T.Y.B.Tech. (Mech) sem VI

Machine Design - I.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

Re Exam

January 2016

Max. Marks: 100

Class: T. Y. B. Tech   Semester: VI

Name of the Course : Machine Design I

Duration: 03 Hours

Program: Mechanical Engineering

Course Code : ME 352

Master file.

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Q.1   Explain :-

    (i)   Asthetic considerations in design

    (ii)   Endurance limit

    (iii)   Stress strain diagram

    (iv)   How does the helix angle influence on the efficiency of square threaded screw.

                                                                    (20)

Q.2(a) Design a Gib and Cotter joint for square rods to carry a maximum load of 35 KN. Assuming that the Gib, Cotter and rods are of same material and have the following allowable stresses.

$\sigma t = 20 \text{ N/mm}^2$, $\sigma c = 15 \text{ N/mm}^2$ and $\tau = 50 \text{ N/mm}^2$.   (15)

Q.2(b) A square key is to be used to key a gear to a 30 mm diameter shaft. The hub length of gear is 55 mm. Both shaft and key are to be made of the same material having an allowable shear stress of 50 MPa. What are the minimum dimensions for the sides of the square key if 390 N-m of torque is to be transmitted.

                                                                    (05)

Q.3(a) A rectangular base plate is fixed at each of its four corners by a 20 mm diameter bolt and nut as shown in Fig. The plate rests on washers of 22 mm internal diameter and 50 mm external diameter. Copper washers which are placed between the nut and the plate are of 22 mm internal diameter and 44 mm external diameter.If the base plate carries a load of 120 kN (including self-weight, which is equally distributed on the four corners),calculate the stress on the lower washers before the nuts are tightened.What could be the stress in the upper and lower washers,when the nuts are tightened so as to produce a tension of 5 kN on each bolt?   ①
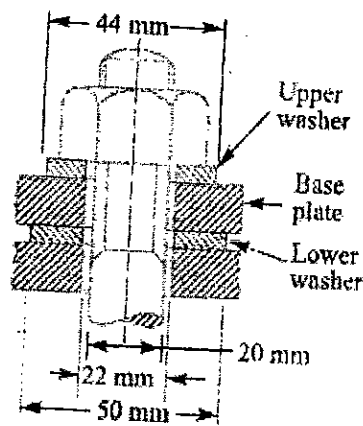
Q.3 (b) A plate 100 mm wide and 10 mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80 kN. Find the length of weld if the permissible shear stress in the weld does not exceed 55MPa. (10)

Q.3(c) What are the assumptions made in the design of welded joint? And explain the strength of fusion welds under the different loading. (05)

Q.4(a) A hollow shaft has greater strength and stiffness than solid shaft of equal weight. Explain. (05)

Q.4(b) A solid steel shaft is used to transmit 18 KW at 180 rpm. The ultimate shear stress for the steel may be taken as 350 MPa and a factor of safety as 7. Find the diameter of solid shaft. Find the inside and outside diameters when the ratio of inside to outside diameter is 0.5. (10)

Q.5(a) A helical spring is made from a wire of 1.25 mm diameter and 750 N/mm^2 as its yield strength. For a mean diameter of 12.5 mm and 14 active coils of the spring determine. (10)

(i) Static load corresponding to the yield point of the material and corresponding deflection to that.

(ii) Solid height assuming that square are square and ground.
Stiffness of the spring

(iv) Pitch of the wire so that the solid stress will not exceed the yield point.
Take G= 0.85 x 10^5 N/mm^2.

Q.5(b) A semi elliptical laminated spring is to carry a load of 5000 N and consist of 8 leaves 46 mm wide, two of the leaves being full length. The spring is to be made 1000 mm between the eyes and is held at the centre by a 60 mm wide band. Assume that the spring is initially stressed so as to induce an equal stress of 500 N/mm^2 when fully loaded. Design the spring giving :- (10)

(v) Thickness of the leaves

(vi) Eye diameter

(vii) Length of the leaves

(viii) Maximum deflection and camber.
Assume E = 2.1 x 10^5 N/mm^2.

(10)

Q.6(a) A screw jack is to lift a load of 90 KN through a height of 350 mm.

    (i)   Select suitable materials for screw and nut.

    (ii)   Design screw and nut.

    (v)   Check screw for buckling failure.   (15)

Q.6(b) What are the different types of threads used in power screws.   (05)

Q.7(a) The diameter of small pulley of the belt drive is 250 mm and rotates at 900 rpm.The centre distance is 2.5 m. If the larger pulley rotates at 300 rpm, determine the diameter of larger pulley. Also find the belt angle of contact on both pulleys and length of the belt for open belt and cross belt arrangement.   (10)

Q.7(b) Power is transmitted by using a V- belt drive. The included angle of V groove is $30°$. The belt is 2 cm deep and its maximum width is 2 cm. If the mass of the belt is 0.03434 N/cm length and the maximum allowable stress is 137.34 N/cm^2. Determine the maximum power transmitted when the angle of lap is $140°$ and $\mu = 0.15$.   (10)

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to University of Mumbai)

T.E (Mech) Sem VI
Manufacturing planning & control.

Re-Exam

Jan 2016

Total Marks : 100

Duration : 3 Hours

Class/Sem : T.E., Mech, Sem VI

Subject : Manufacturing Planning and Control

Master file.

- Question Number 1 is compulsory.
- Attempt any Four question out of remaining questions.
- Answers to all sub questions must be grouped together.
- Figures to the right indicate full marks
- Assume suitable data wherever required.

Q1 Solve any four of the following .   **[20]**
    A. Explain in brief any two manufacturing planning functions
    B. State and explain the factors affecting Under capacity planning
    C. State the salient features of the MRP-I
    D. Steps of Monte Carlo simulation
    E. ABC analysis of inventory control

Q2A. What are the benefits of MPC to stakeholders Explain the functions of MPC with suitable Diagram.   **[10]**
Q2B. Explain capacity planning with respect to following points   **[10]**
    • Need
    • Rough cut capacity planning
    • Draw the flow chart necessary to be used while planning capacity
    • Factors favoring lower capacity planning.

Q3A. Derive an equation for basic Inventory control Model, draw the model and state the assumptions.   **[10]**
Q3B. State the salient features of MPS   **[10]**

Q4A. What do you mean by Simulation? Why the simulation is needed? State the salient features of Monte Carlo simulation.   **[10]**

Q4B. The air-conditioner manufacturing company has following demand pattern for last 10 years. Compute the demand for next 3 years using LSM.   **[10]**

Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Sales [000]	30	33	37	39	42	46	48	50	55	58

①

Q5A. A project schedule has following characteristics. Construct Network , compute E and L for each event. Find total Float. Find critical path. Comment on float. [10]

Activity	Time in weeks	activity	Time in weeks
1-2	4	5-6	4
1-3	1	5-7	8
2-4	1	6-8	1
3-4	1	7-8	2
3-5	6	8-10	5
4-9	5	9-10	7

Q5B. A small manufacturer employees 5 skilled men & 10 semi skilled men & makes an article in 2 Types a deluxe model & an ordinary model. The making of deluxe model requires 2hrs. by a skilled man & 2hrs by semi skilled man. The ordinary model requires 1hr work by skilled & 3hrs by semi skilled man. By union rules no man can work more than 48hrs/week in 6 working days of week. The manufacturer's clear profit on deluxe model is Rs.10 & ordinary model is Rs.8.It is identified based on previous experimental records that Deluxe and ordinary model units must be produced not less than 5 and 10 respectively. Deluxe and ordinary models produce 1 and 2 kg of industrial wastes respectively. According to the govt. norms these waste can not be produced more 30 kgs and 40 kg for deluxe and ordinary models respectively. Deluxe model needs 2units and Ordinary model needs 3 units of energy and permissible economical consumption of energy per week is 480 units. Determine the no. of units of deluxe model & ordinary model to maximize the profit. Solve it graphically. Assume suitable data if needed. Attach the graph paper at the page of solution.   [10]

Q6A. A batch of four axles is to be processed on the following three machines in sequence; lathe-L, milling –M, and grinding G, instead of working on these 4 axles first on the lathe then on milling and finally on grinding in this sequence, it is desired to process the first axle on the lathe and as and when it is processed ,It is taken up on milling and the second axle on the lathe, and so on. In other words, each of the three activities L, M, G have been quartered for the sake of concurrent operation. Draw the network for the problem.   [10]

Q6B Derive an equation for Production model of Inventory. State the assumptions and draw the model.   [10]

Q7A Two major parts P1 and P2 for product require processing through six machine centre. The technological sequence of the parts on six machines and manufacturing times on each machine are

Machine sequence	C	A	E	F	D	B
PART 1 Time (hrs):	2	3	4	5	6	1
Machine sequence	B	A	E	F	C	D
PART 2 Time (hrs):	3	2	5	3	2	3

What would be the optimal scheduling for processing two parts? Find also the Total Elapsed time. For each machine specify the job that should be done first. Use graphical method. Attach the graph paper at the page of solution. [10]

Q7B Refer the following table and find the optimal sequence of jobs that minimizes the total elapsed time and idle time for machines. [10]

JOBS							
	A	B	C	D	E	F	G
Machine M1	12	6	5	3	5	7	6
Machine M2	7	8	9	8	7	8	3
Machine M3	3	4	11	5	2	8	4

*****

③

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Re-Exam, Jan 2016

Max. Marks: **100**   Duration: **3 Hrs.**

Class: **T. Y. B. Tech.**   Semester: **VI**   Program: **Mechanical Engineering**

Name of the Course: **Internal Combustion Engines**   Course Code : **ME 354**

Instructions: Master file.

1. **Question No 1 is compulsory.**
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Q. 1   **Answer the following questions (any Four)**   **20**

(a) Differentiate between a steam engine and I C Engine. What are the fundamental differences between petrol and diesel engine?

(b) What is the reason that two-stroke engines are not used in passenger cars? List the environmental car engines.

(c) What do you mean by normal and abnormal combustion in S I Engines? What are the parameters that govern the normal combustion in S I Engine?

(d) What do you mean by octane number? Discuss the important qualities of diesel fuels.

(e) Explain why a rich mixture is required for idling, maximum power and sudden accelerations.

Q2 (A)   An experimental four-stroke gasoline engine of 1.7 litre capacity is to develop   **10** maximum power at 5000 RPM. The volumetric efficiency is 75% and the A/F ratio is 14:1. Two carburetors are to be fitted and it is expected that at maximum power the air speed at the choke is 100 m/s. The coefficient of discharge for the venturi is assumed to be 0.80 and that of main jet is 0.65. An allowance should be made for emulsion tube, the diameter of which can be taken as 1/3 of choke diameter. The gasoline surface is 6 mm below the choke at this engine condition. Calculate the sizes of a suitable choke and main jet. The specific gravity of the gasoline is 0.75. Atmospheric pressure and temperature are 1 bar and 300K respectively.

(B).   Discuss the performance characteristics of SI and CI engines. Explain the uses of   **10** different types of test usually conducted on I C Engines?

Q3 (A)   Find the air-fuel ratio of a four-stroke, single-cylinder, air-cooled engine with fuel   **10** consumption time for 10 cc is 24.4 sec and air consumption time for 0.1 m^3 is 16.3 sec. The load is 17 kg at the speed of 3000 RPM. Find also brake specific fuel consumption in kg/kWh and brake thermal efficiency. Assume the density of air as 1.175 kg/m^3 and specific gravity of fuel to be 0.7. The lower heating value of fuel is 43 MJ/kg and the dynamometer constant is 5000.

(B)   Calculate the diameter of the injector orifice for the following data of a 6-cylinder, 4-   **10** stroke C I engine.

BP = 240 kW, N = 1300 RPM, BSFC = 0.3 kg/kWh, cylinder pressure = 36 bar,

injection pressure = 200 bar, specific gravity of fuel = 0.90, Coefficient of discharge of the fuel orifice = 0.92, period of injection = 36° of crank angle.

Q4 (A) The following observations were made during a trial of a single-cylinder, four-stroke   **10**
    cycle gas engine:
Bore = 18 cm, stroke = 24 cm, duration of trial = 30 min, total number of revolution = 9000, total number of explosion = 4450, mean effective pressure = 5 bar, net load on the brake wheel = 40 kg, effective diameter of brake wheel = 1 m, total gas used at NTP 2.4 m^3, calorific value of gas at NTP = 19 MJ/m^3, total air used = 36 m^3, pressure of air = 720 mm of Hg, temperature of air = 17°C, density of air at NTP = 1.29 kg/m^3, temperature of exhaust gas 350°C, room temperature = 17°C, specific heat of exhaust gas = 1 kJ/kgK, cooling water circulated = 80 kg, rise in temperature of cooling water = 30°C. Take R = 287 J/kgK
Draw up a heat balance sheet and estimate the mechanical and indicated thermal efficiencies.

(B) With the help of suitable sketch, discuss the working principle of battery ignition   **10**
system. Differentiate between battery ignition and magneto ignition system.

Q5 (A) Explain the effect of the following factors on the performance of an S I engine: **10**
Compression ratio, A/F ratio, spark timing, engine speed, heat losses

(B) Discuss the properties of good lubricant. What are the basis for material selection for   **10**
the design of cylinder, piston, crankshaft and camshaft?

Q6 (A) A 4-Stroke engine working on dual-combustion cycle is supercharged by a   **10**
turbocharger. Air from the atmosphere at 1 bar and 27°C is compressed isentropically to 1.6 bar. Both compressor and turbine have isentropic efficiency of 75%. The air is cooled to 37°C before entering the engine cylinder. The compression ratio of the engine is 18 and the peak pressure not to exceed 125 bar. The total input is 1200 kJ/kg. The heat rejection is at constant volume. The exhaust gas, assumed to obey gas laws, is throttled to 1.6 bar before entering the turbine where it expands isentropically to atmospheric pressure. Neglecting all the pressure and frictional losses, calculate the extra work available from turbocharger.

(B) State the limitations experienced in the evaluation of friction power using Willian's   **10**
line method. Why Morse test is not suitable for single cylinder engine? Describe the method of finding friction power using Morse test.

Q7   **Answer the following questions (Any Four)**   **20**

    (A) Advantages and disadvantages of two-stroke engine
    (B) Advantages and limitations of supercharging in an I C engines
    (C) Causes and problems of exhaust emissions
    (D) Solex carburetor with neat sketch with fuel circuit
    (E) Working principle of four stoke petrol engine

T.E. (Elect) Sem VI

Communication Engineering.

BHARATIYA VIDYA BHAVAN'S
SARDAR PATEL COLLEGE OF ENGINEERING
[An Autonomous Institution Affiliated to University of Mumbai]
### Re Examination (Even Semester)

SEM/CLASS: VI/TE ELECTRICAL.,
SUBJECT: Communication Engineering.

TOTAL MARKS: 100.
DURATION: 3Hours.
DATE : Jan,2015

Master file.

Note: Solve any Five Questions.

Q1: a> What is entropy? Derive the expression for entropy. Show that entropy is maximum
when all the messages are equiprobable. (10)
  b> What is source coding? Why is it required? Explain any source coding? (10)

Q2: a> Prove that the balanced modulator produces an output consisting of sidebands only
with the carrier removed. (10)
  b> Using circuit diagrams, show how the Foster-Seeley discriminator is derived from
balanced slope detector and how in turn, the ratio detector is derived from
discriminator. (10)

Q3: a> With a neat block diagram explain Super heterodyne radio receiver. (10)
  b> With a neat diagram explain Independent Side Band(ISB) transmission system.(10)

Q4: a> Define and describe pulse position modulation. Explain with waveforms how is it
derived from pulse width modulation. (10)
  b> Explain with a neat block diagram Frequency Division Multiplexing (FDM) and
Time Division Multiplexing (TDM) systems. (10)

Q5: a> Draw the state diagram for convolution encoder shown below. Write the code for
message bits 11101. (10)
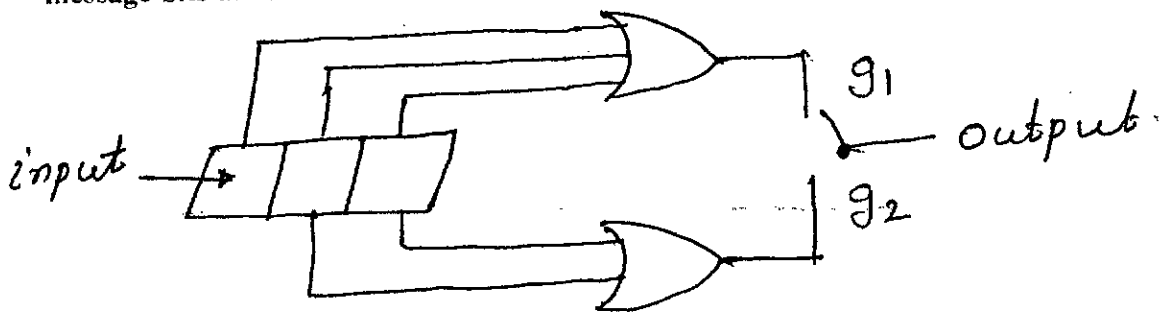
  b> What is channel capacity? Derive an expression for channel capacity of noisy
channel. (10)

①

Q6: a> Determine the power content of each of the sidebands and of the carrier of an AM signal whose total power is 1200 W while the modulation index is set at 85%   (05)

b>Explain the working of delta modulation system and discuss the errors produced by the same. How can these errors be avoided?   (15)

Q7: Write short note on   (20)
    a> QPSK modulator.
    b> BPSK demodulator.
    c> DPSK modulator.
    d> Pulse code modulation

Re Exam Lib
09-01-16

T.Y.B.Tech. (Elect) Sem VI
Protection & Switchgear Engineering.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

Re Exam Even Semester Examinations

January 2016

Max. Marks: 100　　　　　　　　　　　　　　　　Duration: 3 Hrs

Class:　T.Y.BTech　　　　Semester: VI　　　Program:Electrical engineering

Name of the Course: Protection and Switchgear Engineering　　　Course Code : EE 356

Instructions:

1. Attempt any five questions.
2. Draw neat diagrams
3. Assume suitable data if necessary

Master file .

Question No		Maximum Marks
Q1(a)	Explain any two 　1. Induction Cup Relay 　2. Attracted Armature relay 　3. Induction Disc Relay	[2*10]
Q2(a)	What are the types of neutral grounding?	[10]
(b)	Write a note on 　1. Zones of protection 　2. dc offset current in CT	[2*5]
Q3(a)	Which are the types of over current relay according to the time-current characteristics? Explain	[10]
(b)	Explain directional relay?	[10]
Q4(a)	Write the different methods for protection of transmission line	[12]
(b)	Write the principle of Buchholz relay.	[8]
Q5(a)	Name and explain the two methods for arc interruption?	[5]
(b)	Explain different bus arrangements for bus protection?	[15]

①

P.T.O

Q6(a)   Explain any four   [4*5]
1. Phenomena of arcing ground
2. Current chopping.
3. B.I.L
4. Restriking voltage
5. Resistance switching.
6. Power swing

Q7(a)   Explain the construction and working of air break circuit breaker?   [10]

(b)   Explain any two methods of lightning arresters?   [10]

T.Y.B.Tech. (Elect)sem VI (old)
Protection & Switchgear Engineering.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
Re Exam Even Semester Examinations
January 2016

Max. Marks: 100   Duration: 3 Hrs
Class: T.Y.BTech   Semester: VI (OLD)   Program:Electrical engineering
Name of the Course: Protection and Switchgear Engineering   Course Code : EE 356

Instructions:
1. Attempt any five questions.
2. Draw neat diagrams
3. Assume suitable data if necessary

Master file.

Question No		Maximum Marks
Q1(a)	Write a note on primary and back up protection?	[5]
(b)	What are the two types of construction used for P.T.s and explain?	[7]
(c)	Write a note on attracted armature relay?	[8]
Q2(a)	Write and explain the disadvantages of ungrounded systems?	[10]
(b)	Explain the principle of arc quenching in SF_6 circuit breaker?	[10]
Q3(a)	Explain the use of directional relay in protection of parallel feeders and ring mains.	[5]
(b)	Write a note on Impedance relay.	[7]
(c)	Explain biased differential relay.	[8]
Q4(a)	Explain any four	[4*5]

1. I.D.M.T Relay
2. Magnetizing current inrush
3. Theories of current zero interruption
4. MHO relay
5. Breaking capacity
6. Expulsion type lightning arresters

Q5(a)	Derive the expression for restriking voltage and RRRV	[10]
(b)	Write and explain different methods of generator protection?	[10]

P.T.O

Q6(a)   Explain lightning phenomenon?   [10]

(b)   Explain the construction and working of air break circuit breaker?   [10]

Q7(a)   Write a note on   [2*5]
        1. Vacuum circuit breaker
        2. B.I.L
(b)   Write and explain any two methods for protection of transformer?   [10]

②

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

KT Exam

JAN2016

Max. Marks: 100

Class: TE Electrical   Semester: VI Sem

Name of the Course: Power System Operation and Control

Duration: 3hrs

Program: EE

Course Code : EE -351

Master file.

Instructions:

1.   Question No 1 is compulsory.
2.   Attempt any four questions out of remaining six.
3.   Draw neat diagrams
4.   Assume suitable data if necessary

Q1	(a)	Explain with the help of neat diagrams the reactive capability limits of synchronous machines.	10
	(b)	Describe the use of shunt reactors and shunt capacitors in EHV overhead lines. Also give advantages and disadvantages of this type of compensation.	10
Q2	(a)	Establish the relation between power transfer and stability consideration for a lossless long line connected to sources at both the ends.	10
	(b)	Derive the general expression for the transmission loss of a system having 'K' plants interconnected.	10
Q3	(a)	Derive the complete block diagram representation for load frequency control of a Two area system.	20
Q4	(a)	Using a neat schematic diagram, derive block diagram for alternator voltage regulator.	10
	(b)	Explain with the help of neat diagrams and waveforms the working of TCR and also suggests a method for reducing the harmonics.	10
Q5	(a)	Name different operating states of power system and also control strategy for respective states.	10
	(b)	Explain the structure of deregulated power system and also mention the entities involve in it.	10
Q6	(a)	Incremental cost in rupees per MWh for a plant consisting of two units are: $dC_1/dP_1=0.16P_1+30$ $dC_2/dP_2=0.2P_2+25$ Assume that both units are operating at all times. The maximum and minimum loads on each unit are 200MW and 50MW respectively. If the total load varies between 100MW and 400MW find load division between two units as the system load varies over the full range.	12
	(b)	Determine the saving in the fuel cost in Rs/H for the economic distribution of total load of 115MW between the two units of plant described in the above question 6(a) compared with equal distribution of the same total load.	8
Q7	(a)	Explain with the help of composite SVS and power system characteristic,	10

how voltage can be maintained using SVS devices.

(b) Explain control strategy for the power flow control of a TCSC compensated **10**
line and also compare the performance of HVDC link with TCSC
compensated line.

T.E. (Elect) sem VI
Control system - II . Dt. 05/01/16.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering
(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

Re Exam

Jan. 2016

Max. Marks: 100

Duration: 3 Hours

Class: T.E,   Semester: VI   Program: Electrical

Name of the Course: Control System II

Instructions:

1. Question No 1 is compulsory.

    Master file.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Q.1.a) List out the frequency domain analysis specifications. State the Principal of Argument.

(5)

Q.1.b) Draw the bode plot for transfer function shown below.   **(5)**

$$G(s) = \frac{100}{s(s+2)(s+100)}$$

Q. 1. c) Explain the importance of observer in state space design. Discuss in details the steps for designing the observer gain vector.   **(10)**

Q. 2) For a unity feedback system with a forward transfer function

$$G(s) = \frac{K}{s(s+50)(s+120)}$$

With K=194200 system is able to achieve some steady state error with 20% overshoot. Design a lag compensator for the above system that will improve the steady-state error obtained for K=194200 tenfold, while still operating with 20% overshoot.

(1)   **(20)**

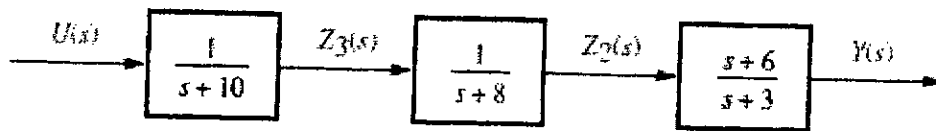**Q.3)** Consider the following transfer function: (20)

$$G(s) = \frac{(s+6)}{(s+3)(s+8)(s+10)}$$

If the system is represented in cascade form as shown in figure below

Consider $Z_1(s) = Y(s), Z_2(s)$ and $Z_3(s)$ as state variables for designing the controller.

Design a controller to yield a closed loop response of **10% overshoot** with a **settling time of 1 second**. Design the controller by first transforming the plant to phase variable.

Q.4) Use frequency response methods to design a lag-lead compensator for a unity feedback system where (20)

$$G(s) = \frac{K(s+7)}{s(s+5)(s+15)}$$

and the following specifications are to be met: **percent overshoot = 15%, settling time = 0.1 second, and Kv = 1000.**

Q. 5. a) A control system is described by the differential equation

$$\frac{d^3 y(t)}{dt^3} = u(t)$$

where y(t) is the observed output and u(t) is the input.

1. Describe the system in state space form
2. Is the system controllable?
3. Is the system Observable?

(10)

Q. 5. b) Explain with mathematical justification why "s" is replaced with "jw" in frequency

domain analysis of the control system. (10)

②

Q.6) Consider the unity feedback system with G(s) as forward path transfer function with

$$G(s) = \frac{K}{s(s+5)(s+20)}$$

The uncompensated system has about 55% overshoot and a peak time of 0.5 second when **Kv= 10**. Use frequency response methods to design a lead compensator to reduce the percent overshoot to 10%, while keeping the peak time and steady state error about the same or less.

(20)

Q. 7. a) For a system represented by the state equation
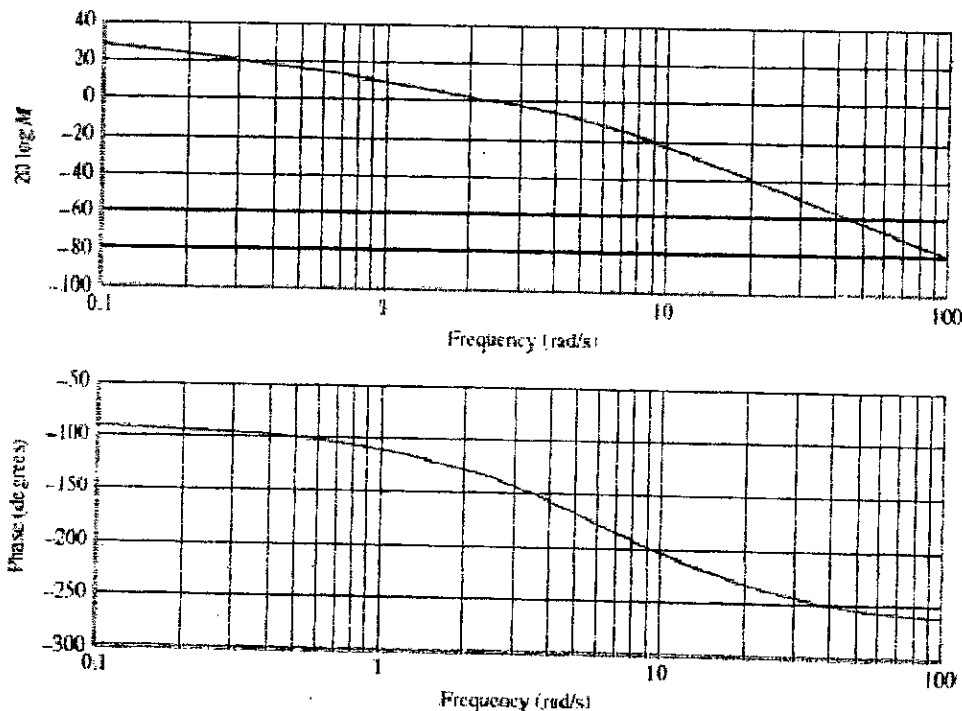
$$\dot{x} = Ax .$$

The response of $x(t) = \begin{bmatrix} e^{-2t} \\ -2e^{-2t} \end{bmatrix}$ when $x(0) = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$

and $x(t) = \begin{bmatrix} e^{-t} \\ -e^{-t} \end{bmatrix}$ when $x(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$

Determine the system matrix **A** and the state transition matrix.

(10)

Q. 7. b) The Bode plots for a plant, G(s), used in a unity feedback system are shown in

Find the gain margin, phase margin, zero dB frequency, 180 degree frequency, and the closed-loop bandwidth.

③

(10)