Te sem-VI (old) Nov-Dec-15

26/11/15

Mech / AUTO

Sub:- MD-I

QP Code : 1900

(Old course)

Max. Marks : 100
Duration : 4 hours

Instructions: 1) Question ***No. I*** is compulsory.
2) Answer any ***four*** from the remaining six questions.
3) Use of recommended ***Design data book*** is permitted.
4) Use your judgment for unspecified data, if any.

Q.1 Solve any **four** of the followings: (4x5 =20)

a) What do you understand by following designations of materials:
i) FG350 ii) CS1030 iii) 40C8 FeE400 iv) 40Cr1Mo28
v) 40C8

b) What is service factor ? state its significance.

c) 'Curved beams cannot be designed by applying the simple bending theory of straight beams'. Justify the statement.

d) What are the advantages of hollow shaft over solid shaft ? State any two examples where hollows shafts are used.

e) 'Square key is stronger against crushing than rectangular key'. Justify the statement.

f) State the advantages and limitations of belt drives.

Q.2 a) What is cotter ?. Why a taper is provided on a cotter ?. state the applications of cotter joint. (5)

b) A Knuckle joint is subjected to an axial load of 80 kN. Determine the diameter of knuckle pin considering the load to be uniformly distributed over the pin in the eye and uniformly varying over the portion of pin in forks. Use the following data:
i) Allowable tensile and compressive stress for pin = 600 N/mm^2
ii) Allowable shear stress for pin = 300 N/mm^2
iii) Allowable bearing pressure for pin = 200 N/mm^2
iv) Thickness of eye = 1.5 x pin diameter
v) Total fork thickness = eye thickness
Draw a neat sketch of the joint. (15)

Q.3 a)) Machine press screw as shown in figure 1 is subjected to an axial force of 45 kN. Overhang of horizontal member of frame is 420 mm and height of screw is 510 mm. (13)
i) Select the suitable material and stresses for screw, nut and frame.
ii) Design screw and nut,
iii) Check the screw for buckling failure.
iv) Determine the dimensions of cross-section of horizontal member of frame.

QP-Con. 8449-15.

P.T.O

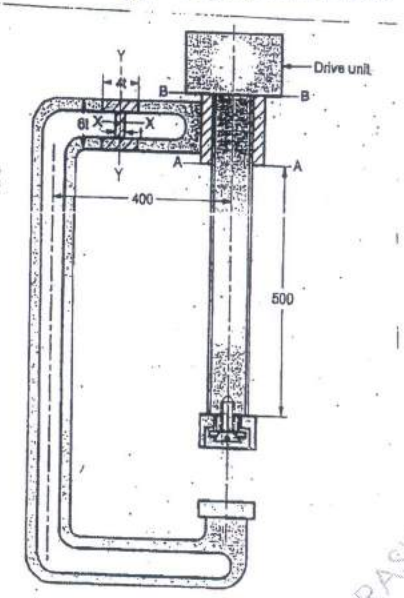


Figure 1

b) A steel plate subjected to a force of 6 kN and fixed to a channel by means of three identical bolts, as shown in figure 2. The bolts are made from plain carbon steel 45C8 and factor of safety is 3. Specify the size of bolts. (7)

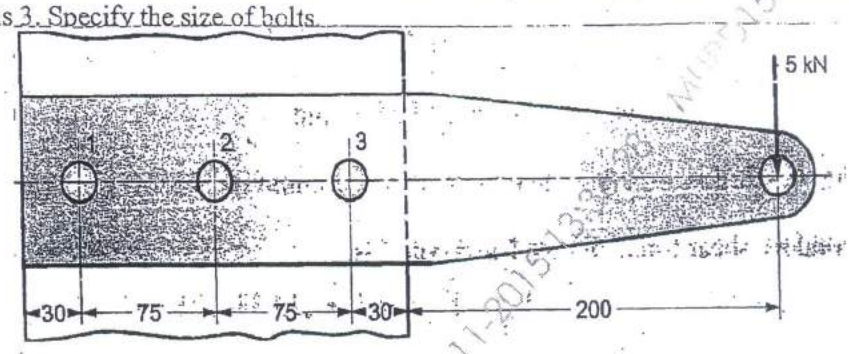


Figure 2

Q.4 a) The mechanical component is subjected to the following bending stress cycles:

i) $\pm$ 350 N/mm^2 for 70 % of time;

ii) $\pm$ 500 N/mm^2 for 5 % of time.

iv) $\pm$ 300 N/mm^2 for remaining time.

The component is made of plain carbon steel 50C4 (S_{ut} = 660 N/mm^2). If the endurance limit of the component is 280 N/mm^2, determine its life. (12)

b) How will you find the endurance limit of the material experimentally ?. Explain. (8)

Q.5 a) Compare the weight of equal length of hollow shaft and solid shaft to transmit a given torque for the same maximum shear stress. The material for both shafts is same and inside diameter is 2/3 of outside diameter for hollow shaft. (8)

b) A bushed-pin type flexible flange coupling is used to transmit 30 kW power at 1440 rpm from an electric motor to a machine. If the peak torque is 20 % more than the average torque, design the coupling. Assuming suitable materials and permissible stresses for the components of coupling. Take permissible bearing pressure= 1 N/mm^2 (12)

Q.6 a) A helical compression spring is to be designed for a maximum load of 8 kN with a corresponding deflection of 85 mm. Determine:

i) the wire diameter; ii) the number of active turns ; iii) free length; iv) pitch length ; v) helix angle.

For the spring material, assume: $S_{ut} = \frac{2000}{d^{0.168}}, N/mm^2$;

$$S_{ys} = \frac{1200}{d^{0.168}}, N/mm^2 \quad ; \quad G = 8 \times 10^4 \text{ N/ mm}^2$$

Assume average service (10)

b) A leaf spring has 12 number of leaves, two of which are extra full length. The spring supports are 1.05 m apart and the central band in 85 mm wide. The central load is 5.4 kN, with permissible stress of 280 N/mm^2 . The ratio of total depth of the width is 3. Determine: i) the thickness and width of leaves ; and ii) the deflection of spring. (10)

Q.7 a) A flat belt drive is to be used to drive a reciprocating compressor running at 720 rpm. by a 15 kW , 1440 r.p.m., electric motor. The required centre distance is 2 m. Select the flat belt for the drive. From the manufacturer's catalogue, the power rating per mm width of the belt per ply at 180^0 arc of contact and 10 m/s belt speed is 0.023 kW. (15)

b) Explain the effect of polygonal action on the performance of chain. (5)

Te sem-VI (CBGS) MDI Nov-Dec-15
Mech/Auto (IE)
CBGS 26-11-15

Sub:- MD-I

Mech
AUTO

QP Code : 6296

Revised Course

Duration: 3 Hrs

MAXIMUM MARKS : 80

- Question No. 1 is compulsory.
- Attempt any THREE questions from the remaining.
- Assumption made should be clearly stated.
- Use of PSG Design Data Book is permitted.

Q.1

(a) Find outer diameter of the cylinder made of GCI- FG300 using Lames equation if the maximum internal pressure is 30MPa, FOS is 2 and internal diameter is 250mm. 5

(b) State different theories of failure and explain any two in details. 5

(c) Explain overhauling and self-locking of Screw. 5

(d) Derive an expression for deflection of helical spring of circular wire. 5

Q. 2 (a) Design a knuckle joint to withstand a tensile load of 25KN if the permissible stresses are 56MPa in tension, 40 MPa in shear and 70 MPa in compression. 15

(b) Show that the efficiency of a self-locking screw is less than 50 percent. 5

Q.3 (a) Determine the size of the circular bar using Soderberg equation with FOS=2.5 if it is subjected to tensile force varying 300KN to 550KN. It is made of carbon steel 35C8 with σ_{yt} =320N/mm^2 and σ_{ut} = 600 N/mm^2. 8

(b) Select a standard hook of trapezoidal cross section to lift a load of 110KN and find the stress induced at critical cross section. 8

(c) Explain different methods to reduce stress concentration. 4

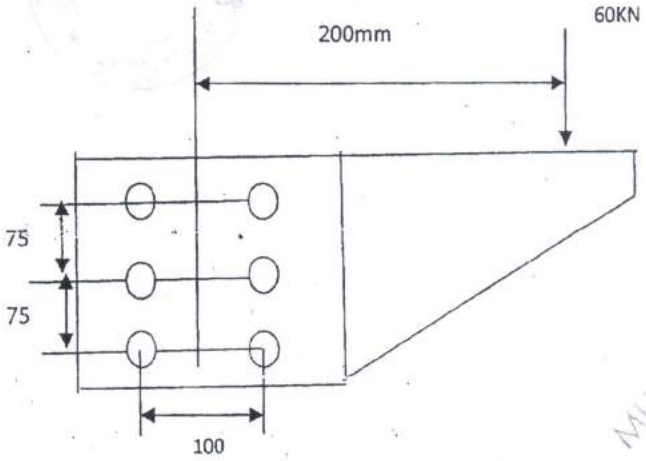
Q.4 (a) A steel shaft is supported at bearing A and B 750mm apart. A spur gear having PCD 400mm is located 150mm to the right of LH bearing and a pinion with PCD 120mm is mounted 350mm to the left of RH bearing. The gear is drive by the pinion located vertically below, while the pinion transmits power to another gear horizontally to the right. Using allowable shear stress 60MPa, determine the diameter of the shaft. The shaft transmitting 10 KW at 200 rpm. Shock and Fatigue factor in bending and torsion are 2.0 and 1.5 respectively. 16

(b) Explain different types of keys with neat sketches 4

[TURN OVER

Q.5 (a) Design a Clamp coupling for mild steel shaft transmitting 40 KW at 100 rpm. Coefficient of friction between the muff and the shaft surface is 0.3 and number of bolts connecting two halves are six. The allowable shear stress in the shaft and coupling bolts are 40 MPa and 70 MPa resp. 10

(b) A Bracket is supported by means of 6 bolts of same size as shown. Determine the diameter of the bolts if the maximum shear stress is 150MPa. 10



Q.6 (a) Explain manufacturing consideration in design. 6

(b) Explain the terms : 6
1) Neeping of spring 2) Surge in spring

(c) A laminated spring 500 mm long and 40 mm wide is held together at the centre by a band 85 mm wide. If the thickness of each leaf is 10 mm, find the number of leaves required to carry a load of 5400N. Assume maximum working stress of 280MPa. 8
If the two of the leaves extend the full length of the spring, find the deflection of the spring. The young modulus for the spring material is 210GPa.

MECH & AUTO / Sem VI (OLD) / 02/12/15

MV

Nov-Dec-15

Sub:- MV

Mech / AUTO

(OLD COURSE) **QP Code : 1953**

(4 Hours) **[Total Marks : 100**

Instructions: 1) Question *No. 1* is compulsory.
2) Answer any ***four*** from the remaining six questions.
3) Use your judgment for unspecified data, if any.

Q.1 Answer any ***four*** of the following: (4 x 5 =20)

i) Explain dry friction or coulomb damping, Damping factor, damping coefficient and critical damping coefficient.

ii) What is logarithmic decrement and derive an expression for it ?.

iii) Define following terms:

a) Coupled and uncoupled differential equations.

b) Mode shapes.

iv)Explain the following terms:

a) Vibration isolation

b) Force transmissibility

v) What do you mean by critical speed of shaft ?. State its significance.

vi) What do you mean by balancing ?. Why it is necessary for high speed engines?.

Q 2 a) Find the natural frequency of oscillation for the roller rolling on horizontal surface without slipping, as shown in figure 1. The mass of roller is 5 kg, radius of roller is 50 mm and stiffness of ring is 2000 N/m. What would be the frequency of oscillation, if radius of roller is made 100 mm without changing the mass?. (10)

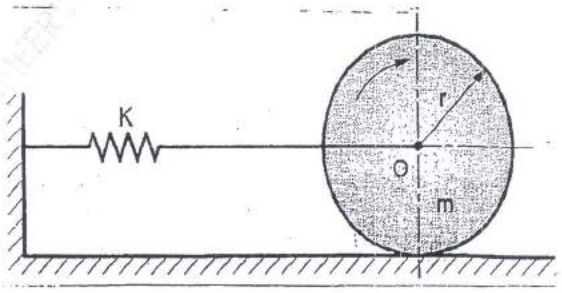


Figure 1.

b)Determine the natural frequency of vibration of a system shown in figure 2. (10)

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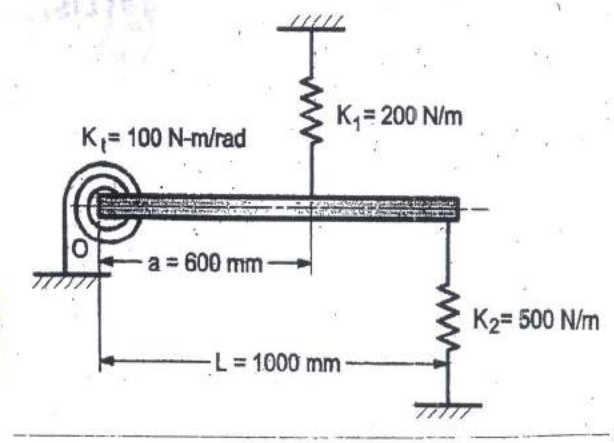


Figure 2

Q.3 a) A door along with door-closing system shown in figure 3, has a moment of inertia of 25 kg-m^2 about the hinge axis. If the stiffness of torsional spring is 20 N-m/rad, find the most suitable value of the damping coefficient. (10)

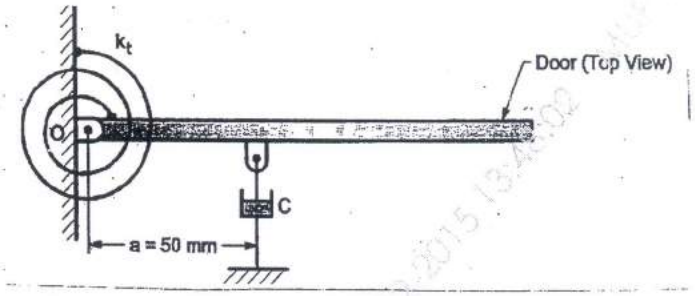


Figure 3

b) A mass placed on rough surface is attached to a spring and is given an initial displacement of 95 mm from its equilibrium position. After completing five cycles of oscillations in 2 sec, the final position of the mass is found to be 8 mm from its equilibrium position. Find the coefficient of friction between the surface and the mass. (10)

Q.4 a) Derive the equation of motion for the system shown in figure 4 by using Lagrange's equation if $K_1 = K_2 = K_3 = 1$ and $m_1 = m_2 = 1$ (10)

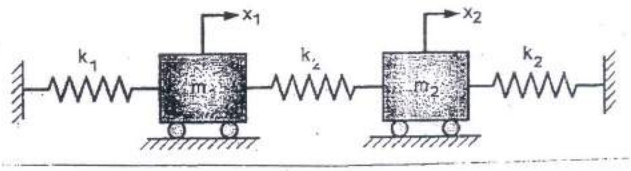


Figure 4

[TURN OVER

b) Find the lowest natural frequency of transverse vibration for the system shown in figure 5 by Rayleigh's method. Take E= 2.01 x 10^{11} N/m^2, I=10^{-6} m^4. (10)

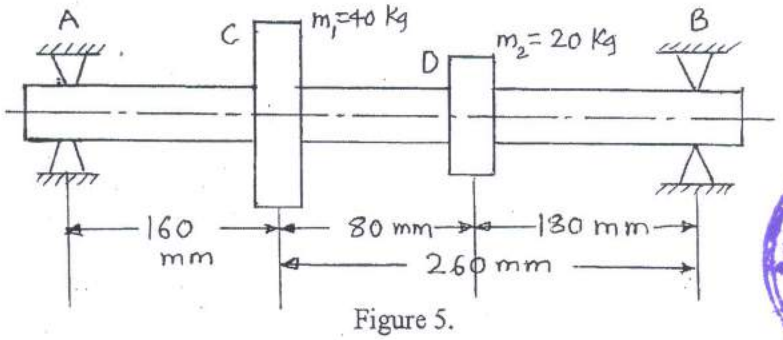


Figure 5.

Q.5 a) A machine part weighing 20 N vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in a resonant amplitude of 0.01 m with a period of 0.2 sec. if the same system is excited by a harmonic force of frequency 4 Hz. What will be the percentage increase in the amplitude of forced vibration when the dash pot is removed. (10)

b) A seismic instrument is mounted on machine at 1200 rpm. The natural frequency of seismic instrument is 18 rad/s. The instrument records relative amplitude of 0.5 mm. Compute displacement, velocity and acceleration of machine. Damping of seismic instrument is neglected. (10)

Q.6 a) An instrument panel of an aircraft is mounted on isolators. The isolator has a negligible damping and it deflects 5 mm under the weight of28 kg. Find the percentage of motion transmitted to the instrument beard, if the vibration of the aircraft is at 2500 rpm. (10)

b) A rotor has a mass of 15 kg and is mounted on a 25 mm diameter horizontal shaft supported at its ends by two ball bearings. The bearings are 1 m apart. The shaft rotates at 2400 rpm. If the center of mass of rotor is 0.11 mm away from the geometric axis of the rotor, due to manufacturing defects, find the amplitude of the steady state vibrations and the dynamic force transmitted to the bearings. Assume E=200 GN/m^2. (10)

Q.7 a) Four masses A,B,C and Dare completely balanced. Masses C and D makes angles of 90^0 and 195^0 respectively with B in the same sense. The masses have following properties:

m_A = magnitude of mass A	r_A = 150 mm 0.15 m
m_B = 25 kg	r_B = 200 mm =0.2 m
m_C = 40 kg	r_C = 100 mm = 0.1 m
m_D = 35 kg	r_D = 180 mm =0.18 m

[TURN OVER

Planes B and C are 250 apart. Determine a) the mass A and its angular position b) the position of planes A and D. (12)

b)What do you understand by primary and secondary balancing of reciprocating masses ?. Explain partial balancing of reciprocating engine. (8)

Mech/AUTO/Sem VI/CBGS/ 2/12/15 Nov-Dec 15

Mech / AUTO Sub :- MV

QP Code : 6339

(3 Hours) [Total Marks ; 80]

N.B. 1) Question No. 1 is **compulsory**

2) Answer any **Three** questions from remaining **Five**

3) Assume sutaible data wherever required, justify the same

4) Answer to questions showed be grouped and written together.

Qu. 1 a) Find the natural frequency of a half solid cylinder of a mass 'm' and radius 'r' when it is displaced from the equilibrium position and released as shown in Fig. 1 (10)

b) Using Newton's second law of motion find the natural frequency of vibration of a spring –mass system arranged on an inclined plane as shown in Fig. 2 (10)

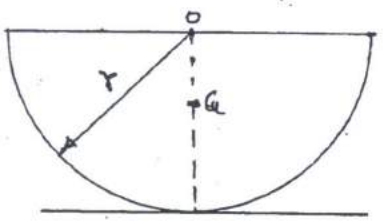


Fig 1

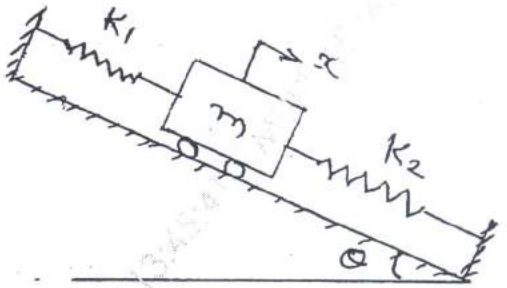


Fig 2

Qu. 2 a) A 35 kg block is attached to a spring of stiffness 1.7×10^5 N/m. Coefficient of friction between the block and surface on which it slides is 0.11. The block is displaced 10 mm from equilibrium and released i) what is amplitude of motion at the end of first cycle? ii) How many cycles of motion occurs? (09)

b) A rotor of mass moment of inertia 2.5 Kg. m^2 is to be attached at the end of a 60 cm circular steel shaft ($G = 80 \times 10^9$ N/m^2). What is the range of shaft diameters such that the torsional frequency of the system is between 100 and 200 Hz. (08)

c) Explain the terms i) Peak Amplitude ii) Peak Frequency (03)

TURN OVER

Qu. 3 a) All the natural frequency of the system shown in Fig. 3, exist below 2 rad/sec. Find all the natural frequencies and draw mode shapes. m= 1kg, K= 1N/m (14)

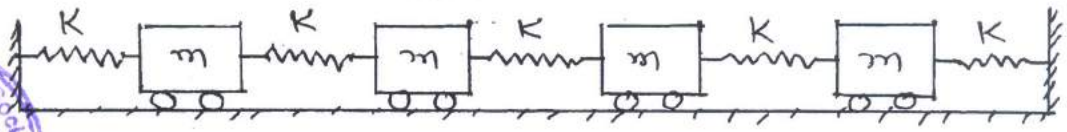


Fig 3

b) How is the critical speed of the shaft determined. (06)

Qu. 4 a) How do you find the response of a viscously damped system under rotating unbalanced? (10)

b) A machine of mass 50 Kg operates at 1200 rpm . Find the maximum stiffness of an isolator that provides 75 percent isolation. Assume that damping ratio of the isolator is 7 percent. (10)

Qu. 5 a) A spring mass damper system, having an undamped natural frequency of 100 Hz and a damping constant of 20 N-s/m, is used as an accelometer to measure the vibration of a machine operating at a speed of 3000 rpm. If the actual acceleration is 10 m/s^2 and the recorded acceleration is 9 m/s^2 , find the mass and the spring constant of accelerometer. (10)

b) Use Lagrange's equation to derive the differential equations governing the motion of the system, using x_1 and x_2 as generalised coordinates. Assume the disc of mass m and radius r rolls without slip. (10)

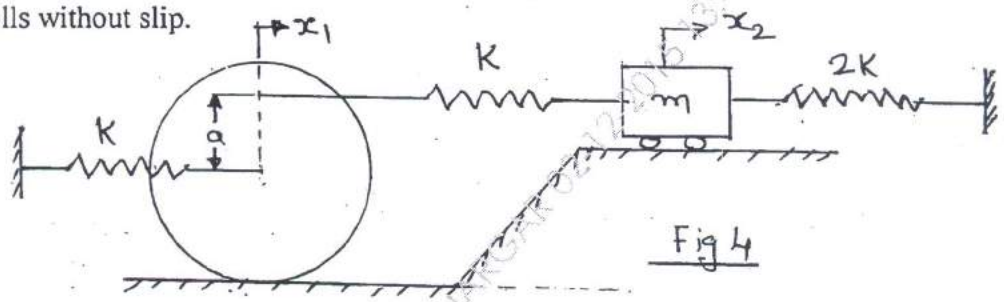


Fig 4

Qu. 6 a) Four pulleys are equally spaced along a shaft and each has an out of balance mass at the same radius. The out of balance mass in second pulley is 3 Kg and third and fourth out of balance masses are at 72^0 and 220^0 to it. Determine the masses in the first , third and fourth pulleys and also the angle of the first mass relative to second. If the complete balance is to be obtained. (10)

b) Explain vibration based condition monitoring and fault diagnosis in rotating machine. (05)

c) Explain the balancing of V- engine. (05)

MECH / T & FPE / Sem VI (Rev)
AUTO
Te sem-VI (CBGS) NOV-DEC-15 08/12/15
Sub:- T & FPE

Mech
AUTO

Q.P. Code : 6381

(3 Hours) **[Total Marks : 80**

Question no.1 is compulsory.

Attempt any **THREE** from question no. 2 to 6.

Use of steam table is permitted.

Q.1 Solve any **Five** 20

a) Give differences between ram jet and pulse jet.

b) Explain the function of draft tube with neat diagram.

c) What are the limitations of pelton wheel turbine?

d) Define the following terms for a turbine:
(i) Stage efficiency
(ii) Blade efficiency

e) Differentiate between high pressure and low pressure boilers.

f) Make a list of any five boiler mountings and write down their functions.

Q.2 a) Derive the expression for the force exerted by a jet of water of velocity V and area A on a plate when: 08
(i) Plate is vertical
(ii) Plate is inclined at θ

b) The following data was recorded during a test performed on a boiler, economizer and a superheater. 12
Steam generated = 5000 kg/hr at 14 bar pressure ; Mass of coal burnt = 660 kg/hr ; Calorific value of coal = 29500 kJ/kg ; Temperature of feed water at entry and exit of economizer = 30°C and 130°C resp.; Temperature of steam leaving the superheater = 320°C ; Dryness fraction of steam leaving the boiler = 0.95 ; C_p (superheated steam) = 2.3 kJ/kg K ; C_p (water) = 4.18 kJ/kg K. Calculate
(i) Factor of evaporation
(ii) Overall efficiency of the plant
(iii) The percentage of available heat utilized in the boiler, economizer and superheater. Hence determine percentage of heat lost.

Q.3 a) With neat sketch explain the working of closed cycle gas turbine plant and discuss the advantages of closed cycle over open cycle gas turbine plant. 08

b) The following particulars refer to a single row impulse turbine: 08
Mean diameter of blade ring = 2.5 m ; speed = 3000 rpm ; nozzle angel = 20° ; ratio of blade velocity to steam velocity = 0.4 ; blade friction factor = 0.8 ; blade angle at exit = 3° less than that at inlet ; steam flow = 36,000 kg/hr.

[TURN OVER

Draw velocity diagram for moving blade and estimate (a) power developed ; (b) blade efficiency ; and (c) steam consumption in kg/kW hr.

c) With neat sketch explain the principle of operation of Turbofan engine 04

Q4) a) Derive the expression for Maximum discharge through steam nozzle. 06

b) A gas turbine unit receives air at 100 kPa and 300 K and compresses it adiabatically to 620 kPa with efficiency of the compressor 88 %. The fuel has heating value of 44180 kJ/kg and the fuel/air ratio is 0.017 kg fuel/kg air. The turbine internal efficiency is 90 %. Calculate the compressor work, turbine work and thermal efficiency. 10

c) Draw general layout of a reaction turbine plant and explain various heads on turbine. 04

Q5) a) Explain the working of any one type of high pressure boiler with the help of neat sketch. 08

b) A single jet pelton turbine operates a 10,000 kW generator. The generator efficiency is 92%, turbine efficiency is 86%, turbine head is 350 m, coefficient of nozzle velocity is 0.98, speed ratio is 0.46 and jet ratio is approximately 12. Find the size of jet, mean diameter of runner, synchronous speed, specific speed of turbine and bucket dimensions. 12

Q6) a) Explain turbojet engine with neat diagram. What are the advantages and disadvantages of turbojet engine? 10

b) The nozzles of an impulse turbine are supplied with superheated steam at 10 bar, 250°C. The steam leaves the nozzles at a pressure of 1.0 bar. The steam consumption for the turbine is 16 kg/kW hr when it develops 225 kW. If the throat diameter is 0.8 cm, determine the number of nozzles required and exit diameter of the nozzle, assuming that the 10% of the total heat drop is lost in overcoming the friction in the divergent portion only. Neglect the velocity of approach. 10

TE SEM VI CBGS NOV-DEC-15

Auto -OR 14/12/15

AUTO Sub:- OR **Q.P. Code : 6441**

(REVISED COURSE)

(3 Hours) **[Total Marks : 80**

N.B. (1) Question number **1** is compulsory and answer any **three** from the remaining.

(2) Graph paper should be given on demand.

(3) Digits in the right indicate full marks.

Q.1. (a) Write the dual of following LPP

Minimize,

$Z = 2X_1 + 9X_2$

Subject to,

$3X_1 + X_2 \leq 4$; $X_1 + 4X_2 \geq 5$; $X_1 + X_2 = 6$; (10)

$X_1, X_2 \geq 0$,

(b) Solve the following game. Find strategies and value of game (10)

Player A	Player B			
	A	B	C	D
P	3	2	4	0
Q	3	4	2	4
R	4	2	4	0
S	0	4	0	8

Q.2. (a) How will you understand from simplex table that solution is Unbounded, Infeasible, Degenerate and Infinite number of solution. (06)

(b) What are the limitations of Game Theory. (04)

(c) Solve the following LPP

Maximize,

$Z = 15X_1 + 17X_2 + 10X_3$

Subject to,

$X_1 + X_2 + 4X_3 \leq 2000$; $2X_1 + X_2 + X_3 \leq 3600$;

$X_1 + 2X_2 + 2X_3 \leq 2400$; X_1, X_2 & $X_3 \geq 0$ (10)

[TURN OVER

Q. 3. (a) Solve the following transportation problem to minimize the total transportation cost (10)

Market

Plant	M1	M2	M3	Supply
P1	8	4	10	10
P2	9	7	9	80
P3	6	5	8	15
Demand	75	20	50	

(b) Assign four jobs to four workers on one to one basis to minimize total cost. (10)

Jobs

Worker	A	B	C	D
P	45	40	51	67
Q	57	42	63	55
R	49	52	48	64
S	41	45	60	55

Q.4. (a) The arrival rate of customers at a single window booking counter of a two wheeler agency follows Poisson distribution and the service time follows exponential distribution. The arrival rate and service rate are 25 customers per hour and 35 customers per hour respectively. Find the following.

(i) Utilization of a booking clerk. (10)

(ii) Average number of waiting customers in the queue.

(iii) Average number of waiting customers in the system.

(iv) Average waiting time per customer in the queue.

(v) Average waiting time per customer in the system.

(b) What is Monte Carlo Simulation Technique. How it will be applicable in solving Queuing problem. (10)

Q.5. (a) The time durations and different activities of a project are given in following table (12)

Activity	1-2	1-3	2-6	3-4	3-5	4-6	5-6	5-7	6-7
Duration (Days)	4	6	8	7	4	6	5	19	10

(i) Draw the network diagram and find the critical path.
(ii) Obtain early and late start time of all activities
(iii) Find Total and Free float of all activities.

[TURN OVER

(b) An item is produced at the rate of 50 items / day. The demand occurs at the rate of 25 items / day. If set up cost is Rs. 100 per set up and holding cost is Rs. 0.01 per unit of item per day. Assuming shortages are not permitted. Find

(i) EOQ (ii) Cycle time (iii) Total minimum cost (iv) Maximum Inventory (08)

Q.6. (a) Solve the following LPP by Graphical method **(08)**

Maximize,

$$Z = 8X_1 + 16X_2$$

Subject to,

$$X_1 + X_2 \leq 200 ; 3X_1 + 6X_2 \leq 900 ; \quad X_2 \leq 125 ;$$ (08)

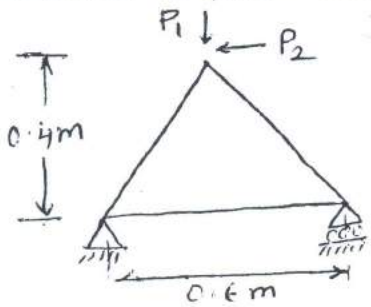
$$X_1, X_2 \geq 0 ,$$

(b) What is safety stock, lead time & Reorder level in Inventory? **(06)**

(c) What are the different approaches for decisions under uncertainty? **(06)**

4. a. Explain Lumped and consistent mass matrix. 6

b. Analysis the plane truss for nodal displacement, element stresses and srtains. Take , $P_1 = 5$ KN, $P_2 = 2$ KN, $E = 180$ Gpa, $A = 6$ cm_2 for all elements. 14

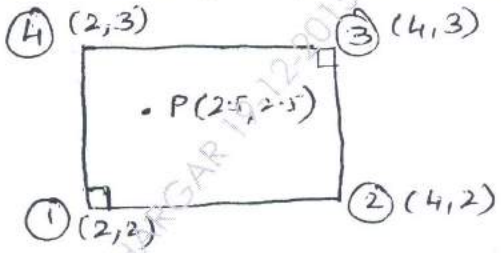


5. a. Solve following differential equation $\frac{d^2y}{dx^2} - 10x^2 = 5; \quad 0 \le x \le 1$ 12

BCs: y0) = y(1) = 0. Using Rayleigh-Ritz method, mapped over entire domain using one parameter method

b. Find the shape function for two dimensional eight noded element. 8

6. a. Coordinates of nodes of a quadrilateral element are as shown in the figure below. Temperature distribution at each node is computed as $T_1 = 100^0$ C, $T_2 = 60^0$ C, $T_3 = 50^0$ C and $T_4 = 90^0$ C. compute temperature at point P (2.5, 2.5). 10



b. What are the h and p versions of finite element method? 7

c. Convergence requirement. 3

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