

Total No. of Questions : 6]

SEAT No. :

P5124

[Total No. of Pages : 2

B.E. / Insem. - 530 - A
B.E. (Mechanical Engineering)
ADVANCED MANUFACTURING PROCESSES
(2012 Pattern) (Semester - I)

Time : 1 Hour]

[Max. Marks :30

Instructions to the candidates:

- 1) *All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4 & Q.5 or Q.6.*
- 2) *Figures to the right indicate full marks*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Explain with neat sketches the principle of shear forming and metal spinning processes. [6]
- b) State the importance of friction and wear of contacting surfaces and strain hardening on metal forming processes. [4]

OR

- Q2)** a) Explain with a schematic the principle and important features of HERF process. [6]
- b) With a schematic state principle of roll forming process. [4]

- Q3)** a) Why friction stir welding is considered as 'Green technology'? [6]
- b) State types and importance of the advanced casting processes. [4]

OR

- Q4)** a) Explain with sketch the principle and process characteristics of squeeze casting process. [6]
- b) State with sketch different metallurgical zones in Friction stir welding. [4]

P.T.O

- Q5)** a) With a schematic state the principle of electrolytic jet machining process. [6]
b) State the principle and applications of shaped-tube electrolytic machining process. [4]

OR

- Q6)** a) State with a sketch the principle of electrolytic in-process dressing process (ELID). [6]
b) How electrochemical grinding process is different than the conventional grinding process? [4]



Total No. of Questions : 6]

SEAT No. :

P5115

[Total No. of Pages : 2

B.E./Insem. - 522

B.E. (Mechanical Engineering) (Semester - I)

CAD/CAM AND AUTOMATION

(2012 Pattern)

Time : 1 hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.
- 2) Figures to the right side indicate full marks.
- 3) Use of Electronic pocket calculator is allowed.
- 4) Assume suitable data, if necessary.

Q1) a) A line is drawn with vertices A (5, 5) Q (10, 10) has undergone following transformation in sequence. **[6]**

- i) Rotation through 45° clockwise.
- ii) Reflection about line y axis.

Find the concatenated matrix and new coordinate of line.

b) Mention the steps to scale entity about any reference point P (xr, yr) with sketeches and related concatenated matrix. **[4]**

OR

Q2) a) Explain orthographic Projections for FV, TV and RSV with sketch and matrix. **[6]**

b) Triangle is defined by points P (2,2) Q (6,2) R (4,4) is created in User coordinate system (UCS) having x axis oriented a 45° and located at 4,5 units from Fixed Model coordinate system (MCS) Find coordinate of triangles in MCS. **[4]**

Q3) a) Compare analytical and parametric representation of curves with example. **[4]**

b) Write equation of line having P1 [3 5 8] and P2 [6, 4, 3]

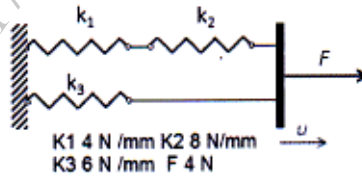
And find tangent vector and points on line at parameter $\mu = 0, 0.25, 0.5, 0.75, 1$ **[6]**

P.T.O.

OR

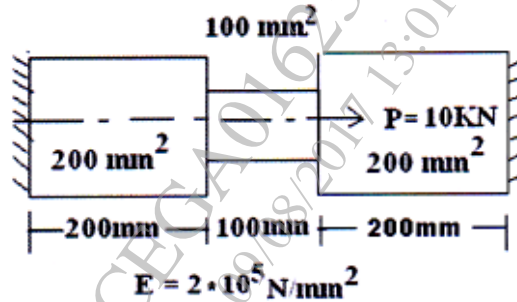
- Q4)** a) Explain Hermite Cubic Spline curve with mathematical formulation. [6]
b) Explain B - Rep and CSG methods of solid modeling. [4]

- Q5)** a) Explain the concept of shape function for 1 D elements. [4]
b) Cluster of springs are shown in figure calculate displacement and reaction force. [6]



OR

- Q6)** a) Find displacement, Stresses and reaction force for bar element shown in figure. [10]



Total No. of Questions : 6]

SEAT No. :

P5116

[Total No. of Pages : 3

BE/Insem - 523
B.E. (Mechanical) (Semester - I)
DYNAMICS OF MACHINERY
(2012 Pattern)

Time : 1 hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data, if necessary.*

Q1) a) Explain the concept of single plane and multiple plane balancing. [4]

- b) A four cylinder vertical engine has cranks 150 mm long. The cylinders are spaced 200 mm apart. Mass of reciprocating parts of 1st, 2nd and 4th cylinders are 50 kg, 60 kg and 50 kg respectively. Find the reciprocating mass of the 3rd cylinder and relative angular positions of the cranks to achieve complete balance. [6]

OR

Q2) a) Explain the terms static balancing and dynamic balancing. [4]

- b) A line shaft carries four pulleys P, Q, R and S, spaced equally at 0.6 m apart and at radii 0.1 m, 0.225m, 0.15 m and 0.15 m respectively. The mass of the pulleys Q, R and S is 10 kg, 5.5 kg and 3.6 kg respectively. If the shaft is to be in complete balance, determine: [6]

- i) Mass of Pulley P
- ii) Angular positions of all four pulleys

Q3) a) The motion of a point is given by $\alpha = -9x$ where α and x are the acceleration and displacement of SHM. The amplitude is 0.05 m. Find. [4]

- i) The time period
 - ii) Frequency
 - iii) Displacement and velocity after 20 seconds.
- b) Determine the natural frequency of the system shown in Fig. Q.3.B. [6]

P.T.O.

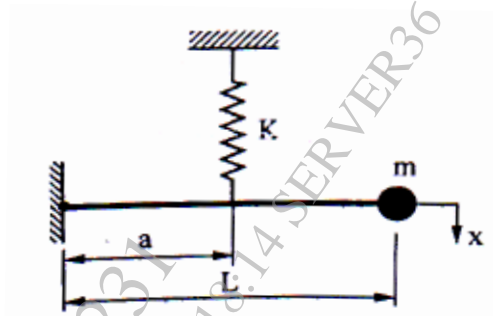


Fig.Q.3.B

OR

- Q4) a)** With neat sketch explain under damped system, over damped system and critically damped system? Give a practical application of each, if so. [6]
- b) A mass of 3 kg is supported on an isolator having a spring constant of 3000 N/m and viscous damping. If the amplitude of free vibration of the mass falls to one half its original value in 2 sec, determine the damping coefficient of the isolator. [4]
- Q5) a)** Fill in the blanks. [4]
- Rotating shafts tend to vibrate violently in transverse direction at certain speed. This speed is called _____.
 i) Critical speed (ii) Whirling speed (iii) Whipping speed
 (iv) All of the above
 - The angle between spring force and damping force is _____.
 i) 90° (ii) 180° (iii) 0° (iv) none of the above
 - For shaft speed less than the critical speed, the phase difference between displacement and centrifugal force is _____.
 (i) 0° (ii) 45° (iii) 90° (iv) 180°
 - The factor which affects the critical speed of a shaft is _____.
 (i) eccentricity (ii) diameter of the disc (iii) span of the shaft
 (iv) all above
- b) A single cylinder vertical petrol engine of total mass 320 kg is mounted on a steel chassis and causes a vertical static deflection of 2mm. The reciprocating parts of the engine have a mass of 24 kg and move through a vertical stroke of 150 mm with SHM. A dashpot attached to the system offers a resistance of 490 N at a velocity of 0.3m/s. Determine: [6]

- (i) The speed of driving shaft at resonance
- (ii) The amplitude of steady state vibrations when the driving shaft of the engine rotates at 480 rpm.

OR

- Q6)** a) Plot frequency response curves and draw any four conclusions from it. [4]
- b) A tractor driving across a field that has undulations at regular intervals. [6]
The distance between the bumps is about 4.2 m. The driver's seat is attached to a spring to absorb some of the shock as the tractor moves over rough ground. Assume the spring constant to be $2.0 \times 10^4 \text{ N.m}^{-1}$ and the mass of the seat to be 50 kg and the mass of the driver 70 kg. The tractor is driven at 30 km. h^{-1} over the undulations. Will an accident occur?



Total No. of Questions : 6]

SEAT No. :

P5117

[Total No. of Pages : 2

B.E./Insem.- 524

B.E. (Mechanical Engg.) (Semester - I)

ENERGY AUDIT AND MANAGEMENT (Elective - I)

(2012 Pattern)

Time :1 hour]

[Max. Marks :30

Instructions to the candidates:

- 1) *Figures to the right indicate full marks.*
- 2) *Draw neat figures wherever necessary.*
- 3) *Use of Scientific Calculators is allowed.*

Q1) a) Discuss Indian energy scenario in context of natural gas, oil and coal. [5]

b) List down the responsibilities of Energy Manager. [5]

OR

Q2) a) Name the designated consumers under the energy conservation act. [4]

b) Write a note: Walk through energy audit. [6]

Q3) a) Explain Energy Audit Methodology for Ice factory. [6]

b) Write short note on the following (i) Key features of Electricity Act 2003
(ii) System Distribution losses. [4]

OR

Q4) a) What are the energy conservation opportunities in Refrigeration and HVAC systems. [6]

b) List the different instruments used for energy audit along with their applications. [4]

Q5) a) A sum of Rs. 4,00,000 is deposited in a bank at the beginning of a year. The bank pays 5% interest annually. How much money is in the bank account at the end of the seventh year, if no money is withdrawn? [5]

b) What is the NPV of a project, (life 2 year) which requires an investment of Rs. 70000 and yield Rs. 20000 in the 1st year and Rs. 50000/- in the next year, if the Interest rate is 10%. [5]

P.T.O.

OR

Q6) Evaluate the financial merit of a proposed project shown in table below. Consider annual discount rate of 8% for each project. Use Net present analysis technique. **[10]**

	Project - I	Project - II
Capital cost (Rs.)	40,000	40,000
Year	Net Annual saving (Rs.)	Net Annual saving (Rs.)
1	6000	6600
2	6000	6600
3	6000	6300
4	6000	6300
5	6000	6000
6	6000	6000
7	6000	5700
8	6000	5700
9	6000	5400
10	6000	5400
11	6000	5000



Total No. of Questions : 6]

SEAT No. :

P5123

[Total No. of Pages : 3

B.E. / Insem. - 530

B.E. (Mechanical Engineering)

OPERATIONS RESEARCH

(Elective - II) (2012 Pattern) (Semester - I)

Time : 1 Hour]

[Max. Marks :30

Instructions to the candidates:

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4,Q.5 or Q.6.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Use of electronic pocket calculator is allowed.*
- 4) *Assume suitable data if necessary.*

Q1) Maximize: $Z = 3x_1 + 5x_2 + 4x_3$ **[10]**

Subject to constraints - $2x_1 + 3x_2 \leq 8$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

$$x_1, x_2, x_3 \geq 0$$

OR

Q2) a) Write short notes on : **[4]**

- i) Laplace Criterion ii) Hurwicz Criterion

b) Daily demand for litres of milk at a supermarket is given by following probability distribution : **[6]**

Daily demand	100	150	200	250	300	350	400
Probability	0.20	0.25	0.30	0.10	0.05	0.05	0.05

If milk is not sold the same day it becomes useless. The supermarket is selling Rs.31 per litre whereas cost per litre to supermarket is Rs.25. If each day's demand is independent of previous day's demand, how many litres of milk should be ordered everyday?

P.T.O

- Q3) a)** Job shop needs to assign 4 jobs to 4 workers. The cost of performing a job is a function of the skills of the workers. Table summarizes the cost of the assignments. Worker 1 cannot do job 3, and worker 3 cannot do job 4. Determine the optimal assignment using the Hungarian method. [6]

Worker	Jobs			
	J1	J2	J3	J4
W1	Rs.50	Rs.50	---	Rs.20
W2	Rs.70	Rs.40	Rs.20	Rs.30
W3	Rs.90	Rs.30	Rs.50	----
W4	Rs.70	Rs.20	Rs.60	Rs.70

- b) Explain Least Cost method of allocation for transportation problem. [4]

OR

- Q4) a)** Find the optimal solution for given transportation problem. [10]

Factories	P	Q	R	S	Availability
A	10	8	7	12	500
B	12	13	6	10	500
C	8	10	12	14	900
Demand	700	550	450	300	

- Q5) a)** Solve the following game using dominance property. [6]

		<i>Player B</i>		
		I	II	III
<i>Player A</i>	I	1	7	2
	II	6	2	7
	III	6	1	6

- b) Explain break even analysis & margin of safety with neat sketch. [4]

OR

Q6) a) A ball bearing manufacturing company is planning to install an additional plant which will require leasing new equipment for monthly payment of Rs.60,000. Variable cost would be Rs.20 per item and each item would retail for Rs.70. **[6]**

- i) How many ball bearing units must be sold in order to break even?
- ii) What would be profit or loss if 1,000 items are made & sold in a month?
- iii) How many items must be sold to realize a profit of Rs.40,000?

b) Write short notes on : **[4]**

- i) Pure and mixed strategies
- ii) Dominance rule



Total No. of Questions : 6]

SEAT No. :

P5122

[Total No. of Pages : 1

B.E./Insem. - 529
B.E. (Mechanical Engineering)
PRODUCT DESIGN AND DEVELOPMENT
(2012 Pattern) (Elective - II)

Time :1 Hour]

[Max. Marks :30

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of non programmable calculator is allowed.*
- 4) *Assume suitable data, if required.*

- Q1)** a) Explain phases of product design. [5]
b) Explain product testing. [5]

OR

- Q2)** a) Explain Standardization with suitable example. [5]
b) Differentiate between product development and product design. [5]

- Q3)** a) Explain the concept of technology forecasting. [5]
b) Identify and explain customer need with suitable example. [5]

OR

- Q4)** a) Explain the concept mission statement with suitable example. [5]
b) Explain the concept of customer population with suitable example. [5]

- Q5)** a) Explain the concept of brainstorming with suitable example. [5]
b) Explain functional modeling. [5]

OR

- Q6)** a) Explain, concept generation with suitable example. [5]
b) Explain the process of concept embodiment. [5]



Total No. of Questions : 6]

SEAT No. :

P5114

[Total No. of Pages : 3

BE/Insem - 521
B.E. (Mechanical) (Semester - I)
REFRIGERATION & AIR CONDITIONING
(2012 Pattern)

Time : 1 hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.
- 2) Figures to the right side indicate full marks.

- Q1)** a) List the various processes in Bell Coleman cycle. Draw cycle on P-v and T-s diagram. Derive expression of COP of Bell Coleman Cycle. [5]
- b) Explain the need of air conditioning for multiplex facilities. [5]

OR

- Q2)** a) With neat schematic, explain the refrigeration system for Ice plant. [5]
- b) Dense air refrigeration system of 10 TR capacity operates between pressure of 4 bar and 16 bar. The air temperature after heat rejection to surrounding is 37°C and air temperature at exit of refrigerator is 7 °C. Determine (i) Compressor and turbine work per TR; (ii) C.O.P. (iii) Power required per TR. Take $n = 1.25$, and $C_p = 1$ kJ/kg K. [5]

- Q3)** a) Explain the benefits of secondary refrigerants. What is selection criteria of secondary refrigerants? [4]
- b) A simple R - 134a heat pump for space heating operates between temperature limits of 15 °C and 50 °C. The heat required to pumped is 100 MJ/h. Determine. [6]
- i) Quality at evaporator inlet. ii) the discharge temperature (assume C_p of vapour 0.996 kJ/kg.K), iii) piston displacement of compressor,
 - iv) Compressor power input & v) Cop of heating. The specific volume of R-134a saturated vapour at 15 °C is 0.0418 m³/ kg.

P.T.O.

Saturation Temperature (°C)	Pressure, MPa	Enthalpy, kJ/kg		Entropy, kJ/kg K	
		hf	hg	sf	sg
15	0.488	220.4	407.1	1.0725	1.72
50	1.318	271.6	423.4	1.24	1.707

OR

Q4) A refrigerant R - 134a vapour compression includes a liquid to vapour heat exchanger in the system. The heat exchanger cools saturated liquid coming out of condenser from 32 °C to 22 °C with the help of vapour coming out of evaporator at -12 °C saturated. The compression is isentropic. Draw the line diagram of components, represents the processes on p -h diagram and find:
 (i) C.O.P. of the system; (ii) Refrigerating capacity of system if the compressor displacement is 1.2m³/min (iii) C.O.P. of the system without the heat exchanger. Take C_{p_l} at 32 °C (Sat) = 1.456 KJ/kg K & C_{p_g} at - 12 °C (sat) = 0.8463 kJ/kg K

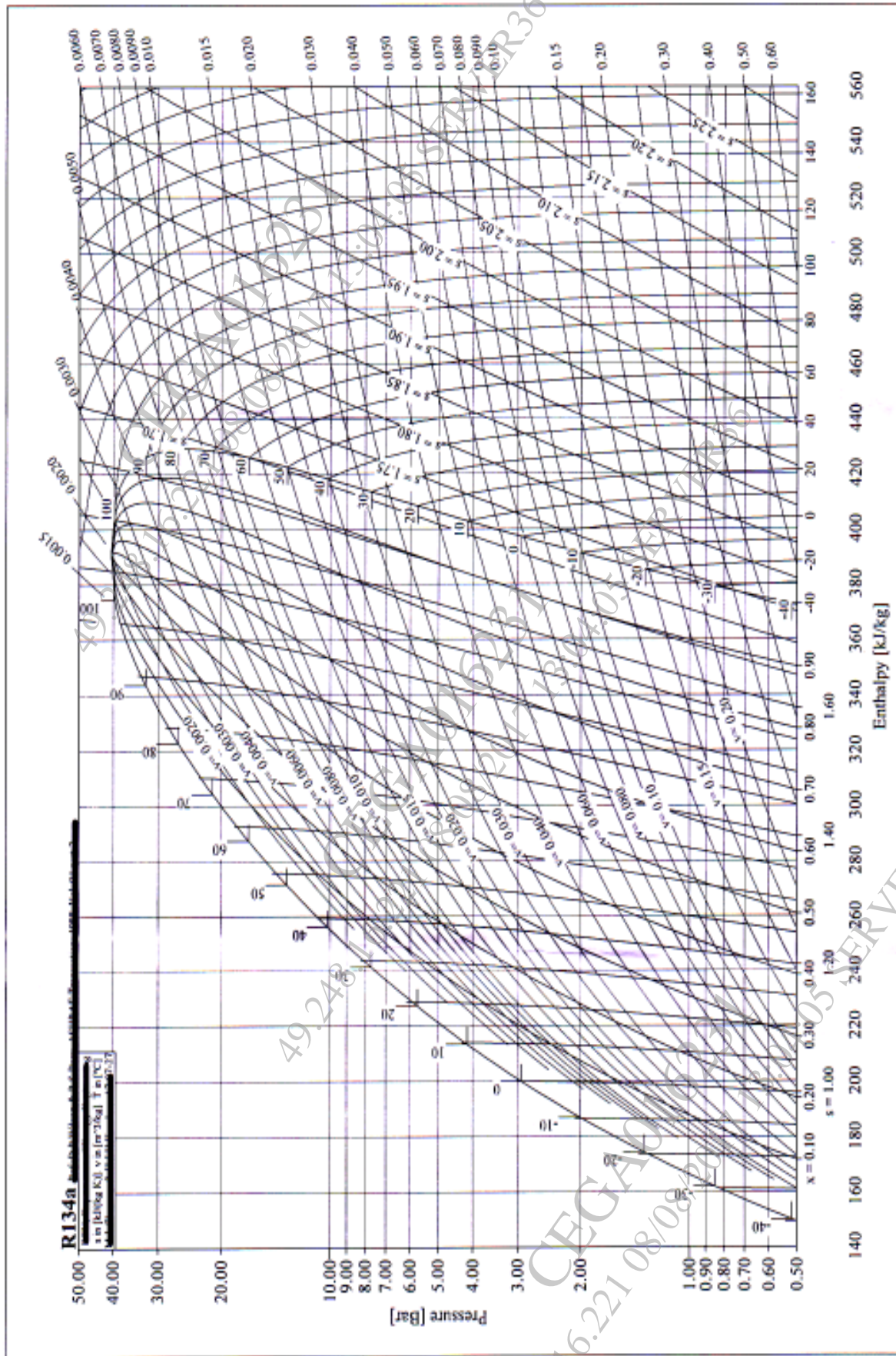
Q5) A Multi - evaporator, vapour compression refrigeration system is working with R - 134a refrigerant. The system uses individual expansion valve arrangement. The refrigeration capacity of the high temperature evaporator operating at - 10 °C is 5 TR, while it is 10 TR for the low temperature evaporator operating at - 35 °C. The condenser pressure is 11bar. Separate compressors are used with each evaporators. Assume saturated conditions at the exit of both evaporators and condenser, and isentropic compression. Draw schematic of system. [10]

- i) Find the required power input to compressor in kW
- ii) COP.

OR

- Q6)** a) With neat diagram explain Cascade refrigeration system. [5]
 b) Draw the neat schematic of practical Li-Br absorption system. List the various components with their function in brief. [5]





Total No. of Questions : 6]

SEAT No. :

P5119

[Total No. of Pages : 3

B.E./Insem. - 526

B.E. (Mechanical Engineering) (Semester - I)

RELIABILITY ENGINEERING

(2012 Pattern)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) *All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Neat diagrams must be drawn wherever necessary.*

- Q1) a)** Eight closely coiled helical (CCH) compression springs were tested for life and following results were recorded for analysis. Find the mean time to failure for 8 CCH springs. Also find mean failure rate for $T = 643$ hrs. and 690 hrs. **[6]**

Specimen Number	1	2	3	4	5	6	7	8
Time to Failure hrs.	425	521	622	624	643	688	689	690

- b) Explain in brief warranty management and life cycle cost. **[4]**

OR

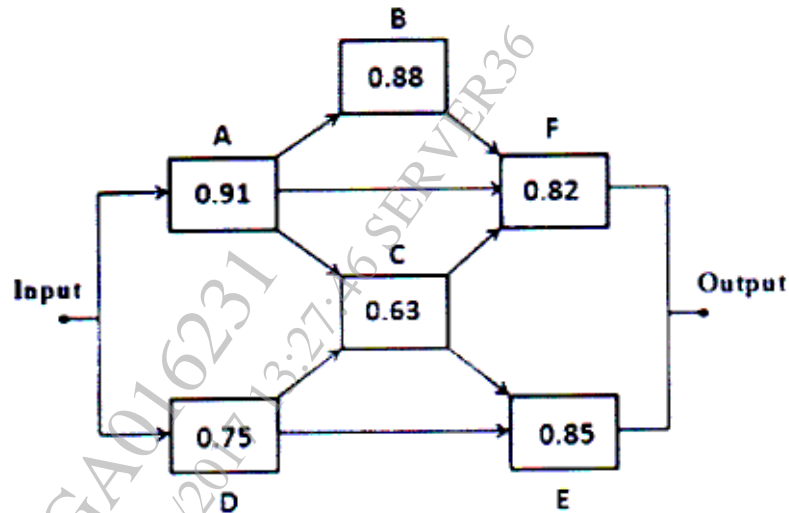
- Q2) a)** Following table shows the test results for 100 components tested simultaneously for 60 hrs. Calculate failure density and hazard rate. **[6]**

Operating time (hrs.)	0	10	20	30	40	50	60
No. of Surviving components	100	87	79	71	65	59	55

- b) State different modes of failures and causes of failures. **[4]**

- Q3) a)** Six elements (A, B, C, D, E and F) of a system are connected as shown in figure which also indicates the reliability of each component. Find the system reliability using tie-set method and also draw an equivalent block diagram using minimal tie-set elements. **[6]**

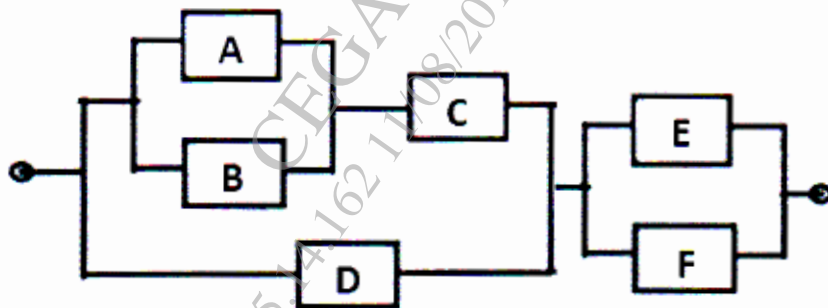
P.T.O.



- b) State various methods to find out the reliability of a mixed configuration (series and parallel) system wherein decomposition of components into series and parallel configuration is not possible. Explain any one method in brief. [4]

OR

- Q4) a) Find the reliability of the system shown in figure assuming all the components (A, B, C, D, E and F) are independent. Also, find reliability of the system when components are independent and identical having reliability R. [6]



- b) Compare the normal and weibull probability distributions. [4]
- Q5) a) An engine assembly consists of three critical components connected in series with reliability values of 0.86, 0.62, 0.75 respectively. The reliability of engine assembly is desired as 0.69. Find for which critical components the reliability values are to be improved and also find the values of individual reliabilities of the critical components by using minimum effort method. [6]
- b) Prove that redundancy at element level resulting in higher reliability of the system than redundancy provided at the unit level. [4]

OR

- Q6)** a) A system of three elements 1,2 and 3 are having failure rates $\lambda_1=0.004$, $\lambda_2=0.006$, $\lambda_3= 0.007$ per hour respectively. Find failure rates as well as reliability of each sub system for the entire mission period using ARINC apportionment technique assuming mission time of 50 hours and desired system reliability of 0.96. [6]
- b) Explain standby redundancy and give types of standby redundancy. [4]



Total No. of Questions : 6]

SEAT No. :

P5118

[Total No. of Pages : 2

B.E./Insem. - 525
B.E. (Mechanical)
TRIBOLOGY (Elective - I)
(2012 Pattern)

Time :1 Hour]

[Max. Marks :30

Instructions to the candidates:

- 1) *Write Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, whenever necessary.*

- Q1)** a) What are the additives? Explain any five types of additives used in lubricant oils. [6]
- b) Explain the effect of temperature and pressure on Viscosity. [4]

OR

- Q2)** a) Explain different regimes of hydrodynamic lubrication with the help of Stribeck curve. [6]
- b) Define Tribology. Explain its importance in the design of machine elements. [4]

- Q3)** a) Define friction and wear. What are the causes of friction. [6]
- b) What are the parameters which govern the wear? Write any four. [4]

OR

- Q4)** a) State laws of friction. Explain how coulomb's vision of friction explains these laws of friction. [6]
- b) Explain Adhesive and Abrasive wear. [4]

- Q5)** Derive from basic principles two dimensional Reynolds equation taking usual notations. [10]

P.T.O.

OR

Q6) A short hydrodynamic journal bearing refers to the following data: **[10]**

Journal speed = 35 revolutions per seconds [rps]

Length of bearing $[l] = 0.5 \times$ journal diameter $[d]$

Radial clearance $[c] = 0.001 \times$ Journal diameter $[d]$

Eccentricity Ratio $[\epsilon] = 0.65$

Flow rate of lubricant = 3.45 litre per hour

Radial load = 1000N

Calculate 1] Journal diameter 2] Radial clearance 3] Dimensions of the bearing

4] Minimum oil film thickness 5] Absolute viscosity of the lubricant.

