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VACHANA PITAMAHA DR.P.G.HALAKATTI COLLEGE OF ENGINEERING AND TECHNOLOGY ,VIJAYPUR

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QUESTION PAPERS

1st,2nd and 4th SEMESTER

M.TECH MMD

JUNE-JULY 2018

INDEX

I sem MTech M.M.D

CBCS Scheme

USN | | | | | | | | | |

17/16MDE/MMD/MST/MTP/MTR/
MCM/MEA/CEA/MAR11

First Semester M.Tech. Degree Examination, June/July 2018
Applied Mathematics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Define : (i) Significant digit (ii) Round off error (iii) Truncation error (iv) Absolute error. **(08 Marks)**

b. If $f = \frac{4x^2y^3}{z^4}$ and errors in x, y, z are 0.001. Find the absolute error and relative maximum error in f at x = y = z = 1. **(08 Marks)**

OR

2 a. Derive the analytical solution $V(t) = \frac{mg}{C}\left[1 - e^{-\frac{C}{m}t}\right]$ for the differential equation $\frac{dV}{dt} = g - \frac{C}{m}V$, where m is the mass of the falling body, 'C' is the drag coefficient 'g' gravitational force, 'V' is the velocity of the parachutist. **(08 Marks)**

b. A parachutist of mass 68.1 kg jumps out of a stationary hot air ballon, use $\frac{dv}{dt} = g - \left(\frac{C}{m}\right)V$ to compute V prior to the opening of the chute. The drag coefficient is equal to 12.5 kg/sec. Given that g = 9.8 m/sec^2, V = 0 at t = 0. Apply finite divided scheme with a step size of 4 sec for the calculation. **(08 Marks)**

Module-2

3 a. Use Regula False method to find the root of the equation, $x^3 - 2x - 5 = 0$. Perform 3 iterations. **(08 Marks)**

b. Explain the Newton-Raphson method to find the root of the equation f(x) = 0. Use it to find the root of $3x = \cos x + 1$ near x = 0.6. **(08 Marks)**

OR

4 a. Use Muller's method to find the root of the equation, $x^3 - 3x - 5 = 0$ correct to 4 decimal places. Perform two iterations. **(08 Marks)**

b. Find all the roots of the equation $x^3 - 6x^2 + 11x - 6 = 0$ using the Graeffe's root squaring method. **(08 Marks)**

Module-3

5 a. Find y'(1.1) and y''(1.6) from the table, **(08 Marks)**

x:	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y:	7.989	8.403	8.781	9.129	9.451	9.750	10.031

b. Use Romberg's method to compute $\int_0^1 \frac{dx}{1+x^2}$, correct to 4 decimal places with h = 0.5, 0.25, 0.125. **(08 Marks)**

OR

6 a. From the following table of values of x and y, obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for x = 1.2 and x = 2.2. **(08 Marks)**

x:	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y:	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

b. Evaluate $\int_0^1 \frac{dx}{1+x}$ correct to three decimal places using Romberg's method. **(08 Marks)**

Module-4

7 a. Apply Gauss-Jordan method to solve the equations $x+y+z=9$, $2x-3y+4z=13$, $3x+4y+5z=40$. **(08 Marks)**

b. Reduce the following matrix to tridiagonal form using Given's method. **(08 Marks)**

$$A=\begin{bmatrix}2 & 1 & 3\\ 1 & 4 & 2\\ 3 & 2 & 3\end{bmatrix}$$

OR

8 a. Apply Factorization method to solve the equations, $3x+2y+7z=4$, $2x+3y+z=5$, $3x+4y+z=7$. **(08 Marks)**

b. Find numerically largest Eigen value and corresponding Eigen vector of the matrix,

$$A=\begin{bmatrix}4 & 1 & -1\\ 2 & 3 & -1\\ -2 & 1 & 5\end{bmatrix}.$$

by power method taking $[1 \quad 0 \quad 0]^T$ as the initial eigen vector. **(08 Marks)**

Module-5

9 a. Define : (i) the matrix with linear transformation (ii) rank of a matrix
(iii) nullity of a matrix. **(08 Marks)**

b. Let $t: R^2 \to R^2$ be a linear transformation defined by, $t(a,b)=(2a-3b, a+b)$ for all $(a,b) \in R^2$. Then find the matrix 't' relative to this basis,
$B = \{(1, 0), (0, 1)\}$, $B' = \{(2, 3), (1, 2)\}$ **(08 Marks)**

OR

10 a. Let S be the subspace of an inner product space R^4 spanned by the vectors $V_1=(1 \quad 1 \quad 1 \quad 1)$, $V_2=(1 \quad 2 \quad 4 \quad 5)$, $V_3=(1 \quad -3 \quad -4 \quad -2)$ in R^4. Apply the Gram-Schmidt orthogonalization process to find the orthonormal basis and then orthonormal basis of S. **(08 Marks)**

b. Find the equation $y=a+bx$ of the least square line that best fits the following data: **(08 Marks)**

x:	1	2	3	4	5
y:	14	27	40	25	68

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CBCS Scheme

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16/17MDE12

First Semester M.Tech. Degree Examination, June/July 2018
Finite Element Method

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing ONE full question from each module.*

Module-1

1 What are the basic steps involved in finite element method to solve mechanical engineering problems and explain briefly with an example. **(16 Marks)**

OR

2 The potential energy for the linear one dimensional rod as shown in Fig.Q2 with body force neglected is $\pi = \frac{1}{2}\int_0^2 EA\left(\frac{du}{dx}\right)^2 dx - 2u$ where $u_1 = u(x = 1)$. Solve it by Galerkin's approach. **(16 Marks)**

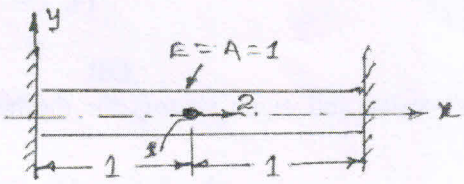

Fig.Q2

Module-2

3 a. What are the properties of stiffness matrix. **(03 Marks)**

b. A stepped bar as shown in Fig.Q3(b). Using Penalty approach for handling boundary conditions. Determine :
i) Nodal displacements ii) Stress in each material iii) Reaction forces. **(13 Marks)**

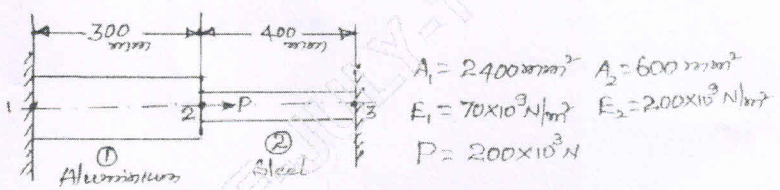

Fig.Q3(b)

OR

4 Derive a stiffness matrix for a beam element by using shape function. **(16 Marks)**

Module-3

5 What are shape function and derive the element stiffness matrix for a four noaded quadrilateral membrane element (QUAD4). **(16 Marks)**

OR

6 a. Write a note on hexahedral elements and explain its properties. **(08 Marks)**

b. What is sendipity finite element method and explain its geometric composition. **(08 Marks)**

Module-4

7 Obtain the equations of equilibrium of plate theory for an isotropicmaterial subjected to twisting moment per unit length. **(16 Marks)**

OR

8 Name the properties and degrees of freedom for the following elements :
i) Flat element ii) Curved element iii) Cylindrical element iv) Conical shell element. **(16 Marks)**

Module-5

9 For the pin jointed truss element shown in Fig.Q9 prove that fundamental frequency is given by $W = \frac{0.648}{L}\sqrt{F/\rho}$. **(16 Marks)**

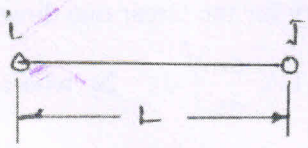

Fig.Q9

OR

10 Find the eigen value and eigen vectors for the beam shown in Fig.Q10 and find buckling load. **(16 Marks)**

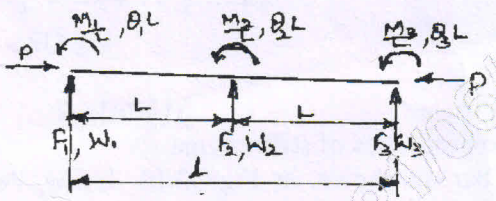

Fig.Q10

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II Sem M.Tech M.MD

CBCS Scheme

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16/17MDE22

Second Semester M.Tech. Degree Examination, June/July 2018
Advanced Machine Design

Time: 3 hrs. Max. Marks: 80

Note: **1.** ***Answer any FIVE full questions, choosing one full question from each module.***
2. ***Use of machine design data hand book is permitted.***
3. ***Missing Data can be suitably assumed.***

Module-1

1 a. A machine part has a combined state of stress σ_x = 50 MPa, σ_y = -30 MPa, τ_{xy} = 30 MPa. The ultimate strength of material in tension σ_{ut} = 140 MPa, ultimate strength in compression σ_{uc} = 560 MPa. Using modified theory find effective stress and FOS against static failure. **(08 Marks)**

b. Draw the schematic diagram of a computer controlled closed loop fatigue testing machine and explain in brief. **(08 Marks)**

OR

2 a. A differential element is subjected to the following state of stress σ_x = 100 MPa, σ_y = -50 MPa, τ_{xy} = 50 MPa, material used in ductile steel with σ_{ij} = 250 MPa. Determine FOS as per modified Mohr's theory. **(08 Marks)**

b. Write a note on:
i) High cycle fatigue and low cycle fatigue
ii) Explain even and uneven material with Mohr circle diagram. **(08 Marks)**

Module-2

3 a. An un notched circular rod with a diameter of 10 mm each subjected to constant amplitude bending at room temperature with s_m is equal to 200 MPa. The material is 4340 quenched and tempered alloy steel with s_u = 1240 MPa, s_y = 1170 MPa and $s_{y'}$ = 1000 MPa, with the rod is commercially polished estimate the value of S_a, S_{max}, S_{min} and 'R' for a median fatigue life of 50000 cycles and no yielding. Take correction factor = 0.87. **(08 Marks)**

b. Write a note on surface finish and other factor influencing strain-life approach. **(08 Marks)**

OR

4 a. Write notes on:
i) General S-N behavior
ii) Fatigue crack nucleation, growth and final fracture. **(08 Marks)**

b. Explain strain based ($\epsilon - N$) approach to life estimation. **(04 Marks)**

c. Explain stress-strain curve of engineering stress and true stress-strain behavior. **(04 Marks)**

Module-3

5 a. Explain with a neat sketch of crack tip plastic zone with strip model. **(08 Marks)**

b. Explain mean stress effect and Haigh's diagram for 7075 – T_6 wrought Aluminum alloy. **(08 Marks)**

OR

6 a. Explain Fatigue crack growth, $\frac{da}{dN} - \Delta K$. **(08 Marks)**

b. Sketch and explain the Haigh's diagram and modified Goodman's diagram for Notch part. **(08 Marks)**

Module-4

7 a. Explain level crossing method. **(08 Marks)**

b. Explain Glinka's rule applied to notch stress-strain analysis. **(08 Marks)**

OR

8 a. Explain peak counting method. **(08 Marks)**

b. Explain application of fracture mechanics to crack growth at notches. **(08 Marks)**

Module-5

9 a. Write notes on:
i) Surface geometry
ii) Mating surface
iii) Friction **(08 Marks)**

b. Derive an expression for the pressure distribution in cylindrical contact and show the pressure distribution schematically. **(08 Marks)**

OR

10 a. An overhead crane wheel runs slowly on a steel rail. What is the size of the contact patch between wheel and rail and what are the stresses? What is the depth of maximum shear stress? The wheel is 250 mm diameter and 20 mm thick and the rail is flat. Both parts are steel, the radial load is 18000 N Poisson's ratio is 0.28 and $E = 2.1 \times 10^5$ N/mm^2. **(08 Marks)**

b. Explain with neat sketch of geometric stress concentration and show the stress distribution under varying load levels. **(08 Marks)**

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16/17MDE23

Second Semester M.Tech. Degree Examination, June/July 2018
Dynamics and Mechanism Design

Time: 3 hrs. Max. Marks: 80

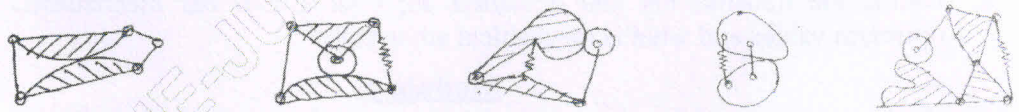
Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. State and explain Grashof's law. **(04 Marks)**

b. Define kinematic inversion. Sketch and explain any two inversions of four bar chain. **(04 Marks)**

c. Draw the equivalent linkage for the following and find their degree of freedom. Solve any four. **(08 Marks)**

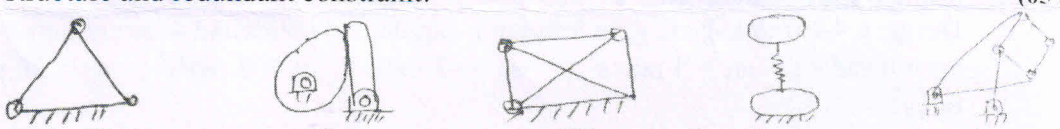


(i) (ii) (iii) (iv) (v)

OR

2 a. Write down the main differences between
i) Plane, spherical and spatial mechanisms.
ii) Analysis and synthesis. **(06 Marks)**

b. Find degree of freedom of following mechanisms and identify which is a mechanism, structure and redundant constraint. **(05 Marks)**



(i) (ii) (iii) (iv) (v)

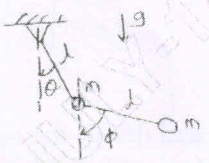
c. Sketch and explain Oldham's coupling. **(05 Marks)**

Module-2

3 a. Explain Holonomic and non-holonomic constraints. **(04 Marks)**

b. Explain principle of virtual work. **(04 Marks)**

c. A double pendulum consists of two particles suspended by massless rods. Assuming that all motions takes place in a vertical plane, find the differential equations of motions. **(08 Marks)**



Linearize these equations, assuming small motion.

OR

4 a. A particle of mass "M" can slide without friction on the inside of a small tube which is bent in the form of a circle of radius 'r'. The tube rotates about a vertical diameter with a constant angular velocity "W" as shown in Fig.Q.4(a). Write the differential equations of motion.

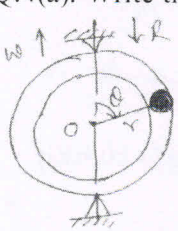
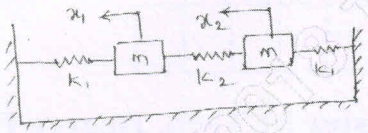


Fig.Q.4(a)

(08 Marks)

b. Using Hamilton equation, find the equations of motion for the system shown in Fig.Q.4(b) below. **(08 Marks)**

Fig.Q.4(b)



Module-3

5 a. Explain any four : i) Type synthesis; ii) Number synthesis; iii) Dimensional synthesis; iv) Path generation; v) Function generation. **(08 Marks)**

b. The rocker of a crank rocker mechanism is to have a length of 50mm and swings through a total angle of 45° with a time ratio of 1.25. Determine the suitable set of dimensions. **(08 Marks)**

OR

6 a. What are the important tasks of kinematic synthesis? Discuss in brief. **(06 Marks)**

b. Define poles and relative poles. **(02 Marks)**

c. Define the transmission and deviation angle of a four bar mechanism. What are their optimum values and what is mechanical advantage? **(08 Marks)**

Module-4

7 a. Explain synthesis of function generation using overlay method of synthesis. **(04 Marks)**

b. Synthesize a function $y = 1/x$ in the range of $1 \leq x \leq 2$ for a function generator using three precession points by Freudenstein's equation. Range of input 30° to 120° and output 240° to 330°. **(12 Marks)**

OR

8 a. Define cognate linkage. **(03 Marks)**

b. Explain Caley's diagram. **(03 Marks)**

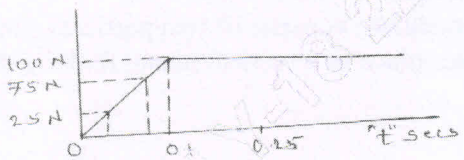
c. Design a 4-bar linkage to give following angular velocities and accelerations.
$\omega_2 = 8$ rad/s ; $\omega_3 = 1$ rad/s ; $\omega_4 = -3$ rad/s ; $\alpha_2 = 0$ rad/s^2 ; $\alpha_3 = 20$ rad/s^2 ; $\alpha_4 = 0$ rad/s^2. **(10 Marks)**

Module-5

9 a. Deduce the condition for free precession of gyroscope with steady precession. **(06 Marks)**

b. Obtain phase plane response of a single degree freedom of a spring mass system with K = 100,000 N/m (100N/mm) mass M = 50kg subjected to excitation as shown below in Fig.Q.9(b). **(10 Marks)**

Fig.Q.9(b)



OR

10 a. Define Eulerian angles and derive the equation for angular velocities. **(10 Marks)**

b. Find the degree of freedom of the following mechanisms. (Refer Fig.Q.10(b)(i) and (ii)). **(06 Marks)**

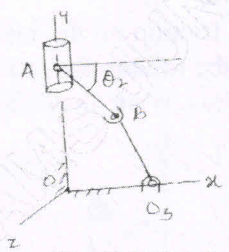


Fig.Q.10(b)(i)

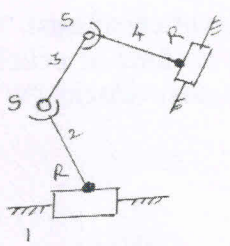


Fig.Q.10(b)(ii)

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CBCS Scheme

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16/17MDE24

Second Semester M.Tech. Degree Examination, June/July 2018

Advanced Theory of Vibrations

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Determine the natural frequency of spring mass system taking the mass of the spring into account. **(08 Marks)**

b. Obtain the response of viscous damped system for critical damped case. **(08 Marks)**

OR

2 a. What is dynamic vibration absorber? Show that the spring force of absorber is equal and opposite to the exciting force on the main mass resulting in no motion of the system. **(08 Marks)**

b. A machine of mass 1 tonne is acted upon by an external force of 2450 N at a frequency of 1500 rpm. To reduce the effects of vibration isolator of rubber having a static deflection of 2 mm under the machine load and an estimated damping factor of 0.2 are used. Determine:
i) Force transmitted to the foundation.
ii) Amplitude of vibration of the machine.
iii) Phase lag of the transmitted force with respect to the external force. **(08 Marks)**

Module-2

3 a. Explain:
i) Frahm's reed tachometer
ii) Vibrometer **(08 Marks)**

b. With a neat sketch explain electro dynamic shaker. **(08 Marks)**

OR

4 a. Explain machine condition monitoring techniques. **(08 Marks)**

b. Briefly explain the hardware of an equipment necessary for experiment modal analysis. **(08 Marks)**

Module-3

5 a. Determine the response of a SDOF system to the step excitation shown in the Fig.Q5(a).

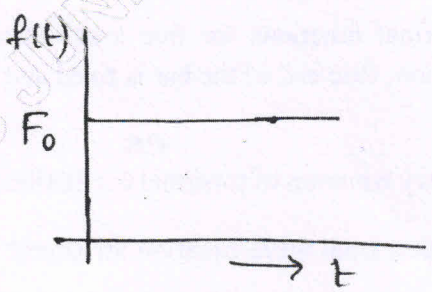

Fig.Q5(a) **(08 Marks)**

b. A container having an apparatus suitably packaged inside is shown in Fig.Q5(b), when the package is dropped on a hard surface during loading and unloading, analyze the system for its response.

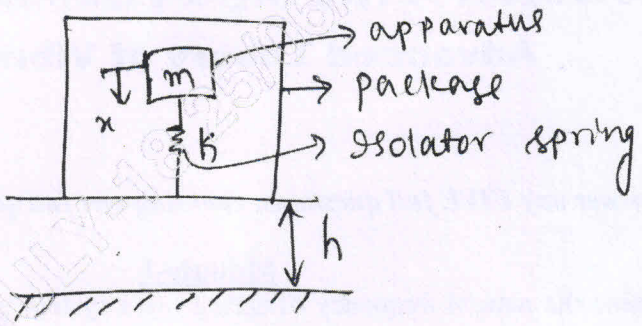

Fig.Q5(b) **(08 Marks)**

OR

6 a. Explain the following terms:
i) Auto correlation
ii) Power spectrum and power spectral density
iii) Ergotic process
iv) Random time functions **(08 Marks)**

b. Define the following terms:
i) Probability distribution
ii) Correlation **(08 Marks)**

Module-4

7 a. Discuss the non linear spring characteristics in soft and hard spring. **(08 Marks)**

b. Derive an expression for the free oscillations of a mass on a non linear spring using perturbation parameter β. **(08 Marks)**

OR

8 a. Explain jump phenomenon. **(04 Marks)**

b. State the difference between a linear and non-linear vibrating systems. **(04 Marks)**

c. Explain:
i) Stable and unstable oscillations with respect to self excited vibrations.
ii) Self excited vibrations caused by dry friction and give examples. **(08 Marks)**

Module-5

9 a. Derive differential equation of motion for the longitudinal vibration of uniform bar. **(08 Marks)**

b. Determine the normal functions for free longitudinal vibration of a bar of length ℓ and uniform cross section. One end of the bar is fixed and the other free. **(08 Marks)**

OR

10 a. Derive the frequency equation of torsional oscillations for a free-tree shaft of length ℓ. **(08 Marks)**

b. Derive the one dimensional wave equation for lateral vibrations of string. **(08 Marks)**

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CBCS Scheme

USN | | | | | | | | | | |

16/17MDE252

Second Semester M.Tech. Degree Examination, June/July 2018
Theory of Plasticity

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Define octahedral stresses and derive the equations for effective stress. **(08 Marks)**

b. Explain the following :
i) State of pure shear
ii) Strain Rate tensor
iii) Stress invariants
iv) Spherical and Deviatorial strain tensors. **(08 Marks)**

OR

2 a. What is cubical Dilation and obtain its expressions in terms of linear strains. **(08 Marks)**

b. The displacement field for a body is given by $u = (x^2 + y)\,i + (3 + z)j + (x^2 + 2y)K$. Determine the principle strains at (3, 1, -2) and the directions of minimum principle strain. **(08 Marks)**

Module-2

3 a. Explain experimental verification of yield criteria using Taylor's and Quinney's experiment. **(08 Marks)**

b. Explain representing of traces of the yield surfaces in two dimensional stress space. **(08 Marks)**

OR

4 a. Explain yield criteria for an isotropic material. **(08 Marks)**

b. Explain Haigh – Westergaard stress space representation of yield criteria. **(08 Marks)**

Module-3

5 a. Derive the Prandtl – Reuss stress strain Relations for plastic flow. **(10 Marks)**

b. State and explain lower bound Theorem. **(06 Marks)**

OR

6 a. Explain the Saint Venant's Theory of plastic flow in detail. What are the limitations of this theory? **(10 Marks)**

b. Explain the following :
i) Concept of plastic potential
ii) The Levy – Lode variables **(06 Marks)**

Module-4

7 a. A cantilever beam of length L carries an end load W. Determine the deflection of the beam if stress – strain diagram for the material is represented by the equation $\sigma = H\epsilon^n$. **(08 Marks)**

b. A solid circular shaft of radius 120mm is required to transmit 600kW at 540rpm. The maximum torque is 30% greater than the mean torque if the shear stress strain curve for the shaft material is given by $\tau = 280\ \gamma^{0.25}$. Determine the maximum stress induced in the shaft and the corresponding angle of twist. What would be their values if the stress – strain curve is a linear one $G = 0.84 \times 10^5$ N/mm^2? **(08 Marks)**

OR

8 a. Derive equations for draw stress in a strip drawing process considering friction. **(10 Marks)**

b. An aluminium rod 6.25mm in diameter is drawn into wires 5.60mm is diameter. The half die angle $\alpha = 10°6'$. Find the drawing stress considering friction if $\mu = 0.04$ and yield stress for aluminium 35N/mm^2. Also calculate the maximum reduction possible. **(06 Marks)**

Module-5

9 a. List out the properties of slip lines. **(06 Marks)**

b. State and prove Hencky's first theorem. **(10 Marks)**

OR

10 a. What do you understand by a Hodograph? How a Hodographs can be drawn? **(08 Marks)**

b. Name different methods of construction of slip lines and explain any one. **(08 Marks)**

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IV Sem M.Tech MMD

CBCS Scheme

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16MDE41

Fourth Semester M.Tech. Degree Examination, June/July 2018

Tribology and Bearing Design

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define the following terms:
i) Tribology
ii) Wear
iii) Viscosity
iv) Newton's law of viscosity **(08 Marks)**

b. Derive an expression for discharge through capillary tube with suitable assumptions. **(08 Marks)**

OR

2 a. Explain with neat sketches of any two types of viscometer. **(08 Marks)**

b. A journal bearing has the following specifications:
Shaft diameter = 60 mm
Bearing length = 80 mm
Radial load = 1 kN
Clearance (c) = 0.1 mm
Oil used SAE at 60°C, coefficient of friction 0.042. Determine:
i) Speed of the journal
ii) Power loss **(08 Marks)**

Module-2

3 Derive the expression for Reynolds equation in 2-dimensions and state the assumptions mode. **(16 Marks)**

OR

4 a. Derive an expression for the load carrying capacity of pivoted shoe slider bearing. **(08 Marks)**

b. A rectangular plain slider bearing with fixed shoe with no end leakage has the following data:
Bearing length = 90 mm
Width of shoe = 90 mm
Load on bearing = 7800 N
Slider velocity = 25 cm/sec
Inclination (α) = –0.0035 radians
Viscosity of oil η = 40 cp
Determine: i) Minimum film thickness
ii) Power loss
iii) Coefficient of friction **(08 Marks)**

Module-3

5 a. What is the principle of hydrostatic bearing? Explain hydrodynamic lubrication system with neat sketches. **(08 Marks)**

b. A hydrostatic step bearing has the following data:
Diameter of the shaft = 150 mm
Diameter of the pocket = 100 mm
Vertical thrust on bearing = 60×10^3 N
External pressure = Atmospheric pressure
Shaft speed = 1500 rpm
Viscosity of lubricant = 30 cp, desirable oil film thickness = 0.0125 cm. Determine:
i) Rate of flow
ii) Power loss due to friction
iii) Coefficient of friction **(08 Marks)**

OR

6 a. A circular hydrostatic thrust bearing has the following data:
Shaft dia = 300 mm
Dia of pocket = 200 mm
Shaft speed = 100 rpm
Pressure at the pocket = 500 kN/m^2
Film thickness = 0.07 mm
Viscosity of lubricant = 0.05 Pa.S
Determine:
i) Load carrying capacity
ii) Oil flow rate
iii) Power loss **(08 Marks)**

b. Derive an equation for film thickness of a line contact bearing (Grubin type solution). **(08 Marks)**

Module-4

7 a. List the advantages of antifriction bearing and explain selection and nominal life of antifriction bearing. **(08 Marks)**

b. Explain Fretting phenomenon and its stages of porous bearing. **(08 Marks)**

OR

8 a. Explain the following terms:
i) Bearing mounting
ii) Porous bearing **(08 Marks)**

b. Explain static and dynamic load bearing capacity and also explain gas lubricated bearing. **(08 Marks)**

Module-5

9 a. Explain the following term:
i) Magnetic bearing
ii) Electrical analogy **(08 Marks)**

b. Explain active magnetic bearing with neat labeled diagram. **(08 Marks)**

OR

10 a. Explain magneto-hydrodynamic bearing. **(08 Marks)**

b. What are the advantages and disadvantages of magnetic bearing? **(08 Marks)**

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CBCS Scheme

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16MTP41

Fourth Semester M.Tech. Degree Examination, June/July 2018
Design of Heat Transfer Equipments for Thermal Power Plant

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions, choosing one full question from each module.***
2. ***Design data hand book is permitted.***

Module-1

1 Its desired to heat 4454.35 kg/hr (9820 lb/hr) of cold benzene from 26.67°C (80°F) to 48.88°C(120°F) using toluene which is cooled from 71.11°C(180°F) to 37.78°C(100°F). The specific gravities at 20°C(68°F) are 0.88 and 0.87 respectively. A fouling factor of 0.001 should be provided for each stream and allowable pressure drop of each stream is 0.702 bar (10 PSI). A number of 5.095 mts (20 ft) hair pins of 50.8 mm (2 inches) by 31.75 mm (1.25 inches) IP are available. How many hair pins are required? **(16 Marks)**

OR

2 There are 25 assemblies in a superheater each having four elements. The table below gives the arrangement history,

1		2		3		4	
L_e(ft)	D_i(in)	L_e(ft)	D_i(in)	L_e(ft)	D_i(in)	L_e(ft)	D_i(in)
60	1.686	70	1.686	70	1.686	65	1.686
125	1.436	120	1.436	115	1.436	100	1.40

If the total steam flow is 5,00,000 lb/hr at 1500 psi, 800°F average. Estimate flow in each element. **(16 Marks)**

Module-2

3 A double pipe heat exchanger consists of a tube 6 cms inner diameter 6.9 cms outer diameter is surrounded by a shell of 11.7 cms bore ethylene glycol flows in annuluis at the rate of 2 kg/s. The heated from 40°C to 80°C by hot water in counter flow in the hot fluid from 95°C to 85°C. What is length of heat exchanger required? **(16 Marks)**

OR

4 A heat flux of steam generated units 1,00,000 BTU/hr the tubes are 2½" OD with thickness 0.197" the pressure of a steam, water mixture is 1500 PSI. compute the inside heat transfer coefficient using Jene's equation and Thomas correlation. **(16 Marks)**

Module-3

5 A local fired furnace operates at the following parameters: A_P = 9200 ft^2, t_{air} = hot air temperature = 600°F, W_f = 6900 lb/hr, Excess air = 25%, LHV = 9500 Btu/lb, HHV = 10,000 Btu/lb, Ash = 20%, Furnace volume = 48130 ft^2 medium speed mills are used. Make quick estimate of T_e. **(16 Marks)**

OR

6 In a boiler having circulation ratio (CR) = 4 upto for at a pressure 1500 PSI. The mass velocity through is 100 ft^2, tubes are 2½"F and 0.197" thickness. Estimate total pressure drop using Thomson's method. **(16 Marks)**

Module-4

7 Design a high pressure feet water heater for the following data:
Quantity of feed water = 636.496 Tons/hr
Inlet (H_2O) temperature = 167°C
Outlet (H_2O) temperature = 200°C
Quantity of Bleed steam to turbine = 34 tons/hr
Condition of Bleed steam pressure and Temperature = 16.3 bar, 432°C.
Also find the total area required across the feed water heater. **(16 Marks)**

OR

8 Design a fuel oil suction heater for typical 210 MW boiler for the following data:
Quantity of oil fired = 48 tons/hr
Inlet temperature of oil = 25°C
Outlet temperature of oil = 50°C
Specific gravity of oil = 0.89
Auxiliary steam available 16 bar (232 PSI) and 230°C (446°F) viscosity of oil at 38°C(100°F) = 3500 Redwood Sec.No.1. Pressure drop is limited to 0.103 bar (1.5 PSI). Tubes of 19.05 mm (0.75 inches) O.D, 16 BWG and 25.4 mm (inches) square pitch are available for services. **(16 Marks)**

Module-5

9 Explain the influence of following process condition on the design of cooling tower:
(i) Un-saturation of the inlet air.
(ii) Close approach.
(iii) Stagging
(iv) Changing operation pressure. **(16 Marks)**

OR

10 Discuss the steps involved and the relevant equations in the design of surface condenser. **(16 Marks)**

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16CAE421

Fourth Semester M.Tech. Degree Examination, June/July 2018
Fracture Mechanics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Derive an expression for fracture strength of a brittle solid containing a crack using Grifths energy balance. **(08 Marks)**

b. Define fracture. List the use of fracture mechanics in modern engineering design. **(04 Marks)**

c. What is surface energy? Explain. **(04 Marks)**

OR

2 a. Explain 3 basic mode of crack displacement. Explain in detail of mode – I. **(06 Marks)**

b. A plate containing the hole is applied uniform stress σ of a value 100MPa. Estimate the magnitude of stress at a point p as shown in Fig Q2(b) for the condition :

i) a = b ii) $a = \frac{1}{10}b$ iii) a = 10b

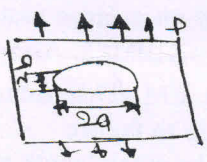

Fig Q2(b)

(06 Marks)

c. List various method of NDT. Explain any one. **(04 Marks)**

Module-2

3 a. Explain Dugdale's plastic strip model and show that internal stress must be equal the yield strength of material. **(08 Marks)**

b. Explain plastic zone shape for plane stress according to Vonmises criteria. **(08 Marks)**

OR

4 a. A thick center cracked plate of high strength A1 Alloy is 20mm void and contain crack of length 80mm. if it feel IS at applied stress of 100MPa. What is the fracture toughness of alloy? What values of applied stress could the produced fracture for the sample length of crack in a i) Infinite body ii) 120mm wide plate. **(06 Marks)**

b. Explain General test procedure for stress intensities fracture K_{IC}. **(10 Marks)**

Module-3

5 a. Determine the energy release rate for double cantilever beam specimen. **(08 Marks)**

b. Define J. integral. Show that J integral is path dependent. **(08 Marks)**

OR

6 a. Define CTOD and explain. **(05 Marks)**
b. Derive the relation for non-linear energy release rate for Elastic mode – I loading. **(06 Marks)**
c. Explain R-Curve Analysis. **(05 Marks)**

Module-4

7 a. Explain Dynamic fracture toughness and crack arrest toughness. **(05 Marks)**
b. Explain briefly crack branching. **(06 Marks)**
c. Write the principle of crack arrest. **(05 Marks)**

OR

8 a. A 3mm thick crack panel 10cm wide containing edge crack of 1mm yield at a load of 150kN however at a load of 120kN another panel of same material cracked into 2 pieces when crack was 5mm fracture. Calculate yield stress and fracture toughness of material. **(08 Marks)**
b. Explain different type of crack arrest. **(04 Marks)**
c. Write a short note on Dynamic energy release rate. **(04 Marks)**

Module-5

9 a. An edge crack, detected on a large plate is of length 3.1mm under a constant amplitude cyclic load having σ_{max} = 310MPa. And σ_{min} = 172MPa. If plat is made of a ferrite, paralite steel and K_{IC} = 165 MPa $\sqrt{M}$. Determine:
i) Propagation life up to failure
ii) Propagation life the crack length a is not allowed to exceed 25mm
Use C = 6.8×10^{-2} M = 3, f = 1.12. **(10 Marks)**
b. Explain factor affecting fatigue performance. **(06 Marks)**

OR

10 Write short note on the following (Four)
a. Variabel amplitude loading.
b. Carack Growth behavior
c. Life estimation
d. Crack closure
e. Mixed mode loading **(16 Marks)**

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16MTP424

Fourth Semester M.Tech. Degree Examination, June/July 2018
Experimental Methods in Thermal Power Engineering

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain briefly the generalized measurement system with schematic diagram. **(10 Marks)**
b. Show the signal flow diagram of measurement system. **(06 Marks)**

OR

2 a. Sketch and explain different pressure measurement instruments and give their comparison. **(08 Marks)**
b. Explain with sketch the dead-weight tester for pressure measurement. **(08 Marks)**

Module-2

3 a. With a neat diagram, explain the working of optical pyrometer. **(10 Marks)**
b. Explain the effect of heat transfer on temperature measurement. **(06 Marks)**

OR

4 a. Explain with neat sketch the measurement of thermal conductivity by guarded hot plate apparatus. **(08 Marks)**
b. Explain the working of pH measurement by using pH meter with neat sketch. **(08 Marks)**

Module-3

5 a. With the help of schematic diagram, explain the working principle of Laser Doppler Anemometer (LDA). **(10 Marks)**
b. Explain with a neat sketch, the working of pitot static tube. **(06 Marks)**

OR

6 a. Explain the method of detection of nuclear radiation by Geiger – Muller counter. **(08 Marks)**
b. Explain with neat sketch, instrument for measurement of torque on rotating shaft. **(08 Marks)**

Module-4

7 a. Explain the types of experimental errors normally encountered in experimental measurement and mention their causes. **(10 Marks)**
b. Briefly explain the uncertainty analysis of experimental data. **(06 Marks)**

OR

8 a. Explain the photoelectric transducer converter with neat sketch. **(08 Marks)**
b. With a neat sketch explain the principle working of photovoltaic cell. **(08 Marks)**

Module-5

9 a. With a block diagram, explain general air-sampling train. **(06 Marks)**
b. Explain with neat sketch the working of gas chromatography. **(10 Marks)**

OR

10 Explain experimental design protocols with example. **(16 Marks)**

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14ECS41

Fourth Semester M.Tech. Degree Examination, June/July 2018
Error Control Coding

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Define Groups and Fields. Construct a group under mod – 7 multiplications. **(10 Marks)**

b. Construct a table of GF(2^4) based on primitive polynomial $p(x) = 1 + x + x^4$. Display power, polynomial and vector representation of each dement. **(10 Marks)**

2 a. For a systematic (7, 4) LBC the parity matrix is given by

$$P = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

i) Find all possible code vectors
ii) Draw encoding circuit
iii) Find minimum distance of code
iv) Find error detecting and correcting capability. **(10 Marks)**

b. A (6, 3) LBC has following check bits

$v_4 = u_1 + u_2 \quad v_5 = u_1 + u_3 \quad v_6 = u_2 + u_3$

i) Find G and H matrices
ii) Draw syndrome calculation circuit
iii) How many errors can it detect and correct?
iv) Detect and correct single error present in received vector r = (101110). **(10 Marks)**

3 a. For a (7, 4) cyclic code the generator polynomial is $g(x) = 1+x+x^3$. Find code vector for the message (1001) both in systematic and non-systematic form. **(10 Marks)**

b. A (15.5) cyclic code has generator polynomial $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$.

i) Draw syndrome calculation circuit
ii) Is $v(x) = 1 + x^4 + x^6 + x^8 + x^{14}$ a code polynomial? **(10 Marks)**

4 a. Let 'α' be primitive dement of Galois field GF(2^4) such that $1 + \alpha + \alpha^4 = 0$. If the minimum polynomials of α and α^3 are $\phi_1(x) = 1 + x + x^4$ and $\phi_3(x) = 1 + x + x^2 + x^3 + x^4$.

i) Compute the generator polynomial for double error correcting (15, 7) binary BCH code.
ii) Compute the syndrome for error correction if the received vector is r = [100000001000000]. **(12 Marks)**

b. Write short note on RS code. **(08 Marks)**

5 a. With neat sketch, explain the general type – I one –step majority logic decoder. **(10 Marks)**

b. For a (7, 4) cyclic code the generator polynomial is $g(x) = 1 + x + x^3$. The parity check matrix (in systematic form) in given by

$$H = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 \end{bmatrix}$$

Construct a type – II two step majority logic decoder for this hamming code. **(10 Marks)**

6 a. For a (3, 2, 1) encoder, shown in Fig Q6(a), find the code word for input sequence $u^{(1)} = 101$ and $u^{(2)} = 110$ using i) time domain approach ii) Transfer domain approach. **(14 Marks)**

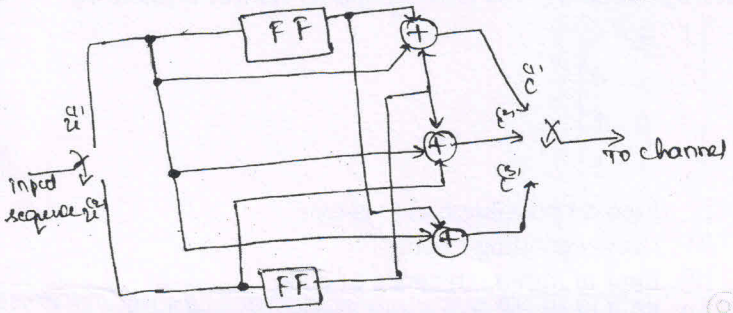

Fig Q6(a)

b. Explain the viterbi algorithm. **(06 Marks)**

7 a. With neat sketch, explain the basic turbo encoding structure. **(10 Marks)**

b. With neat sketch, explain the multilevel concatenated encoder. **(10 Marks)**

8 Write short notes on the following :

a. Fire codes

b. Burst error correcting codes

c. Binary RS codes

d. Interleaving technique. **(20 Marks)**

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