Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

RE SEM EXAM

Subject code MTMD114 **May 2018**

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

CLASS/SEM :_M.Tech Mech, Machine Design , SEM I **Subject : RE DOE**

- Question 1 is compulsory
- Attempt any Four questions out of Five questions.
- Figures to the right indicate full marks
- Assume Suitable data wherever required.

Sr.No.	Questions	Marks	CO	Module
Q1A	What is the measure of central tendency and measure of dispersion. Differentiate between measure of central tendency and measure of dispersion.	10	CO1	M2
Q1B	Write selection criteria for hypothesis tests. Differentiate between ANNOVA and T Test	10	CO1	M1
Q2A	Carry out a Process FMEA for the process of Design of new racing cycle	10	CO1	M1
Q2B	Short notes on Fault Tree Analysis and Success Tree Analysis ?	10	CO3, CO4	M6
Q3A	Explain the Network evaluation techniques in detail.	10	CO3	M6
Q3B	Explain the following with respect to hypothesis testing. Level Of significance, Test Statistic, Type one and Type Two error, procedure for Hypothesis test, Two Tailed test	10	CO1	M1
Q4A	Write a short note on Application of MTTF, MTBF, MTTR for reliability assessment.	10	CO3	M7
Q4B	Differentiate the Linear and non linear regression analysis with suitable application.	10	CO3, CO4	M3
Q5A	Illustrate the ANNOVA test with suitable example.	10	CO3	M2
Q5B	Differentiate between F test and T Test . Give the suitable examples.	10	CO1, CO4	M2
Q6A	Illustrate with suitable examples Single and multi variate regression analysis,	10	CO1	M3
Q6B	Illustrate with suitable examples Probability and Distributions for reliability	10	CO3	M5
Q7A	Explain Life History Curve / Bath tub Curve Comment on Debugging phase, Chance failure phase, wear out phase	10	CO3	M7
Q7B	Write a short note on Planning of experiments and Full factorial DOE	10	CO2, CO4	M1, M4

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Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
RE EXAMINATION JUN 2018

Max. Marks: 100
Class: M.Tech(Mechanical) with Machine Design Semester: I
Name of the Course: TRIBOLOGY

Q. P. Code:
Duration: 3 Hour
Program: M.Tech
Course Code : MTMD111

Instructions:
1. Answer any five questions including Q.No.1 which is compulsory.
2. Assume suitable additional data if necessary and state the same.
3.Use of (1)Machine Design Data Book by V B Bhandari and
(2) List of Formulae and Derivations permitted.

Question No		Max Marks	C O Number	Module No
Q1	Answer any four:- A) Derive an expression for the torque carrying capacity of Centrifugal Clutch. B) Parameters that to be selected in designing journal bearings C) Determine the viscosity of lubricant in centi-poise and centi-stokes having viscosity of 160 SUS and specific gravity 0.85. D) State the factors which lead to considerable variation in the wear rate between rubbing surfaces. E) State the advantages of band brakes. F) Since lubricants are selected to reduce friction and suppress tool wear, what are the considerations in selecting the lubricant for metal working?	20 (5each)	1,2,3	1,2,4,5
Q2.	A) A transmission shaft ,transmitting 8 kW of power at 400 rpm from a bevel G_1 to a helical gear G_2 and mounted on two taper roller bearings B_1 and B_2 as shown in the Fig.1.The gear tooth forces on the helical gear act at a pitch circle radius of 55mm, while those on the bevel gear can be assumed to act at the large end of the tooth at a radius of 50mm.The diameter of the journal at the bearings B_1 and B_2 is 40 mm. The load factor is 1.2 and the expected life for 90% of bearings is 10 000 h. Bearings B_1 and B_2 are identical. The thrust force due to bevel and	12	1	6

	helical gears is taken by bearing B_2. Select suitable taper roller bearings for this application. B) A single plate clutch consists of one pair of contacting surfaces. Because of space limitation, the outer diameter of the friction disc is fixed as D. The permissible intensity of pressure is p_a and the coefficient of friction is μ. Assuming uniform wear theory , plot the variation of the torque transmitting capacity against the ratio of diameters(d/D). Show that the torque transmitting capacity of the clutch is maximized, when (d/D) is equal to 0.58(approx).	08	4	7
Q3	A) The following data is given for the hydrostatic step bearing of a vertical turbo-generator. Thrust load = 450kN ; Shaft diameter = 400mm ;Recess diameter = 250mm ;Shaft speed = 750 rpm ;Viscosity of lubricant = 30cP Draw the effect of film thickness on energy losses in the graph sheet and indicate the optimum film thickness for minimum power loss. Cross check the answer with analytical calculation. B) A 360 ^{0} journal bearing has the following features: a) Ratio of bearing length to journal diameter = 0.5 ; b) Bearing length =25 mm ; c)Radial load = 5kN ; d) Journal speed = 1000rpm ;e) Radial clearance = 0.05mm ; f) Oil viscosity = 30cP Find: i) Friction coefficient : ii) Oil flow : iii) Eccentricity	12 08	2 3	5 3
Q4	A) Explain the application of gas bearings. State merits and demerits of gas bearing. B) A circular plate of diameter 200mm is approaching a plane at a velocity of 12cm/s at the instant, oil film thickness is 0.30 mm. The Viscosity of the oil is 0.035Pa.s.Evaluate for squeeze film action i) The maximum pressure, ii)Average pressure, iii) Load carrying capacity iv)Time required to squeeze the oil film from 0.25 mm to 0.005mm.	08 12	2 1,4	5 4,5
Q5	A) A hydrodynamic plane slider bearing with fixed shoe is operating under the following conditions. Length of bearing = 300 mm; Length to width ratio =2; Sum of surface roughness for fixed shoe and moving plate =	12	1,3	3,4

	0.006mm; Minimum oil film thickness = 5(sum of surface roughness); Viscosity of oil =30M Pa-s; Sliding velocity = 145 m/min. Neglect side leakage. Calculate:- i) Maximum load carrying capacity ; ii) Maximum pressure ; iii) Optimum oil-film thickness ; iv) Position of point of application of load ; v) Power lost in friction. B) The cylinder of a four stroke diesel engine has the following specifications: Brake power =3.75kW Speed =1000 rpm Indicated mean effective pressure =0.4MPa Mechanical efficiency =80% Make suitable assumptions and calculate: i) Bore and length of cylinder liner. ii) Thickness of the cylinder liner.	08	4	7
Q6	Explain the following:- A) Hydrostatic squeeze lubrication. B) Properties of lubricants. C) Hydrodynamic Lubrication. D)The concept and scope of Surface Engineering	20 (5each)	1,3,4	4,6,7
Q7	A) Explain the various means of wear measurements. B) The following data is given for a hydrostatic thrust bearing: Thrust load =500 kN ; Shaft speed = 700 rpm ; Shaft diameter = 450mm; Recess diameter = 250mm; Film thickness = 0.15mm; Viscosity of lubricant = 29.3 cP. Calculate:- i) Supply pressure ; ii) Flow requirement in l /min ; iii) Power loss in pumping; iv) Power loss in friction.	08 12	4 3	6,7 5

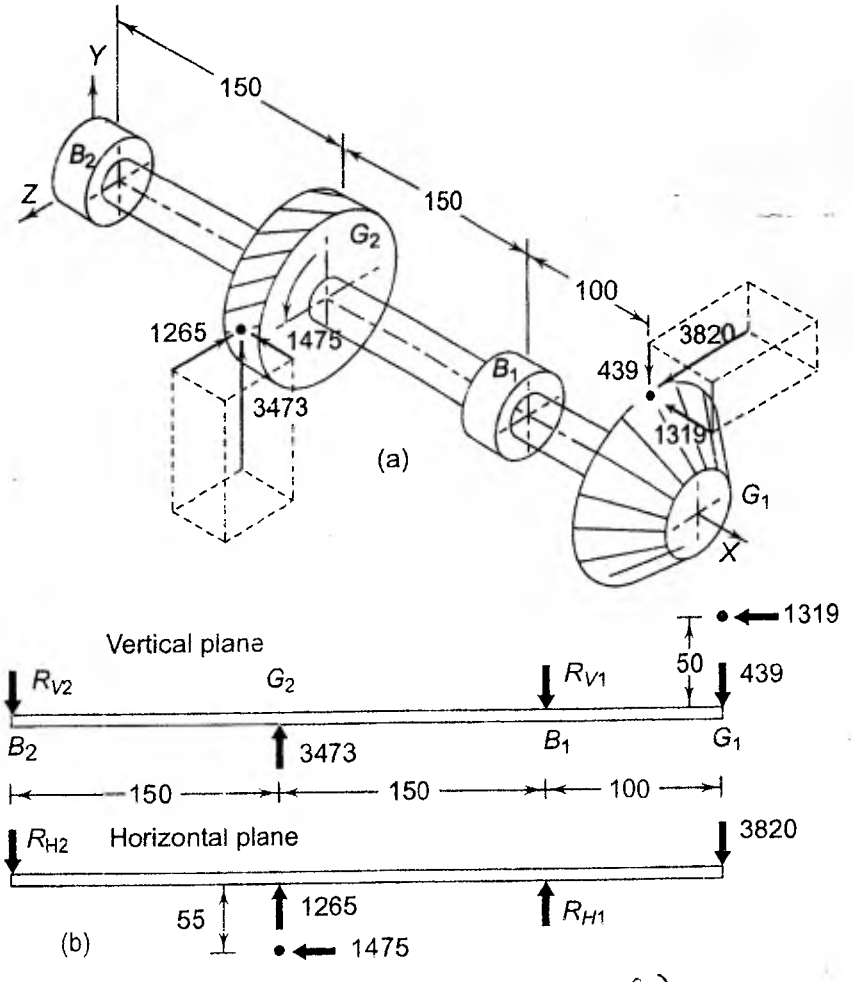
Y
150
B2
Z
150
G2
100
1265
1475
3820
439
B1
3473
1319
(a)
G1
X
1319
Vertical plane
50
RV2
G2
RV1
439
B2
3473
B1
G1
150
150
100
RH2
Horizontal plane
3820
55
1265
RH1
(b)
1475

Fig. 1: Q. 2 (A)

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ReExam

JUNE 2018

Max. Marks:100 Duration: 3hrs

Class: M.Tech. M/C Design Semester I Program: Mechanical Engg.

Name of the Course: CAD Course Code : MTMD103

Instructions:

1. Q.1 is Compulsory
2. Solve any four questions out of remaining six
3. Figures to the right indicates full marks
4. Support neat sketches wherever necessary
5. Assume suitable data wherever necessary

Question no.	Questions	Maxi. marks	Course outcome no
Q.1(a)	Explain the characteristics of Bezier Curve & B-Spline curve with neat sketches?	10	01
Q.1(b)	Explain the various Geometric Modeling Techniques with sketches	10	01
Q.2(a)	A Triangle XYZ has its vertices at X (0, 0) Y (4, 0) & R (2, 3) It is to be translated by 4 units in X direction & 2 units in Y direction, and then it is to be rotated in anticlockwise direction about the new position of point Z through 90 degree. Find the new position of the triangle?	10	02
Q.2(b)	Explain Knowledge Based Engineering (KBE) with neat figures?	10	01
Q.3(a)	Develop a C++ program in terms of homogeneous coordinates for 2D transformations on object like line. Insert necessary comments wherever necessary. 1) Translation 2) Scaling 3) Rotation 4) Reflection	20	04
Q.4(a)	Explain Artificial Intelligence in Design with neat figures?	06	01
Q.4(b)	What is Feature Recognition? Explain any one method of Feature recognition with neat sketches?	10	01
Q.4(c)	What are the steps involved in DDA Algorithm	04	03

Q.5(a)	Obtain transformation matrix for rotation about the line joining the points (0,0,0) and (1,1,1) with the angle of rotation 45 degree in counter clockwise sense.	10	02
Q.5(b)	Explain the following with diagrams • Cohen Sutherland Algorithm • Gouraud Shading Algorithm	10	01
Q.6(a)	A Cubic Spline is represented by the following equation $P(U)= C_3U^3 + C_2U^2 + C_1U + C0 \quad 0 \leq u \leq 1$ where C_3, C_2, C_1, C_0 are the polynomial Coefficients. Determine the four control points of an identical Bezier curve in terms of these polynomial coefficients.	06	02
Q.6(b)	How Reverse Engineering technology is useful for the Indian industries, explain? Also explain the data capture techniques used in RE along with neat sketches	08	01
Q.6(c)	Find the normalization transformation window to viewpoint, with window lower left corner at (1,1) and upper right corner at (3,5) onto a viewpoint with lower left corner at (0.0) and upper right corner at (1/2,1/2).	06	03
Q.7(a)	Write Short notes on (Any Two) a) Design for Assembly (DFA) b) Role of Modeling & Communication c) Engineering Data Management System (EDMS) d) Virtual Reality (VR)	10	01
Q.7(b)	Write Short notes on (Any Two) a) Structured Query Language (SQL) b) CAD-VR Integration c) CAD-PLM integration d) Concurrent Engineering	10	01

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Re-Exam_JUN 2018

Program: M. Tech (Machine Design) Date: Jun 2018

Course code/course Name/sem: MTMD101/ Stress Analysis/ I

Maximum Marks: 100 Time: 3hrs

Note:

- **Question 7 is compulsory, solve any four of remaining six.**
- Assume suitable data if necessary
- Answer to the sub-questions should be grouped together.

Q.no.		Max. Marks	Module	COs
1	a) The state of stress (in MPa) at a point relative to *xyz* coordinate system is given by stress matrix as shown. $\begin{Bmatrix} 9 & 6 & 3 \\ 6 & 5 & 2 \\ 3 & 2 & 4 \end{Bmatrix}$ Determine the principal stresses and principal directions. b) The principal stresses on a plane are: $\sigma_1 = 9$, $\sigma_2 = 5$, $\sigma_3 = 4$ kPa. Determine normal and shearing stresses on a plane whose direction cosine's are , $1/\sqrt{3}$, $1/\sqrt{3}$, $1/\sqrt{3}$ by using three dimensional mohr's circle.	15 05	1	2
2	a) Derive equilibrium equations in polar co-ordinates. b) Discuss the graphical construction for the determination of normal and shear stresses.	10 10	2	1,4
3	Prove the following relationship: $9\tau^2_{oct} = 2I^2_1 - 6I_2$; where I_1, I_2 are stress invarients.	20	1	2
4	a) If the co-ordinate system given in Q.no. 1 a). is rotated about z-axis in anti-clockwise direction through 30^0, determine the new stress components. b) Derive the expression for radial and hoop stresses for a solid disc subjected to angular rotation.	10 10	1,5	2
5	a) Derive the expression for torsion (T) in elliptical bar. (Use Laplace operator ψ=Axy) b) Given the following displacement field: $u_x = 2x^1y + y^1z$; $u_y = x^2z + 3y$; $u_z = xy^2z^2$; i. What is the deformation position of a point *P* initially at (1,-2,3)? c) What is the change in distance between two points after deformation originally at P(1,2,3) and Q(2,-1,-2)?	10 10	5,2	2,3

6	a) State the principle of photo-elastic stress analysis method. List the advantages of this method. Sketch the experimental set-up of this method and name the components. b) What is strain rosette? What are the different types of strain gauge rosette? Discuss in detail any one type.	10 10	6	4
7	a) List the characteristics of the Ideal strain gauge. b) Discuss strain sensitivity or gauge factor c) Derive the stress equilibrium equation from the first principle. (2D) d) Airy's stress function. e) Plane stress and strain problems of stress analysis.	20	7	3

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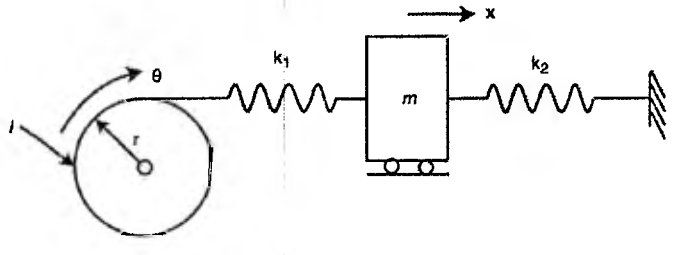
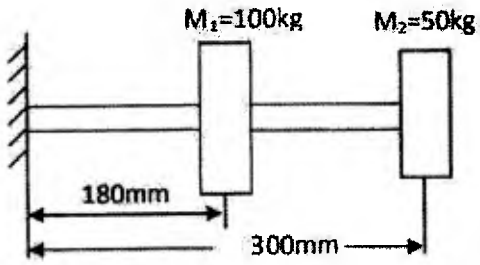
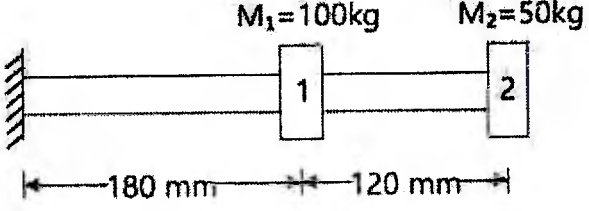
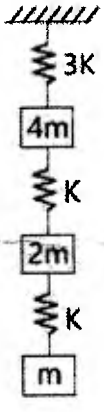
RE-EXAM
June 2018

Date: 04 June 2018
Duration: 3 Hours
Maximum Marks: 100
Semester: I

Program: M.Tech Machine Design
Course code: MTMD102
Name of the Course: Machine Dynamics and Advance Vibration

Instructions:
Question no. 1 is compulsory.
Attempt any four questions out of six.
Assume Suitable data if necessary.
Draw Diagrams Wherever Necessary.
Use of Scientific calculator is allowed.

Q. No.		Max. Mark	CO No.	Module No.
Q1	(a) Explain the nonlinear vibration. How is it differ from linear vibration? Explain any two nonlinear vibration systems.	10	04	07
	(b)Find out the derivative of a vector fixed in a moving reference.	10	02	03
Q2	(a) Briefly explain the steps involved in vibration analysis.	06	03	05
	(b) Derive the wave equation of a transverse vibration of a string and obtain its solution.	08	02	04
	(c) Draw a plot of Magnification Factor versus Frequency Ratio curves for various Damping Factor values. Write the expression consisting of the three parameters. State the conclusion that may be drawn from the plot.	06	02	03
Q3	(a) Using Lagrange's method, derive the equations of motion for the following system. 	10	01	02
	(b) Find the lowest natural frequency of vibration of system shown in Fig. by Rayleigh's method. Assume E= 1.96 * 10 ^{11} N / m^2, I=4 *10^{-7} m^4.	10	02	04

				
Q4	(a) (a) Plot the variations of natural frequency and the time period with static deflection of an undamped system using MATLAB. Take the range of δ_{st} 0 to 0.5	10	03	04
	(b) State and explain the Chasles theorem for describing the general motion of a rigid body.	10	01	01
Q5	(a) State the various types of vibrational machine maintenance techniques. Explain in brief.	10	02	04
	(b) Find fundamental frequency of a transverse vibration for the system shown in figure by dunkerley's method. 	10	02	04
Q6	Find the fundamental natural frequency for the system shown in figure using Matrix Iteration method. 	20	02	04
Q7	Write short note on any <u>four</u>:			
	1. Jeffcott rotor model	05	02	05
	2. Eigen value for MDOF vibration system.	05	02	04
	3. Experimental Modal Analysis.	05	03	07
	4. Instantaneous center of Zero velocity	05	01	02
	5. Influence coefficient method	05	02	03

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RE EXAMINATION

June2018

Q. P. Code:

Max. Marks: 100 Duration: 3 Hour

Class: M. Tech (Mechanical) with Machine Design Semester: I I Program: M.Tech

Name of the Course: DESIGN OF POWER TRANSMISSION SYSTEMS Course Code :MTMD212

Instructions:

1. Answer any five questions including Q. No.1 which is compulsory.
2. Assume suitable additional data if necessary and state the same.
3. Use of Design Data Book by Bhandari is permitted.

Q. No		Max Marks	CO	Mod. No
Q 1	A) A,B and C are three double acting pneumatic cylinders. For an assembly operation the three cylinders will be having sequence of motion as given herein. (AB) + , C + / Delay, (BC)-/ Delay, A -. Draw pneumatic circuit using CASCADE or SHIFT REGISTER METHOD. Auxiliary condition is single cycle or continuous cycle. List the parts used.	12	1	3
	B) A hydraulic cylinder has a bore of 200 mm and a piston rod diameter of 140mm.For extend speed of 5m/min, calculate: i) Supply flow rate ; ii) Flow rate from the annulus side on extend ; iii) Retract speed; iv)Flow rate from the full bore end on retract.	08	3	2
Q2	A)A pair of spur gears with 20^0 full depth involute teeth consists of a 24T pinion meshing with a 48T gear. The module is 4mm while the face width is 45mm.The material for pinion and gear is alloy steel with an ultimate tensile strength 0f 720 N /mm^2.The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.8.Assume that the velocity factor accounts for the dynamic load and factor of safety is 1.5. Determine the rated power that the gears can transmit.	10	3	1
	B)A herringbone speed reducer consists of a 28T pinion driving a 84T gear. The gears have a normal module of 2mm. The pressure angle is 20^0 and the helix angle is 25^0. The pinion receives 90kW through its shafts and rotates at 3000rpm.The face width of each half is 40mm.The gears are made of alloy steels (S_{ut} = 1200 N /mm^2) and heat treated to a surface hardness of 400 BHN. The service factor is 1.25. Determine the factor of safety against bending failure and against pitting failure.	10	3	2

Q3	A) A pair of worm and worm wheel is designated as : 1/40/10/8. The input speed of the worm is 1200 rpm. The worm wheel is made of centrifugally cast phosphor bronze and the worm is made of case hardened carbon steel 14C6. Determine the power transmitting capacity based on beam strength and wear strength. B)A pair of straight bevel gears is made of Grey cast iron FG200(E= 114000N/ mm^2).The surface endurance strength is 90 N/mm^2.The number of teeth on the pinion and gear are 30T and 40T respectively. The module and face width are 6mm and 50 mm respectively. The pressure angle is 20^0. Determine the beam and wear strength of the tooth. Assume surface hardness of the gear as 250 BHN.	10 10	3 3	2 2
Q4	A)The following data is given for an open type V belt drive: a)Diameter of driving pulley =200mm; b)Diameter of driven pulley= 400mm; c)Center Distance = 1.25m;d)Groove angle =40^0;e) mass of belt =0.25 kg /m; f) Maximum permissible tension=800 N; g) Coefficient of friction =0.25. i) Plot a graph of maximum tension and power transmitted against the belt velocity. ii) Calculate the maximum power transmitted by the belt and the corresponding belt velocity. Neglect power losses. B)A simple chain 12 B is used to transmit power from a 1000rpm electric motor to a line shaft running at 400rpm.The number of teeth on the driving sprocket wheel is 21.The operation is smooth without any shocks. Calculate:- i) Rated power for which the chain drive can be recommended. ii) Tension in the chain for this rated power. iii) Factor of safety for the chain based on the breaking load	12 08	4 4	5 5
Q5	A) A single row deep groove ball bearing has a dynamic load capacity of 41000N and operates on the following work cycle. i) Radial load of 6000N at 500 rpm for 30% of the time. ii) Radial load of 12000N at 750 rpm for 50% of the time. iii) Radial load of 6000N at 400 rpm for the remaining20% of the time. Calculate the expected life of the bearing in hours. B) The following data is given for the hydrostatic step bearing of a vertical turbo generator. Thrust load= 500kN; Shaft Diameter = 500mm; Recess Diameter=250mm; Shaft speed= 800rpm; Viscosity of lubricant=30cP. Draw a graph showing the effect of film thickness on energy loss. Calculate the optimum film thickness for minimum power loss.	08 12	3 2	7 3

Q6	A) A cone clutch is used to connect an electric motor running at 1440 rpm with a machine which is stationary. The machine is equivalent to a rotor of 160 Kg mass and radius of gyration as 275mm.The machine has to be brought to the full speed of 1440 rpm from stationary condition in 50s. The semi cone angle is 12.5^0. The mean radius of the clutch is twice the face width. The coefficient of friction is 0.25 and normal pressure between contacting surfaces should not exceed $0.1\ N/mm^2$. Assuming uniform wear criterion calculate:- i) The inner and outer diameters. ii) The face width of friction lining. iii) The force required to engage the clutch. iv) The amount of heat generated during each engagement of the clutch. B) List the advantages and disadvantages of band brakes. State the application of band brakes. What are the thermal considerations to be taken note in designing brakes.	12 08	3 4	3 7
Q7	Write short notes on (any four):- A) Application of accumulators in hydraulic circuits. B) Different types of prime movers and their characteristics. C) Design - to – assemble in product design. D) Steps in power shaft design. E) Design procedure for flexible coupling.	20 (each5 marks)	 4 2 1 3 4	 4 1 1 6 2

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REEXAMINATION June 2018

Q. P. Code:
Max. Marks: 100 **Duration: 3 Hour**
Class: M.Tech(Mechanical) with Machine Design Semester: II **Program:**
Name of the Course: Advanced Finite Element Methods **Course Code : MTMD202**

Instructions:
1. Answer any five questions including Q.No.1 which is compulsory.
2. Assume suitable additional data if necessary and state the same.

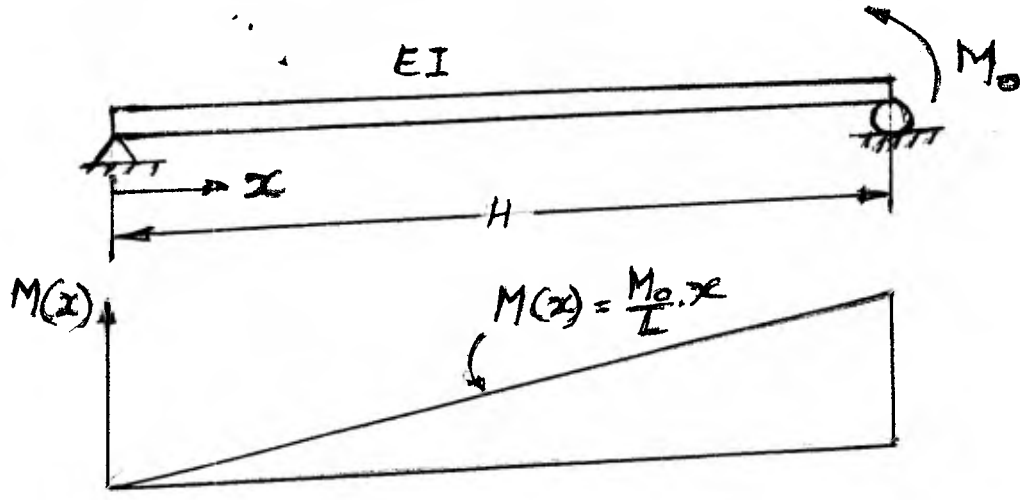
Q. No		Max Marks	C.O No	Mod. No
Q1	A) With suitable own example explain the steps involved in details for conducting finite element analysis for the following case. **Steady state thermal analysis OR Steady state structural analysis** B) For the cantilever beam subjected to the concentrated free end load P and uniformly distributed load W acting over the whole beam length as shown in Fig, 1, determine the free end displacements and the nodal forces.	10 10	4 2	7 5
Q2	A) Obtain an approximate displacement equation for the simply supported beam shown in Fig.2 using the trial solution $y(x) = A \sin \pi x / H$. Governing differential equation is $E I d^2y/dx^2 - M_0 x/H = 0$. Integral equation is $\Pi = \int_0^H \{E I/2 (dy/dx)^2 + M_0 [x/H] y\} dx$. Also evaluate A by requiring the residual to vanish at X = 0.577H. B) The differential equation $D^{(e)} d^2\phi/dx^2 = 0$ is applicable to each section of the composite wall shown in Fig.3 , where $D^{(e)}$ is the thermal conductivity. Calculate the nodal values within the wall and evaluate the heat flow though each material. The heat flow is given by, $q = - D^{(e)} d\phi/dx$ .A unit of surface area is assumed. Use Residual Integration Method for finding nodal values.	10 10	1 2	1 2
Q3	A) The nodal values for a rectangular element are as given below:- $X_i = 0.31$; $Y_i = 0.18$; $X_j = 0.38$; $Y_m = 0.25$; $\Phi_i = 115$; $\Phi_j = 85$; $\Phi_k = 76$; $\Phi_m = 105$. At the point B, x = 0.35 and y = 0.22. Evaluate $\partial\phi/\partial x$ and $\partial\phi/\partial y$ at point B. B) Derive the element matrices $[K^{(e)}]$ and $\{f^{(e)}\}$ for the two dimensional triangular element with i , j and k nodes.	10 10	3 2	4 2

Q4	A) Determine the temperature distribution in the circular fin shown in Fig.4.Include the convection heat loss from the end of the fin. Assume K = 2 W / cm.^{0} c; h = 0.2 W /cm^2.^{0} c and ϕ_f =15 ^{0}c.	10	3	4
	B) Derive the expressions for element stiffness matrix and force vector for the axial force member by differentiating the strain energy equation.	10	4	5
Q5	A) For the plane truss shown in Fig.5 determine the displacements and reactions. All elements have E =210 GPa, A= 7 ×10^{-4} meter^2 for element 1 & 2, A = 7 √ 2 ×10^{-4} meter^2 for element 3.	12	4	5
	B) Derive from integral equation associated with two dimensional field equations for the element matrices to show that $[K^{(e)}] = [K_D{}^{(e)}] + [K_G{}^{(e)}]$.	08	3	4
Q6	A) Determine the nodal displacements and the global and element forces for the beam shown in Fig.6.The beam is fixed at node 1, has a roller support at node 2 and has an elastic spring support at node 3. Assume E =210 GPa and I= 2×10^{-4} meter^4 throughout the beam and Spring constant ,K_s =250 kN/meter.	15	2	5
	B) Derive element stiffness matrix and element force vector in a continuous three dimensional elastic system	05	4	6
Q7	The rigid plain frame shown in the Fig.7 is fixed at nodes 1 and 3 and subjected to uniformly distributed load of 12kN /meter applied downward over element 2.The global co ordinate axes have been established at node 1. E= 210GPa, A= 0.065 m^2 and I =4×10^{-4} meter^4. Find the nodal displacements and the nodal forces.	20	4	5

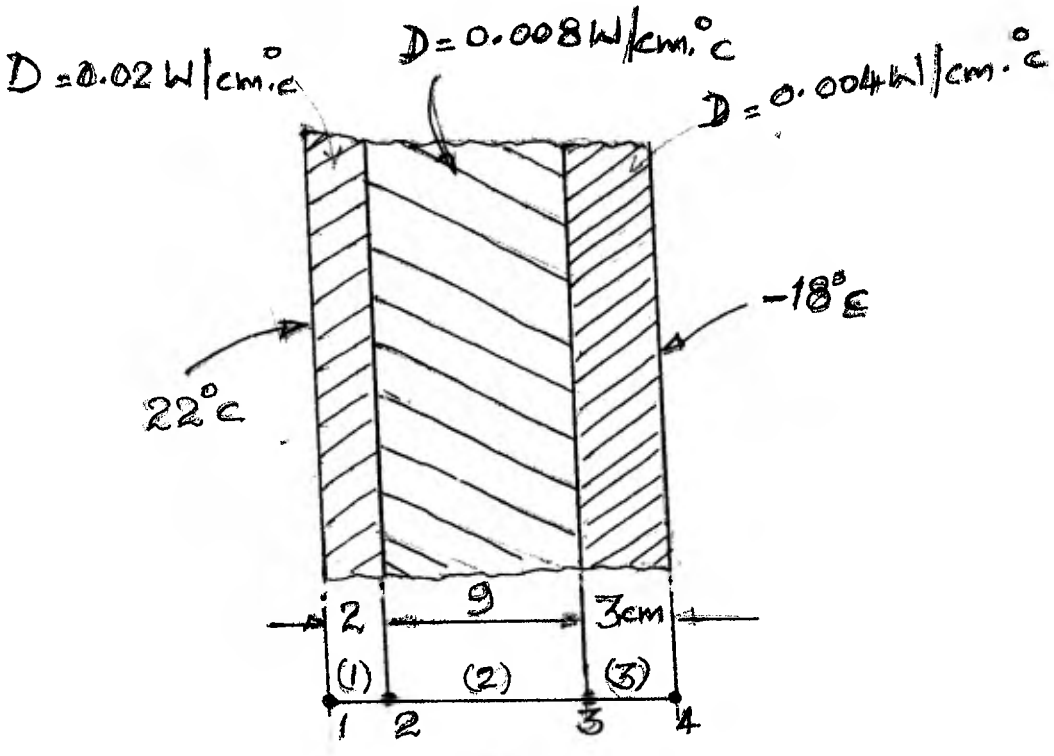
The general transformed global stiffness matrix for a beam element that includes axial force, shear force, and bending moment effects as follows:

$$k = \frac{E}{L} \times$$

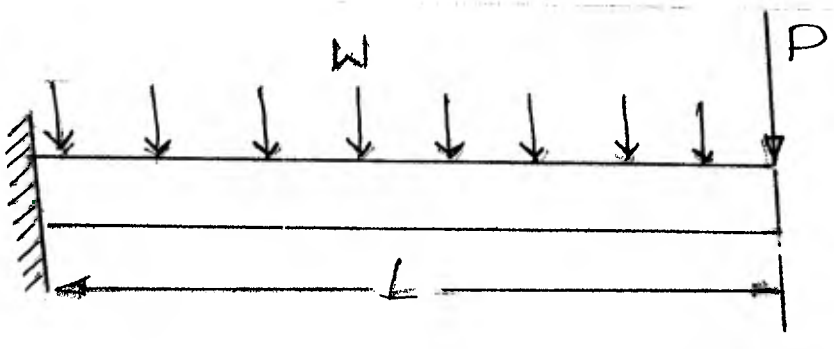
$$\begin{bmatrix} AC^2+\frac{12I}{L^2}S^2 & \left(A-\frac{12I}{L^2}\right)CS & -\frac{6I}{L}S & -\left(AC^2+\frac{12I}{L^2}S^2\right) & -\left(A-\frac{12I}{L^2}\right)CS & -\frac{6I}{L}S \\ & AS^2+\frac{12I}{L^2}C^2 & \frac{6I}{L}C & -\left(A-\frac{12I}{L^2}\right)CS & -\left(AS^2+\frac{12I}{L^2}C^2\right) & \frac{6I}{L}C \\ & & 4I & \frac{6I}{L}S & -\frac{6I}{L}C & 2I \\ & & & AC^2+\frac{12I}{L^2}S^2 & \left(A-\frac{12I}{L^2}\right)CS & \frac{6I}{L}S \\ & & & & AS^2+\frac{12I}{L^2}C^2 & -\frac{6I}{L}C \\ \text{Symmetry} & & & & & 4I \end{bmatrix}$$



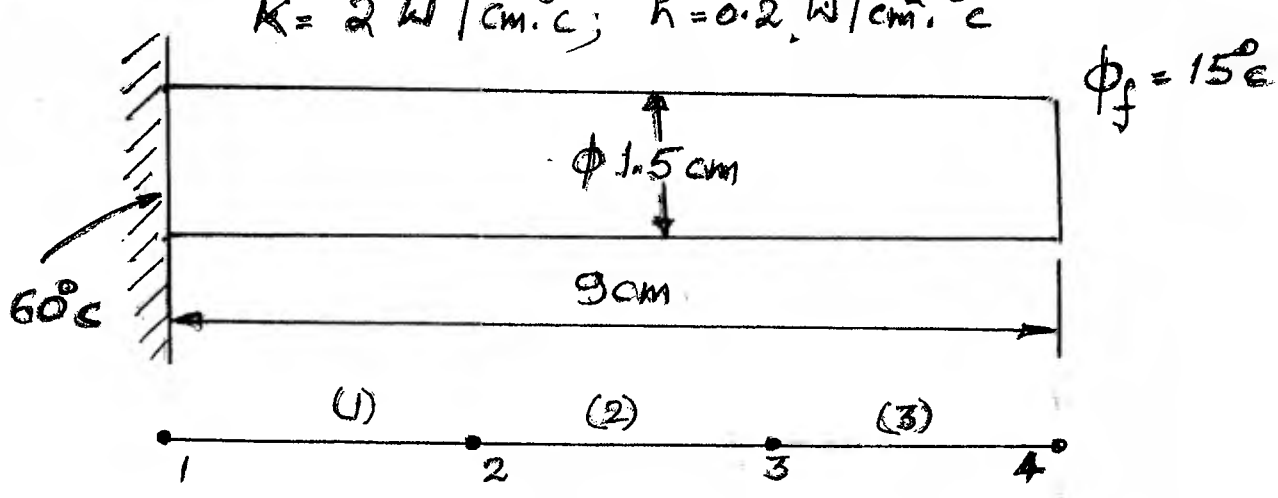
Q. No. 2(A), Fig. 2



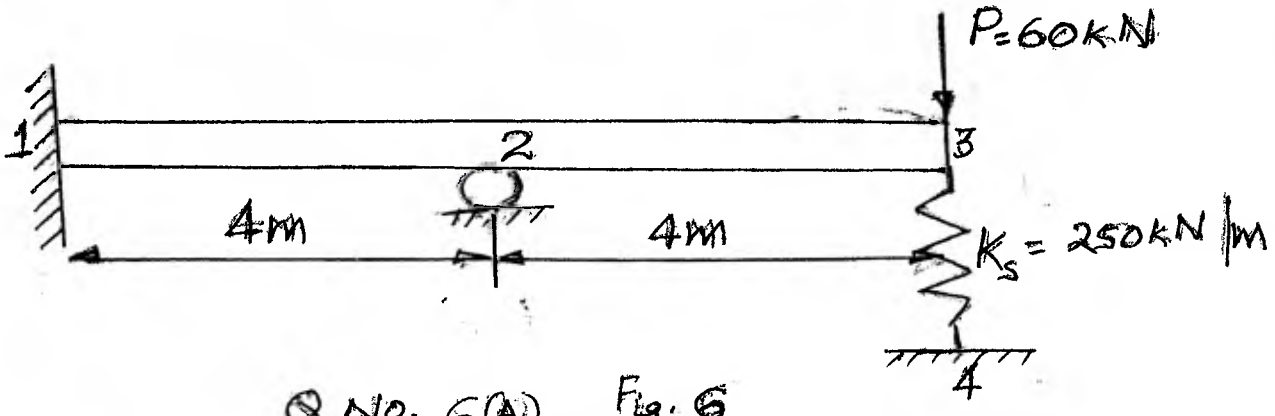
Q. No. 2(B) Fig No: 3



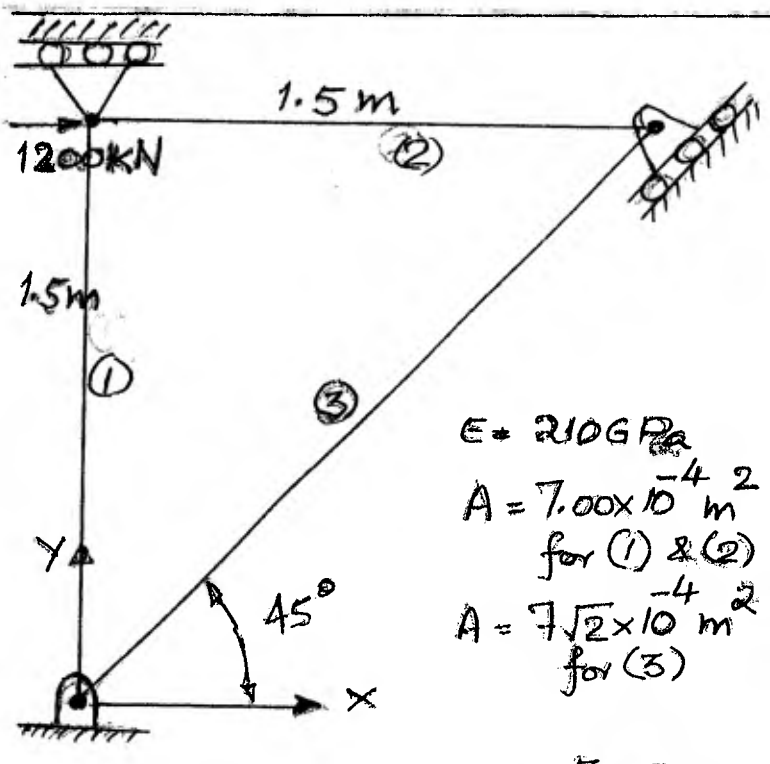
Q. No 1(B) Fig. 1



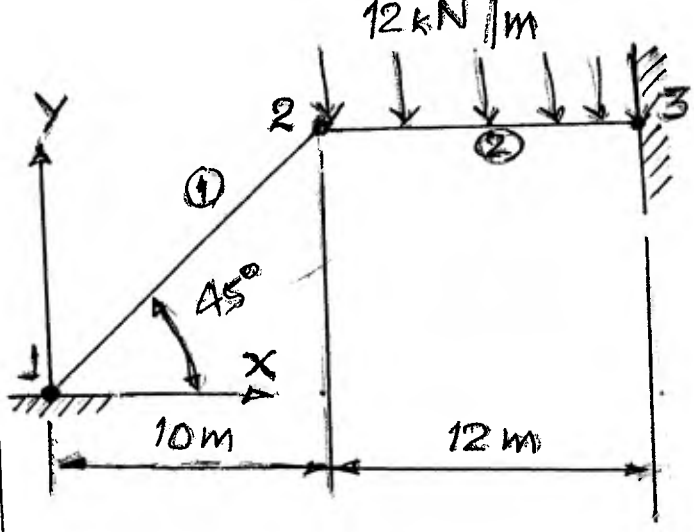
Q. No. 4(A). Fig. 4



Q. No. 6(A) Fig. 6



Q. No. 5(A) Fig. 5



Q. No. 7 Fig. 7

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SARDAR PATEL COLLEGE OF ENGINEERING

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End Semester Examination

May 2018

Class: M. Tech. (Mechanical)

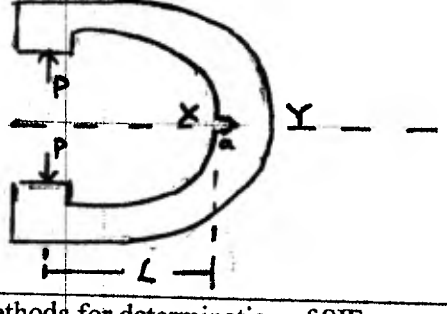
Program: M. Tech. (Mechanical Engineering)/M/C Design **Duration: 3 Hrs**

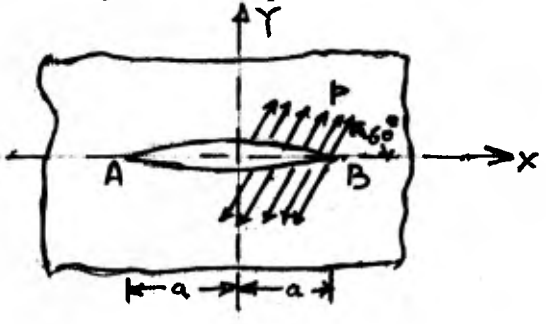
Course Code: MTMD201 **Maximum Marks:100**

Name of the Course: FRACTURE MECHANICS **Semester: II**

Instructions:

1. **Question No 1 is compulsory**
2. **Attempt any four questions out of remaining six.**
3. **Draw neat diagrams wherever necessary.**
4. **Assume suitable data if necessary.**
5. **Answers to the sub questions should be grouped together.**

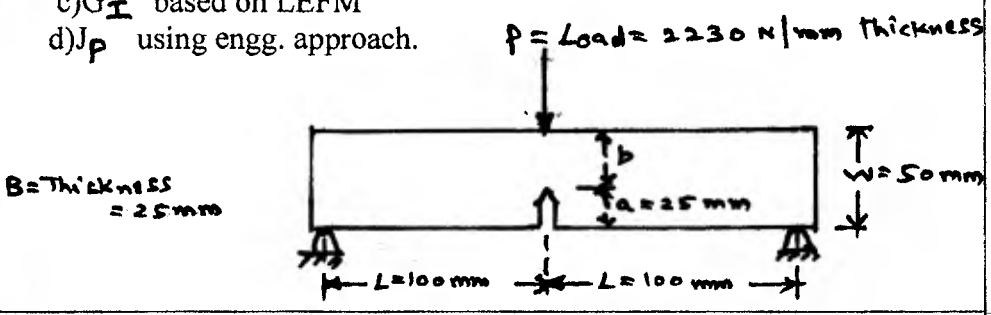
Q. No.			Max. Marks	CO No.	Module No
1	a)	Explain the main steps in a KIC test.	07	3	5
	b)	An edge crack detected on a large plate is of length 40 mm,under fatigue load of 140.0 Mpa to 0.0Mpa .The plate is of steel with KIC =150 Mpa$\sqrt{m}$.Use Paris law with C=7.2*10^{-12} units and m=3.Determine i)Propagation life upto failure ii)Propagation life if crack is not allowed to exceed 60% of critical length.	07	2,4	6,7
	c)	Write a short note on 'Environment Assisted Fracture'	06	4	6
2	a)	Write a short note on ductile and brittle fracture.	05	1,2	1
	b)	Derive the relationship between G and K for a uniaxially loaded infinite plate with a central crack.	10	1	2,
	c)	Calculate the safe load P for the C frame shown in the figure below. (a= 5 mm; depth h of section XY =40 mm; L =150 mm; Thickness B of section = 25 mm;KIC =59 MPa$\sqrt{m}$; σ_Y =1500 MPa) 	05	2,4	3,7
3	a)	List various methods for determination of SIF	05	1	3
	b)	Determine the stress field ahead of the crack tip for a biaxially loaded specimen with a central crack of length 2a in Mode I using Westergaard's approach.	15	1	3

4	a)	Explain the method to determine G for a centre cracked specimen under load control using the change in compliance	04	2	2
	b)	Determine the depth of a DCB specimen beyond the crack tip if G is to remain constant with growth of crack.The specimen is under constant load.Initial crack length is 50 mm;Thickness B= 30 mm;E= 207 GPa;Depth of each cantilever over initial crack length is 12 mm.	08	2	2
	c)	A large plate of 36 mm thickness is tested under displacement control. It has an edge crack a= 32 mm.At displacement of 7.2 mm,the load is 2750 N and the crack starts growing.At a= 41.7 mm ,the crack stops and the load is 1560 N.Determine GIC.	08	2	2
5	a)	Explain the steps involved in determining the SIF using the Finite Element Method.	08	1	3
	b)	Determine by the Green's Function approach both KI and KII at both crack ends for the following distributed pressure loads. 	12	2	3
6	a)	Explain the limitations of Griffith's theory and the Irwin Orowan modification	04	1	2,3
	b)	Estimate the size of the plastic zone in both plane stress and plane strain condition using Tresca criterion.Sketch the same.	08	1	3
	c)	A large plate of 5 mm thickness made of medium carbon steel with yield strength of 350 MPa and a through thickness centre crack of length 2a =40 mm is subjected to a stress of 150 MPa.Determine effective crack length using Irwin's correction.	08	1	3
7	a)	Define the J integral and show that it is path independent	04	2	4
	b)	Define CTOD and calculate the same for a central crack of length 2a in Mode I loading.	08	2	3
	c)	A 3 pt. bend specimen as shown below carries a central load of 2230 N/mm.The material properties for the Ramberg Osgood relation are $\sigma_{ys} = \sigma_0$ =700 Mpa; $\varepsilon_0 = \sigma_0/E$;E=207 Gpa; α =8.2; n=6; P_0 = 0.728 $\sigma_{ys} \times b^2/L$ (Pl.Strain) P_0 =0.536 $\sigma_{ys} \times b^2/L$ (Pl.Stress) g =1; h_1 = 0.585(Pl.strain) h_1 =0.389(Pl.stress) Find a)K_I-- Use appropriate formula. Take f(a/w)=f(α) = $\frac{3\alpha^{1/2}\left[1.99-\alpha(1-\alpha)(2.15-3.93\alpha+2.7\alpha^2)\right]}{2(1+2\alpha)(1-\alpha)^{3/2}}$ b)Plastic zone size	08	4	4

(Contd.)

c) G_I based on LEFM

d) J_p using engg. approach.



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END SEM

May 2018

Date: 23.05.2018

Duration: 3 Hours

Maximum Marks: 100

Semester: II

Program: M.Tech Machine Design

Course code: MTMD216

Name of the Course: **Optimization Methods**

Instructions:

- **Question no. 1 is compulsory.**
- **Attempt any four out of six.**
- **Use of Scientific calculator is allowed.**
- **Necessary and Sufficient conditions should mentioned clearly.**
- **Answers to all sub questions should be grouped together.**
- **Assume suitable data if necessary justify the same and state the assumptions clearly.**
- **Use three to five iterations in order to optimize function.**

Q. No.		Maximum Marks	Course Outcome Number	Module No.
Q1	(a) Define the following terms: • Behavior Constraint • PDE • SDE • Geometric Programming Problem • Difference between Fibonacci and Golden Section Method • Infeasibility Form	10	01	1,2,3,4
	(b) State and prove necessary and Sufficient conditions for the maxima of multivariable function F(x)	10	03	4
Q2	(a) Use three iterations of the golden section search method in order to maximize the function $f(x)=10+x^3-2x-5\exp(x)$ in the interval (-5,5)	10	02	2
	(b) Predict any five MATLAB codes; which are operate to solve any linear programming functions with equality or inequality constraints.	10	02	3

09/10.

Q3	Solve the Following problem graphically, check necessary and sufficient conditions for candidate local minima/maxima points and verify them on graphs	10	03	4
	(a) Minimize $f(x)=(x_1-2)^2+(x_2+1)^2$ subject to $2x_1+3x_2=4$;	10	03	5
	(b) Maximize $f(x)=4x_1^2+3x_2^2-5x_1x_2-8$ subject to $x_1+x_2=4$;			
Q4	Determine the nature of following Quadratic forms			
	(a) $F(\bar{X})=x_1^2+4x_1x_2+2x_1x_3-7x_2^2-6x_2x_3+5x_3^2$	05	03	4
	(b)$F(\bar{X})=2x_1^2+x_1x_2+2x_2^2+3x_3^2-2x_1x_3$	05	02	5
	(c)Explain the need of optimization in industry and organization with example.	05	01	1
	(d) What are the effects of manufacturing errors on optimum design?	05	01	1
Q5	Consider the following Problem Minimize $f(x) = x_1^2+ x_2^2+ x_3^2$ subject to $x_1+ x_2+ x_3 \geq 5$ $2 - x_2x_3 \leq 0$ $x_1 \geq 0,\ x_2 \geq 0,\ x_3 \geq 2$ Determine whether the Kuhn-tucker conditions are satisfied at the following points: $X_1=\begin{Bmatrix}3/2\\3/2\\2\end{Bmatrix}$ $X_2=\begin{bmatrix}4/3\\2/3\\3\end{bmatrix}$ $X_3=\begin{Bmatrix}2\\1\\2\end{Bmatrix}$	20	02	3
Q6	(a) Bracket the minimum of the following function using the bounding phase method $f(x) = x^3-2x+10$	10	02	5
	(b)State the Optimum Design Procedure of Mechanical Elements.	10	04	7
Q7	Conclude the Box's Evolutionary Optimization Algorithm for Genetic Algorithm to designate the minimum point.	20	04	6

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RE EXAM

June 2018

Date: 27 June 2018

Program: M.Tech Machine Design

Duration: 3 Hours

Course code: MTMD203

Maximum Marks: 100

Name of the Course: Analysis and Synthesis of Mechanisms

Semester: II

Instructions:

Question no. 1 is compulsory.
Attempt any five questions.
Assume Suitable data if necessary.

Q. No.		Max. Marks	CO No.	Module No.
Q1	Give two examples of each: (a) Spatial Mechanism (b) Mechanisms with multidegree freedom. (c) Unconstrained kinematic pairs (d) Differentiate between degree of freedom of a kinematic pair and that of a mechanism. How the two are interconnected? (e) Summarize the standard assumptions made in kinematic analysis of mechanism.	20	01	01 02 03
Q2	(a) State and Explain Chebyshev Theorem. (b) Demonstrate the Overlay Method for kinematic synthesis.	10 10	01 04	02 06
Q3	Solve the Euler's Savary equation with inflection points and inflection circle.	20	03	04
Q4	(a) Explain the complex number method of synthesis. (b) Obtain an expression for coupler point curve for a four bar linkages.	10 10	03 04	07 04
Q5	(a) Design four bar linkages to generate the function $1/2\ y = x$ for the range $x = 2$ to $x = 6$. The input and output sectors of angles are 60°and 90° respectively. Determine angle co-ordination. Take three accuracy points. (b) Explain the procedure to get approximate dwell linkages using four accuracy points with suitable sketches.	10 10	04 02	06 06
Q6	(a) Design a four bar linkage to meet the following specifications:- Crank Position Angular velocity Angular acceleration Input $\theta = 90°$ $\omega_2 = 3$rad/sec $\alpha_2 = 0$ rad/sec^2 Output $\varphi = 90°$ $\omega_4 = 1.5$ rad/sec $\alpha_4 =$ rad/sec^2	10	01	01

	(b) Design four bar linkage to meet to the following requirement: Input Angle: 50° / Output Angle: 45° Input Angle: 70° / Output Angle: 75° Input Angle: 90° / Output Angle: 120°	10	01	05
Q7	Write short note on following: (any four) (a) Kinematic Pairs (b) Equivalent Linkages (c) Bobillers Construction (d) Dimensional Synthesis (e) Function Generator	20	03	01 02 03 04