ore	3. Metamorphic
S. Platinum	4. Magmatic

a) P-2, Q-1, R-3, S-4
b) P-3, Q-2, R-1, S-4
c) P-4, Q-3, R-2, S-1
d) P-3, Q-2, R-4, S-1

34) The scale of an aerial photograph acquired from a height of 5000 m using a camera having focal length of 200 mm, is

(GATE GG 2008)

a) 1:5000 b) 1:20000 c) 1:40000 d) 1:60000

35) The ratio of axial stress to corresponding axial strain for elastic material is known as

(GATE GG 2008)

a) Bulk modulus
b) Poisson's ratio
c) Shear modulus
d) Young's modulus

36) An x-ray beam of wavelength $\lambda = 1.541$ Å is incident on a cubic crystal having lattice spacing of 4 Å. What will be its 2θ value (where θ is the glancing angle) on x-ray diffractogram?
(GATE GG 2008)

a) 11.10°
b) 20.10°
c) 22.20°
d) 44.20°

37) The dip slip of a fault is 200 m and the dip amount is 30°. The throw of the fault (m) is
(GATE GG 2008)

a) 300 b) 200 c) 100 d) 50

38) Which of the following modes of origin applies to snowball garnet?
(GATE GG 2008)

a) Pre-tectonic
b) Syn-tectonic
c) Post-tectonic
d) Contact metamorphic

39) Rocks of which of the following facies form under low geothermal gradient?
(GATE GG 2008)

a) Blueschist
b) Granulite
c) Hornblende hornfels
d) Sanidinite

40) Which of the following statements is/are true for porosity of sandstone?
a) P - Porosity increases with sorting of grains.
b) Q - Porosity decreases with sorting of grains.
c) R - Porosity decreases with shale content.
d) S - Porosity increases with shale content.
(GATE GG 2008)

a) Q b) P, S c) P, R d) S

41) On crystallization of anorthite, Sr concentration in the magma will
(GATE GG 2008)

a) decrease
b) increase
c) increase and then decrease
d) remain constant

42) If the solubility product of gypsum is $10^{-4.36}$, the solubility (mol/litre) of gypsum in an ideal aqueous solution will be
(GATE GG 2008)

a) $10^{-9.72}$
b) $10^{-4.36}$
c) $10^{-2.18}$
d) $10^{-1.09}$

43) What is the age of the lignite deposit of Neyveli?
(GATE GG 2008)

a) Eocene b) Miocene c) Oligocene d) Permian

44) Find the correct match of mineral pair in Group I with the corresponding crystallization behaviour in Group II

(GATE GG 2008)

Group I	**Group II**
P. Silica K feldspar	1. Solid solution
Q. Albite Anorthite	2. Peritectic
R. Forsterite - Silica	3. Eutectic

a) P-3, Q-1, R-2
b) P-1, Q-2, R-3
c) P-2, Q-1, R-3
d) P-3, Q-2, R-1

45) An igneous rock with 50% olivine, 25% orthopyroxene and 25% clinopyroxene by mode will be called

(GATE GG 2008)

a) dunite
b) harzburgite
c) lherzolite
d) wehrlite

46) In a gravity survey, if the observation point lies below the datum plane, then for gravity data reduction

(GATE GG 2008)

a) Free-air and Bouguer corrections are positive
b) Free-air correction is positive and Bouguer correction is negative
c) Free-air correction is negative and Bouguer correction is positive
d) Free-air and Bouguer corrections are negative

47) If the Earth's magnetic field at the north pole is 60,000 γ and the radius of Earth is R, at what height above the north pole will its magnitude be 30,000 γ?

(GATE GG 2008)

a) 0.26 R
b) 0.52 R
c) 0.78 R
d) 1.04 R

48) Match the apparent resistivity type curves observed on the surface in Group I with the subsurface resistivity variations in Group II

(GATE GG 2008)

Group I	**Group II**
P. AK-Type	1. $\rho_1 < \rho_2 > \rho_3 > \rho_4$
Q. HK-Type	2. $\rho_1 > \rho_2 < \rho_3 > \rho_4$
R. KQ-Type	3. $\rho_1 > \rho_2 < \rho_3 < \rho_4$
S. HA-Type	4. $\rho_1 < \rho_2 < \rho_3 < \rho_4$
	5. $\rho_1 < \rho_2 > \rho_3 < \rho_4$
	6. $\rho_1 < \rho_2 < \rho_3 > \rho_4$

a) P-2, Q-4, R-1, S-3
b) P-3, Q-4, R-2, S-6
c) P-4, Q-5, R-6, S-1
d) P-6, Q-2, R-1, S-3

49) The plane wave electromagnetic field traveling vertically downward in a homogeneous half-space of resistivity 500 Ωm varies with depth 'z' as,

$$H_y(z) = H_0 e^{-0.5z}\{\cos(\omega t - 0.5z) + i\ \sin(\omega t - 0.5z)\}$$

What is the frequency (in Hz) of the primary field given $\mu = \mu_0 = 4\pi \times 10^{-7}$ H/m?

(GATE GG 2008)

a) 7.16×10^7
b) 5.16×10^7
c) 3.16×10^7
d) 1.16×10^7

50) Wenner survey is performed over a homogeneous ground of resistivity 200 Ωm. For the current electrode spacing of 60 m, 100 mA current flow is recorded. What will be the magnitude of potential difference (in mV) between potential electrodes?

(GATE GG 2008)

a) 53.0
b) 159.2
c) 477.7
d) 1433.1

51) Potential Difference (PD) and Gradient of Potential Difference (GPD) are measured along a profile over a massive sulfide body in self-potential survey. Which of the following statements is correct for the anomalies over the center of the body?

(GATE GG 2008)

a) PD is positive and GPD is positive
b) PD is positive and GPD is zero
c) PD is negative and GPD is negative
d) PD is negative and GPD is zero

52) Match the phase differences between the quantities of induction phenomena (Group I) with the amount of phase difference in Group II

(GATE GG 2008)

Group I	**Group II**
P. Secondary field with respect to primary field	1. leads by 90°
Q. Inphase component of secondary field with respect to primary field	2. lags by 90°
R. Quadrature component of secondary field with respect to primary field	3. lags between $90^\circ - 180^\circ$
S. Quadrature component of secondary field with respect to inphase component of secondary field	4. lags by 180°

a) P-4, Q-1, R-3, S-2
b) P-1, Q-2, R-4, S-3
c) P-2, Q-3, R-1, S-4
d) P-3, Q-4, R-2, S-1

53) Which of the following combinations of electromagnetic field components is measured in magnetotelluric method?

(GATE GG 2008)

a) E_x, E_y, H_x, H_y, H_z
b) E_x, E_y, E_z, H_x, H_z
c) E_x, E_y, E_z, H_y, H_z
d) E_x, E_z, H_x, H_y, H_z

54) Which form of partial differential equation is used for the interpretation of electromagnetic anomalies in geophysical prospecting?

(GATE GG 2008)

a) Diffusion equation
b) Laplace's equation
c) Poisson's equation
d) Wave equation

55) A radioactive substance decays to one third of its original value in 6 hours time. What is the half-life (in hours) of the substance?

(GATE GG 2008)

a) 3.58 b) 3.78 c) 3.98 d) 4.18

56) The relation between magnetic latitude (θ) and the magnetic inclination (i) is

(GATE GG 2008)

a) $2\tan i = \tan\theta$
b) $\tan i = 2\tan\theta$
c) $\tan i = 2\tan^2\theta$
d) $2\tan i = \cos\theta$

57) To derive magnetic field from gravity field, the Poisson's relation can be used only when the direction of magnetization is

(GATE GG 2008)

a) horizontal $\left(0^\circ\right)$
b) 45°
c) 60°
d) vertical $\left(90^\circ\right)$

58) Fourier analysis matches the signal by a series of sinusoids. Each member of the series fits an exact number of

(GATE GG 2008)

a) one-fourth wavelength
b) one-third wavelength
c) half-wavelength
d) one wavelength

59) Compton scattering is the physical basis of

(GATE GG 2008)

a) Neutron - Gamma logging
b) Neutron-thermal neutron logging
c) Natural Gamma logging
d) Gamma - Gamma logging

60) If the P-wave velocity is twice that of S-wave velocity in a medium, the Poisson's ratio of the material is

(GATE GG 2008)

a) 0.50 b) 0.33 c) 0.25 d) 0.12

61) The Lame's coefficient (λ) can be written in terms of compressibility of the material (β) and Poisson's ratio (σ) as

(GATE GG 2008)

a) $\lambda = \frac{3\sigma}{(1+\sigma)\beta}$
b) $\lambda = \frac{(1+\sigma)}{3\sigma\beta}$
c) $\lambda = \frac{\sigma}{(1+\sigma)(1-2\sigma)\beta}$
d) $\lambda = \frac{3(1-2\sigma)}{\beta}$

62) The amplitude of seismic wave varies due to spherical spreading as a function of

(GATE GG 2008)

a) radius of sphere
b) 1/(radius of sphere)
c) (radius of sphere)^2
d) 1/(radius of sphere)^2

63) If f is the frequency of seismic wave and v is its velocity, the relation between absorption coefficient (α) and quality factor (Q) is

(GATE GG 2008)

a) $\alpha = \frac{\pi f}{Qv}$
b) $\alpha = \frac{Qf}{\pi v}$
c) $\alpha = \frac{Qv}{\pi f}$
d) $\alpha = \frac{\pi Q}{vf}$

64) In marine seismic surveys, the maximum depth d (in feet) at which the bubble will break is related to the charge weight W (in pounds) by the relation

(GATE GG 2008)

a) $d = 3.8\ W$
b) $d = 3.8\ W^{1/2}$
c) $d = 3.8\ W^{1/3}$
d) $d = 3.8\ W^{1/4}$

65) Considering noise problem (reverberation) in marine seismic work, the frequencies for higher harmonics are expressed by $f_n = \frac{(2n-1)V_w}{4d_w}$, where f_n - frequency of n^{th} harmonic, V_w - velocity of sound in water and d_w - water depth. The fundamental frequency in terms of the reciprocal of one way travel time is

(GATE GG 2008)

a) one - fourth
b) one - third
c) one - half
d) three fourth

66) In a linear inverse problem having rectangular system matrix that is rank deficient, the inverse solution is

(GATE GG 2008)

a) unique solution
b) least square solution
c) minimum norm solution
d) minimum norm least square solution

67) In a linear inverse problem having eigenvalues 100, 10, 1, 0.1, 0.01, 0.001, the highest condition number of the system matrix is

(GATE GG 2008)

a) 100000 b) 10000 c) 1000 d) 100

68) A combination of radioactive logging to detect chlorine in a formation is

(GATE GG 2008)

a) Neutron-thermal neutron log and Gamma-Gamma log
b) Neutron-epithermal neutron log and Neutron-Gamma log
c) Neutron-Gamma log and Gamma-Gamma log
d) Neutron-epithermal neutron log and Gamma-Gamma log

69) In electrical logging, the measured resistivity of flushed zone is 19.2 Ωm, the resistivity of mud-filtrate is 1.33 Ωm and the computed value of residual oil saturation in flushed zone is 20%. The value of formation resistivity factor is

(GATE GG 2008)

a) 8.50 b) 8.85 c) 9.11 d) 9.24

70) In a seismic reflection survey, lithological boundaries P (Shale and Gas sand), Q (Gas sand and Oil sand) and R (Oil sand and Water sand) computed on the basis of reflection coefficients are shown in figure. Which is the correct sequence of reflection coefficients at these boundaries?

(GATE GG 2008)

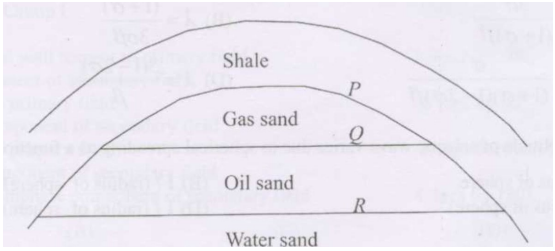

Fig. 70

a) P (-0.30), Q (+0.20), R (+0.03)
b) P (-0.30), Q (+0.03), R (+0.20)
c) P (+0.20), Q (-0.30), R (+0.03)
d) P (+0.20), Q (+0.03), R (-0.30)

Common Data for Questions 71, 72 and 73: The following geological map shows exposures of sedimentary beds p, q, r, s, t and a batholith (hatched) in a flat terrain.

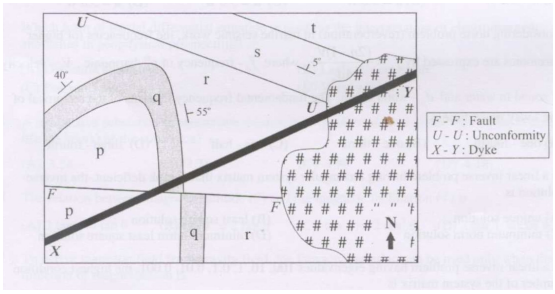

Fig. 70

71) The fold seen in the area is

(GATE GG 2008)

a) a synform plunging northerly
b) a synform plunging southerly
c) an antiform plunging northerly
d) an antiform plunging southerly

72) If the fault dips 70° southerly, it is a

(GATE GG 2008)

a) normal fault with southern upthrown block
b) right lateral strike-slip fault
c) reverse fault with northern upthrown block
d) reverse fault with southern upthrown block

73) The intrusion of dyke took place

(GATE GG 2008)

a) after deposition of beds 's' and 't'
b) before deposition of beds 's' and 't'
c) before faulting
d) before folding

Common Data for Questions 74 and 75: Two sampled data sets are given as: $X(t) = [1, \frac{1}{2}, -1, -\frac{1}{2}]$ and $Y(t) = [1, -\frac{1}{2}, -1, \frac{1}{2}]$.

74) The cross-correlation between these two time series for zero lag is

(GATE GG 2008)

a) $-\frac{3}{2}$
b) $\frac{5}{2}$
c) $-\frac{1}{2}$
d) $\frac{3}{2}$

75) The convolution of the data sets results in a time series

(GATE GG 2008)

a) $[1, 1, -\frac{11}{2}, 4, -\frac{17}{2}, -1, 1]$
b) $[-1, 1, 4, \frac{17}{2}, -\frac{11}{2}, 1, 1]$
c) $[1, \frac{17}{2}, 4, -\frac{11}{2}, -1, \frac{3}{2}, 1]$
d) $[1, -1, \frac{17}{2}, 5, \frac{11}{2}, -1, 1]$

Statement for Linked Answer Questions 76 and 77: A mineral assemblage consists of fayalite, ferro-silite and quartz in equilibrium.

76) The number of components in the system is

(GATE GG 2008)

a) 4
b) 1
c) 2
d) 3

77) The degree of freedom of the system is

(GATE GG 2008)

a) 1
b) 2
c) 0
d) 3

Statement for Linked Answer Questions 78 and 79: A seismic survey is conducted at a constant velocity of 2000 m/s. The record section shows a reflection event with a slope of 0.2 s/km.

78) The dip of the reflector (in degrees) is

(GATE GG 2008)

a) 5.74
b) 6.74
c) 7.74
d) 8.74

79) If the minimum record time is 0.5 s, the depth of the reflector just below the shot point is

(GATE GG 2008)

a) 497 m
b) 597 m
c) 697 m
d) 797 m

Statement for Linked Answer Questions 80 and 81: A gravity survey is carried out in a flat terrain to locate a porphyry copper deposit having a spherical shape with radius 100 m and density contrast 0.5×10^3 kg/m^3.

80) The maximum gravity anomaly (in mgal) is

(GATE GG 2008)

a) 1.40
b) 1.90
c) 2.30
d) 2.80

81) The depth of the center of the body (in m) is

(GATE GG 2008)

a) 100 b) 150 c) 200 d) 250

Statement for Linked Answer Questions 82 and 83: A seismic survey is carried out over a horizontal ground underlain by two horizontal layers. The thickness of the first layer is 200 m and the velocities of the first and second layers are 2000 m/s and 2500 m/s, respectively.

82) The critical angle of refraction (in degrees) is

(GATE GG 2008)

a) 43.13 b) 53.13 c) 63.13 d) 73.13

83) The crossover distance (in m) is

(GATE GG 2008)

a) 1105 b) 1205 c) 1305 d) 1405

Statement for Linked Answer Questions 84 and 85: A magnetic survey is carried out to locate an abandoned well casing made of steel having magnetic susceptibility 10^5 times that of the surrounding medium. The well casing is 100 m long and 0.1 m in radius. The survey is carried out in a region where the Earth's magnetic field is 50000 nT and the magnetic inclination is 90°.

84) The magnetic moment $\left(\text{in Am}^2\right)$ of the well casing is

(GATE GG 2008)

a) 12.5 b) 15.7 c) 18.2 d) 21.5

85) The magnetic anomaly (in nT) at a point on the ground surface at a horizontal distance of 10 m from the top of the well casing is

(GATE GG 2008)

a) 31.4 b) 38.4 c) 45.4 d) 52.4

END OF QUESTION PAPER