GATE

Previous Year Questions

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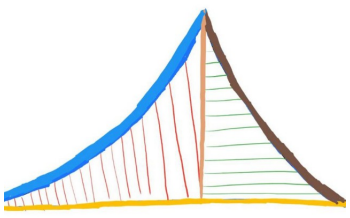


Contents

Introduction

This book contains a typed GATE question set.

Chapter 1

2007

Chapter 2

2008

Chapter 3

2009

CE

3.1 A square matrix $\mathbf{B}$ is skew-symmetric if (2009-CE)

(a) $\mathbf{B}^\top = -\mathbf{B}$ (b) $\mathbf{B}^\top = \mathbf{B}$ (c) $\mathbf{B}^{-1} = \mathbf{B}$ (d) $\mathbf{B}^{-1} = \mathbf{B}^T$

3.2 For a scalar function $f(x, y, z) = x^2 + 3y^2 + 3z^2$, the gradient at the point P(1, 2, -1) is (2009-CE)

(a) $2\overrightarrow{i} + 6\overrightarrow{j} + 4\overrightarrow{k}$ (b) $2\overrightarrow{i} + 6\overrightarrow{j} - 4\overrightarrow{k}$ (c) $2\overrightarrow{i} + 12\overrightarrow{j} + 4\overrightarrow{k}$ (d) $\sqrt{56}$

3.3 The analytic function $f(z) = \frac{z-1}{z^2+1}$ has singularities at (2009-CE)

(a) 1 and -1 (b) 1 and i (c) 1 and $-i$ (d) i and $-i$

3.4 A thin walled cylindrical pressure vessel having a radius of 0.5 m and wall thickness of 25 mm is subjected to an internal pressure of 700 kPa. The hoop stress developed is (2009-CE)

(a) 14 MPa (b) 1.4 MPa (c) 0.14 MPa (d) 0.014 MPa

3.5 The modulus of rupture of concrete in terms of its characteristic cube compressive strength (f_{ck}) in MPa according to IS 456:2000 is (2009-CE)

(a) $5000 f_{ck}$ (b) $0.7 f_{ck}$ (c) $5000\sqrt{f_{ck}}$ (d) $0.7\sqrt{f_{ck}}$

3.6 In the theory of plastic bending of beams, the ratio of plastic moment to yield moment is called (2009-CE)

(a) shape factor
(b) plastic section modulus
(c) modulus of resilience
(d) rigidity modulus

3.7 For limit state of collapse, the partial saftey factors recommended by IS 456:2000 for estimating design strength of concrete and reinforcing steel are respectively(2009-CE)

(a) 1.15 and 1.5 (b) 1.0 and 1.0 (c) 1.5 and 1.15 (d) 1.5 and 1.0

3.8 The point within the cross sectional plane of a beam through which the resultant of the external loading on the beam has to pass through to ensure pure bending without twisting of the cross-section of beam is called (2009-CE)

(a) moment centre (b) centroid (c) shear centre (d) elastic centre

3.9 The square root of the ratio of moment of inertia of the cross section to its cross sectional area is called (2009-CE)

(a) second moment of area
(b) slenderness ratio
(c) section modulus
(d) radius of gyration

3.10 Deposit with flocculated structure is formed when (2009-CE)

(a) clay particles settle on sea bed
(b) clay particles settle on fresh water lake bed
(c) sand particles settle on river bed

(d) sand particles settle on sea bed

3.11 Dilatancy correction is required when a strata is (2009-CE)

(a) cohesive and saturated and also has N value of STP > 15

(b) saturated slit/fine sand and N value of SPT < 10 after the overburden correction

(c) saturated slit/fine sand and N value of SPT > 15 after the overburden correction

(d) coarse sand under dry condition and N value of SPT < 10 after the overburden correction

3.12 A precast concrete pile is driven with a 50 kN hammer falling through a height of 1.0 m with an efficiency of 0.6. The set value observed is 4 mm per blow and the combined temporary compression of the pile, cushion and the ground is 6mm. As per Modified Hiley Formula, the ultimate resistance of the pile is (2009-CE)

(a) 3000 kN (b) 4285.7 kN (c) 8333 kN (d) 11905 kN

Chapter 4

2010

CE

4.1 The $\lim_{x\to 0} \frac{sin\left[\frac{2}{3}x\right]}{x}$ (2010-CE)

(a) $\frac{2}{3}$ (b) 1 (c) $\frac{3}{2}$ (d) ∞

4.2 Two coins are simultaneously tossed. The probability of two heads simultaneously appearing is (2010-CE)

(a) $\frac{1}{8}$ (b) $\frac{1}{6}$ (c) $\frac{1}{4}$ (d) $\frac{1}{2}$

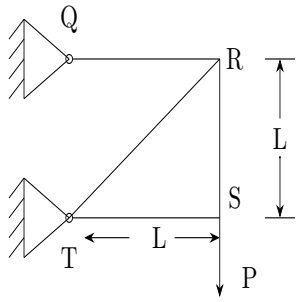
4.3 The order and degree of the differential equation $\frac{d^3y}{dx^3} + 4\sqrt{(\frac{dy}{dx})^3 + y^2} = 0$ (2010-CE)

(a) 3 and 2 (b) 2 and 3 (c) 3 and 3 (d) 3 and 1

4.4 Two people weighing W each are sitting on a plank of length L floating on water at $\frac{L}{4}$ from either end. Neglecting the weight of the plank. The bending moment at the centre of the plank is (2010-CE)

(a) $\frac{WL}{8}$ (b) $\frac{WL}{16}$ (c) $\frac{WL}{32}$ (d) zero

4.5 For the truss shown in figure, the force in member QR is



(2010-CE)

(a) zero (b) $\frac{P}{\sqrt{2}}$ (c) P (d) $\sqrt{2}P$

4.6 The major and minor principal stresses at a point 3 MPa and -3 MPa respectively. The maximum shear stress at the point is (2010-CE)

(a) zero (b) 3 MPa (c) 6 MPa (d) 9

4.7 The number of independent elastic constants for a linear elastic isotropic and homogeneous material is (2010-CE)

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

4.8 The effective length of a column of length L fixed against rotation and translation at one end and free at the other end is (2010-CE)

(a) 0.5 L (b) 0.7 L (c) 1.414 L (d) 2 L

4.9 As per Indian standard code for practice for prestressed concrete (IS:1343-1980) the minimum grades of concerte to be used for post-tensioned and pre-tensioned structural elements are respectively (2010-CE)

(a) M20 for both (b) M40 and M30 (c) M15 and M20 (d) M30 and M40

4.10 A solid circular shaft of diameter d and length L is fixed at one end and free at the other end. A torque T is applied at the free end. The shear modulus of the material is G. The angle of twist at the free end is (2010-CE)

(a) $\frac{16TL}{\pi d^4 G}$ (b) $\frac{32TL}{\pi d^4 G}$ (c) $\frac{64TL}{\pi d^4 G}$ (d) $\frac{128TL}{\pi d^4 G}$

4.11 In a compaction test, G, w, S and e represent the specific gravity, water content, degree of saturation and void ratio of the soil sample, respectively. If γ_w represents the unit weight of water and γ_d represents the dry unit weight of the soil, the equation for zero air voids line is (2010-CE)

(a) $\gamma_d = \frac{G\gamma_w}{1+Se}$ (b) $\gamma_d = \frac{G\gamma_w}{1+Gw}$ (c) $\gamma_d = \frac{Gw}{1+S\gamma_w}$ (d) $\gamma_d = \frac{Gw}{1+Se}$

4.12 A fine grained soil has liquid limit of 60 and plastic limit of 20. As per the plasticity chart, according to IS classification, the soil is represented by the letter symbols(2010-CE)

(a) CL (b) CI (c) CH (d) CL-ML

4.13 Quick sand condition occurs when (2010-CE)

(a) the void ratio of the soil becomes 1.0

(b) the upward seepage pressure in soil becomes zero

(c) the upward seepage pressure in soil becomes equal to the saturated unit weight of the soil

(d) the upward seepage pressure in soil becomes equal to the submerged unit weightof the soil

Chapter 5

2011

Chapter 6

2012

ME

6.1 In abrasive jet machining, as the distance between the nozzle tip and the work surface increases, the material removal rate (2012-ME)

(a) increases continuously

(b) decreases continuously

(c) decreases, becomes stable and then increases

(d) increases, becomes stable and then decreases

6.2 Match the following metal forming processes with their associated stresses in the workpiece (2012-ME)

Metal Forming Process	**Type of Stress**
1. Coining	S. Compressive
2. Wire Drawing	P. Tensile
3. Blanking	Q. Shear
4. Deep Drawing	R. Tensile and Compressive

(a) 1-S, 2-P, 3-Q, 4-R

(b) 1-S, 2-P, 3-R, 4-Q

(c) 1-P, 2-Q, 3-S, 4-R

(d) 1-P, 2-R, 3-Q, 4-S

6.3 In an interchangeable assembly, shafts of size $25.000^{+0.040}_{-0.010}$ mm mate with holes of size $25.000^{+0.030}_{+0.020}$ mm. The maximum interference (in $microns$) in the assembly is (2012-ME)

(a) 40 (b) 30 (c) 20 (d) 10

6.4 During *normalizing* process of steel, the specimen is heated (2012-ME)

(a) between the upper and lower critical temperature and cooled in still air.

(b) above the upper critical temperature and cooled in furnace.

(c) above the upper critical temperature and cooled in still air

(d) between the upper and lower critical temperature and cooled in furnace.

6.5 Oil flows through a 200 mm diameter horizontal cast iron pipe (friction factor, $f = 0.0225$) of length 500 m. The volumetric flow rate is 0.2 m^3/s. The head loss (in m) due to friction is (assume $g = 9.81\ m/s^2$) (2012-ME)

(a) 116.18 (b) 0.116 (c) 18.22 (d) 232.36

6.6 For an opaque surface, the absorptivity(α), transmissivity(τ) and reflectivity(ρ)are related by the equation (2012-ME)

(a) $\rho + \alpha = \tau$ (b) $\rho + \alpha + \tau = 0$ (c) $\rho + \alpha = 1$ (d) $\rho + \alpha = 0$

6.7 Steam enters an adiabatic turbine operating at steady state with an enthalpy of 3251.0 kJ/kg and leaves as a saturated mixture at 15 kPa with quality (dryness fraction) 0.9. The enthalpies of the saturated liquid and vapor at 15 kPa are $h_f = 225.94\ kJ/kg$ and $h_g = 2598.3\ kJ/kg$ respectively. The mass flow rate of steam is 10 kg/s. Kinetic and potential energy changes are negligible. The power output of the turbine in MW is (2012-ME)

(a) 6.5 (b) 8.9 (c) 9.1 (d) 27.0

6.8 The following are the data for two crossed helical gears used for speed reduction:
Gear I : Pitch circle diameter in the plane of rotation 80 mm and helix angle 30°
Gear II : Pitch circle diameter in the plane of rotation 120 mm and helix angle 22.5°
If the input speed is 1440 rpm, the output speed in rpm is (2012-ME)

(a) 1200 (b) 900 (c) 875 (d) 720

6.9 A solid disc of radius r rolls without slipping on a horizontal floor with angular velocity ω and angular acceleration α. The magnitude of the acceleration of the point of contact on the disc is (2012-ME)

(a) $zero$ (b) $r\alpha$ (c) $\sqrt{r\alpha^2 + (r\omega^2)^2}$ (d) $r\omega^2$

6.10 A thin walled spherical shell is subjected to an internal pressure. If the radius of the shell is increased by 1% and the thickness is reduced by 1%, with the internal pressure remaining the same, the percentage change in the circumferential (hoop) stress is (2012-ME)

(a) 0 (b) 1 (c) 1.08 (d) 2.02

6.11 The area enclosed between the straight line $y = x$ and the parabola $y = x^2$ in the x-y plane is (2012-ME)

(a) $\frac{1}{6}$ (b) $\frac{1}{4}$ (c) $\frac{1}{3}$ (d) $\frac{1}{2}$

6.12 Consider the function $f(x) = |x|$ in the interval $-1 \leq x \geq 1$. At the point $x = 0, f(x)$ is (2012-ME)

(a) continuous and differentiable.

(b) non-continuous and differentiable.

(c) continuous and non-differentiable.

(d) neither continuous nor differentiable.

6.13 Which one of the following is **NOT** a decision taken during the aggregate production planning stage? (2012-ME)

(a) Scheduling of machines

(b) Amount of labour to be committed

(c) Rate at which production should happen

(d) Inventory to be carried forward

Chapter 7

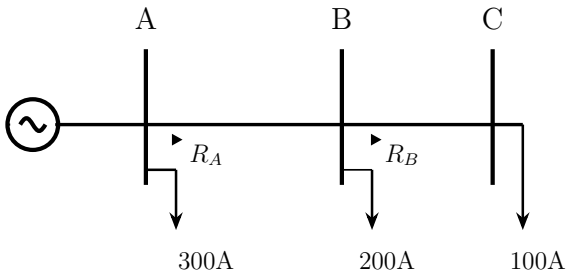
2013

Chapter 8

2014

EE

8.1 The overcurrent relays for the line protection and loads connected at the buses are shown in the figure (2014-EE)

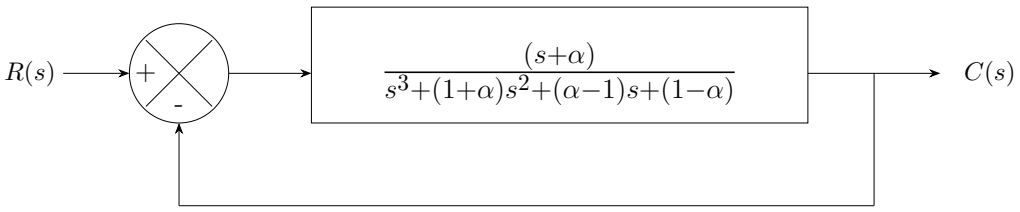


The relays are IDMT in nature having the characteristic

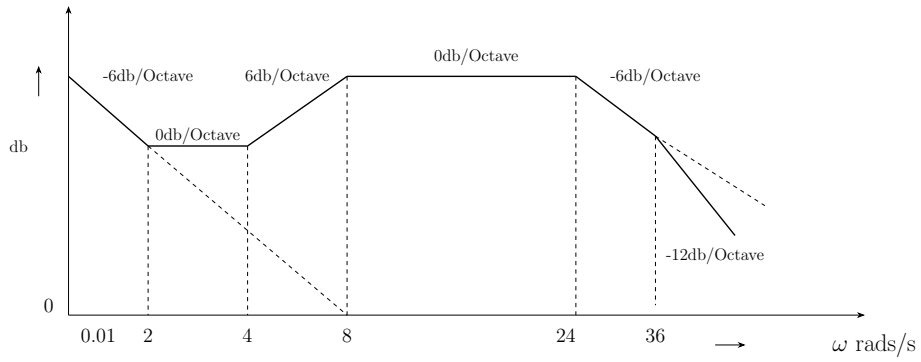
$$t_{op} = \frac{0.14 * TimeMultiplierSetting}{(PlugSettingMultiplier)^{0.02} - 1}$$

The maximum and minimum fault currents at bus B are 2000 A and 500 A respectively. Assuming the time multiplier setting and plug setting for relay RB to be 0.1 and 5A respectively, the operating time of RB (in seconds) is _____.

8.2 For the given system, it is desired that the system be stable. The minimum value of α for this condition is _____. (2014-EE)



8.3 The Bode magnitude plot of the transfer function $G(s) = \frac{K(1+0.5s)(1+\alpha s)}{s\left(1+\frac{s}{8}\right)(1+bs)\left(1+\frac{s}{36}\right)}$ is shown below: Note that -6 dB/octave = - 20 dB/decade. The value of $\frac{a}{bK}$ _____. (2014-EE)

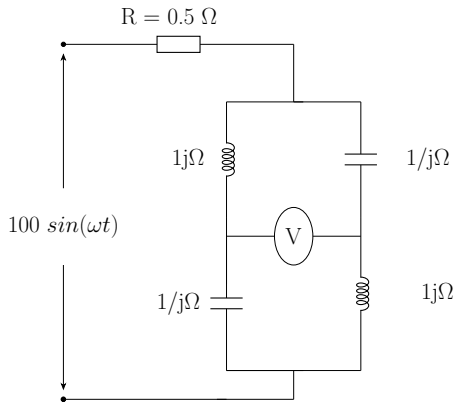


8.4 A system matrix is given as follows.

$$A = \begin{bmatrix} 0 & 1 & -1 \\ -6 & -11 & 6 \\ -6 & -11 & 5 \end{bmatrix}$$

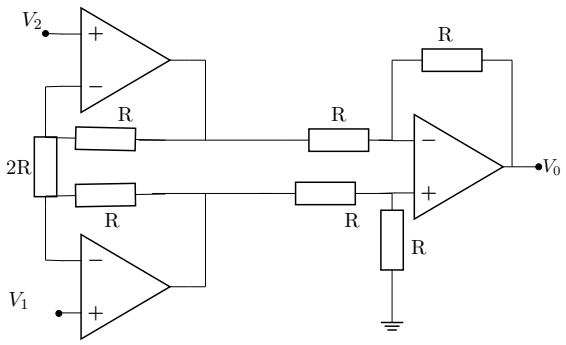
The absolute value of the ratio of the maximum eigenvalue to the minimum eigenvalue is _____. (2014-EE)

8.5 The reading of the voltmeter (rms) in volts, for the circuit shown in the figure is _____ (2014-EE)



8.6 The dc current flowing in a circuit is measured by two ammeters, one PMMC and another electrodynamometer type, connected in series. The PMMC meter contains 100 turns in the coil, the flux density in the air gap is 0.2 Wb/m^2, and the area of the coil is 80 mm^2. The electrodynamometer ammeter has a change in mutual inductance with respect to deflection of 0.5 mH/deg. The spring constants of both the meters are equal. The value of current, at which the deflections of the two meters are same, is _____. (2014-EE)

8.7 Given that the op-amps in the figure are ideal, the output voltage V_0 is



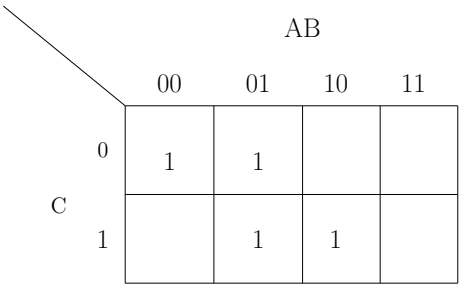
(a) $(V_1 - V_2)$

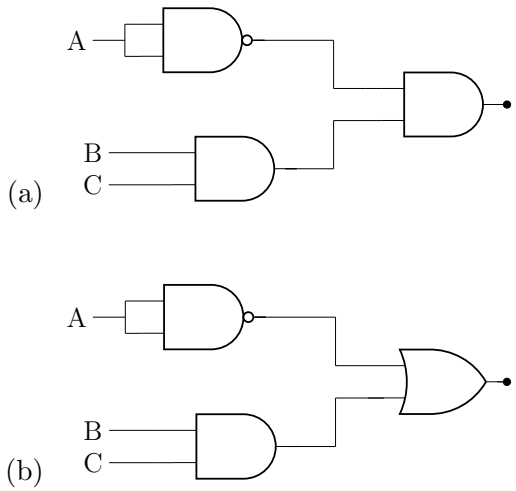
(b) $(V_1 - V_2)/2$

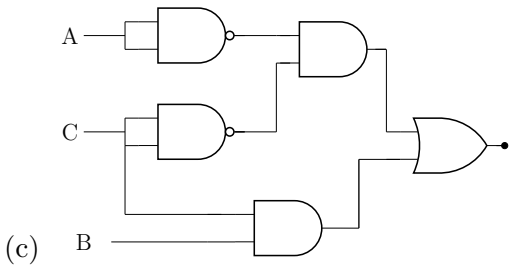
(c) $2(V_1 - V_2)$

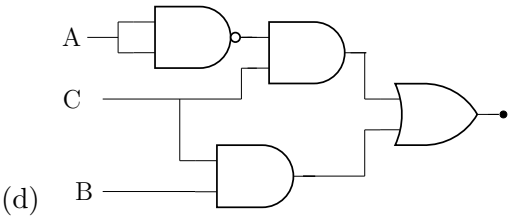
(d) $(V_1 + V_2)$

8.8 Which of the following logic circuits is a realization of the function F whose Karnaugh map is shown in figure (2014-EE)

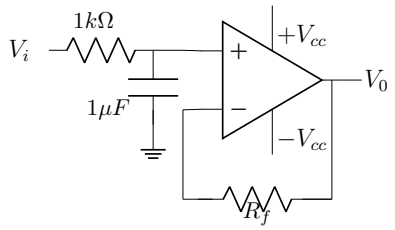


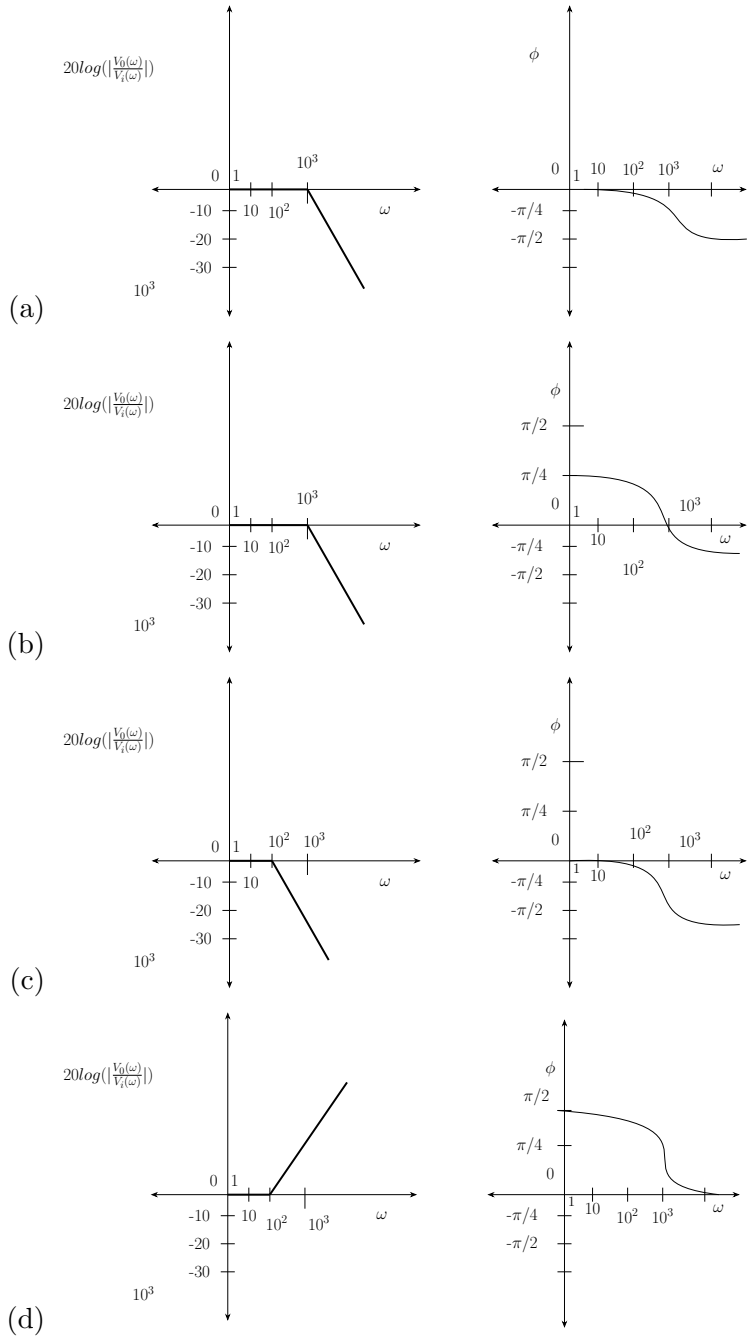




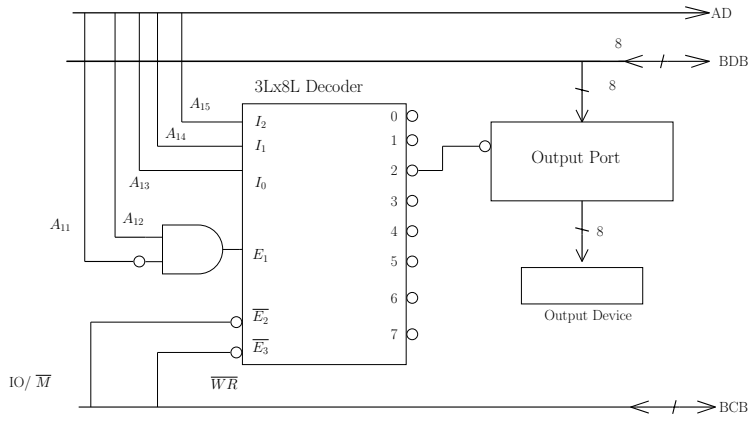


8.9 In the figure shown, assume the op-amp to be ideal. Which of the alternatives gives the correct Bode plots for the transfer function $\frac{V_0(\omega)}{V_i(\omega)}$ (2014-EE)





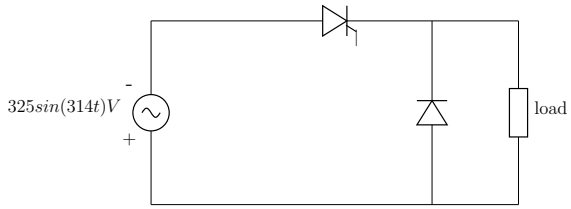
8.10 An output device is interfaced with 8-bit microprocessor 8085A. The interfacing circuit is shown in figure



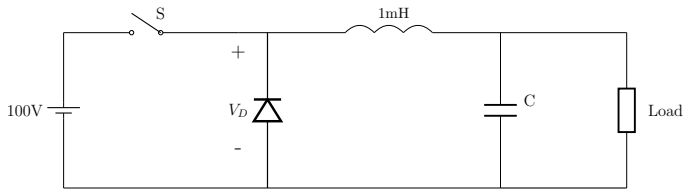
The interfacing circuit makes use of 3 Line to 8 Line decoder having 3 enable lines E_1, $\overline{E_2}$, $\overline{E_3}$. The address of the device is (2014-EE)

(a) 50_H (b) 5000_H (c) $A0_H$ (d) $A000_H$

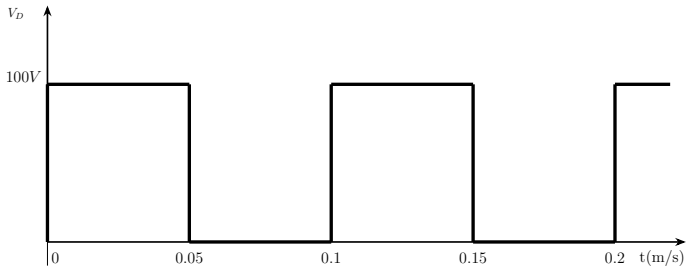
8.11 The figure shows the circuit diagram of a rectifier. The load consists of a resistance 10 Ω and an inductance 0.05 H connected in series. Assuming ideal thyristor and ideal diode, the thyristor firing angle (in degree) needed to obtain an average load voltage of 70 V is _____ (2014-EE)



8.12 Figure (i) shows the circuit diagram of a chopper. The switch S in circuit in figure (i) is switched such that the voltage v_D across the diode has the wave shape as shown in figure (ii). The capacitance C is large so that the voltage across it is constant. If switch S and the diode are ideal, the peak to peak ripple(in A) in the inductor current is _____ (2014-EE)

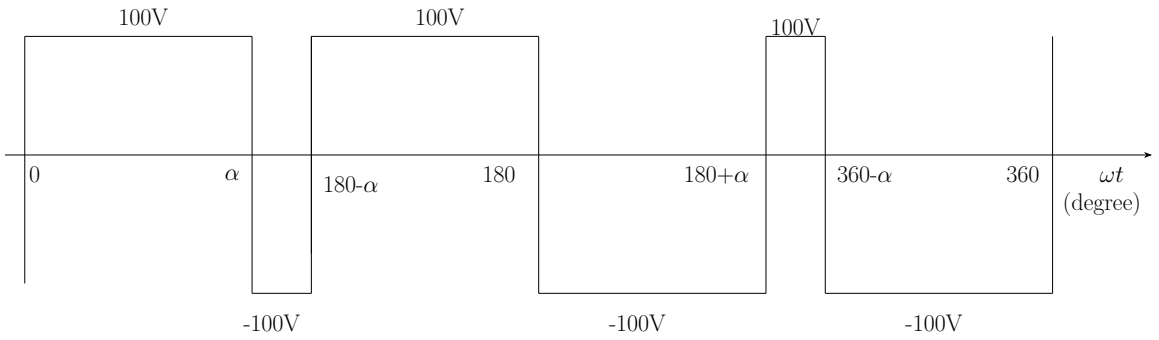


Figure(i)



Figure(ii)

8.13 The figure shows one period of the output voltage of an inverter. α should be chosen such that $60° < \alpha < 90°$. If the rms value of fundamental component is 50 V, then α in degree is _____ (2014-EE)



Chapter 9

2015

Chapter 10

2016

Chapter 11

2017

Chapter 12

2018

Chapter 13

2019

Chapter 14

2020

Chapter 15

2021

Chapter 16

2022

Chapter 17

2023

Chapter 18

2024