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6E7011

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6E7011

B.Tech. VI Semester (Main/Back) Examination, April/May - 2017

Mech. Engg.

6ME1A Design of m/c Element II

AE, ME, PI

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

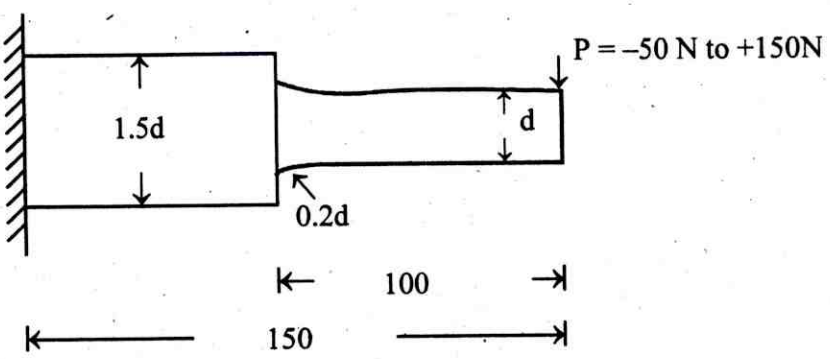
Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit-I

1. a) Explain modified goodman diagram for bending stresses. **(6)**

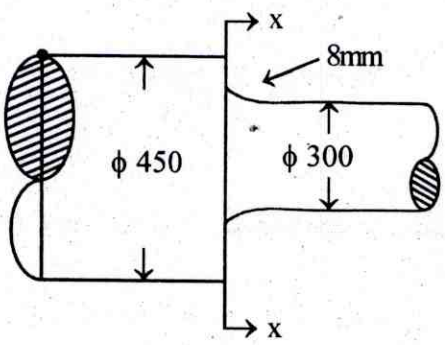
b) A cantilever beam made of cord drawn steel 40C8 (S_{ut} = 600N/mm^2 and S_{yt} = 380 N/mm^2) as shown in fig. The force P acting at the free end varies from – 50N to + 150N. The expected Reliability is 90% and factor of safety is 2. Notch sensitivity at fillet is 0.9. Determine diameter of beam at the fillet cross section. **(10)**



(OR)

1. a) What is endurance strength? Draw S-N diagram, What are the factors that affect endurance strength. **(8)**

b) The section of a steel shaft is shown in fig



The shaft is machined by a turning process. The section x-x is subjected to a constant bending moment of 500kN-m, the shaft material has $S_{ut} = 500MN/m^2$ & $S_{yt} = 350MN/m^2$ and endurance limit in bending for 7.5mm diameter specimen of 210 MN/m^2. Notch sensitivity is 0.8. Expected reliability is 90%. Determine life of shaft. Theoretical stress concentration factor can be taken from tabulated values. **(8)**

r/d	0.025	0.05	0.1
k_t	2.6	2.05	1.66

Unit-II

2. a) Explain Buckling of connecting rod. also prove for connecting rod cross section that $3.2\ I_{yy} = I_{xx}$. **(6)**

b) Design a connecting rod for a high speed I.C engine using following data.

Cylinder bore = 125mm, length of connecting rod = 300mm

Max. gas pressure = 3.5 MPa, length of stroke = 125mm

Mass of reciprocating parts = 1.6kg, engine speed = 2200 rpm

Assume suitable data and state the assumptions you made. **(10)**

(OR)

2. a) The cylinder of a four stroke diesel engine has the following specification :

Brake power 7.5 kW, Speed = 1400rpm, Indicated mean eff. pr. = 0.35MPa η_{mech} = 80%, Max. gas pr. = 3.5 MPa. The cylinder liner and head are made of grey cast Iron FG 260 (S_{ut} = 260N/mm^2 and μ = 0.25) the studs are made of plain carbon steel 40C8 (S_{yt} = 380N/mm^2). Factor of safety for all parts is 6. Calculate : **(8)**

i) Bore and length of cylinder liner

ii) Thickness of cylinder liner

iii) Thickness of cylinder head

iv) Size, number and pitch of studs

b) Design a cost iron piston for a single acting four stroke diesel engine with the following data.

Cylinder bore = 300mm, length of stroke = 450mm, speed = 300rpm.

IMEP = 0.85MPa, Max. gas pr. = 5MPa, fuel consumption = 0.3kg/BP/hr.

Higher calorific value of fuel = 44000 kJ/kg.

Assume suitable data and state the assumptions. **(8)**

Unit-III

3. a) Explain spring design against fluctuating load also draw fatigue diagram for spring. **(6)**

b) A railway wagon moving at a velocity of 1.5m/s is brought to rest by a bumper consisting of two helical springs arranged in parallel. The mass of wagon is 1500kg. The springs are compressed by 150mm is bringing the Wagon to rest. The spring index can be taken as 6. The springs are made of oil hardened and tempered Steel wire with S_{ut} = 1250 N/mm^2 and modulus of rigidity = 81370N/mm^2. The permissible shear stress for spring wire can be taken as 50% of S_{ut}. Design spring and calculate. **(10)**

i) Wire diameter

ii) Mean coil diameter

iii) Number of active coils

iv) Total number of coils

v) Solid length

vi) Free length

vii) Pitch of coil

viii) Required spring rate

ix) Actual spring rate

(OR)

3. a) Prove that for Belt drive - **(8)**

$$\frac{P_1 - mv^2}{P_2 - mv^2} = e^{\mu\theta}$$

Where P_1 and P_2 are tension in tight and slack side

$\mu \rightarrow$ coefficient of friction

$\theta \rightarrow$ Angle of lap

$m \rightarrow$ mass per meter of belt

b) It is required to design a V-Belt drive to connect a 7.5kW, 1440 rpm induction motor to a fan, running at approximately 480rpm, for a service of 24h/day. Space available for a center distance is about 1m. **(8)**

Unit-IV

4. a) Derive lewis equation for Beam strength of gear. **(6)**

b) It is required to design a pair of spur gear with 20° full depth involute teeth consisting of 20 teeth pinion meshing with 50 tooth gear. The pinion shaft is connected to a 22.5kW, 1450rpm electric motor. The starting torque of motor can be taken as 150% of rated torque. The material for pinion is plain carbon steel Fe410 (S_{ut} = 410N/mm^2). While gear made of grey cast iron FG200 (S_{ut} = 200N/mm^2). Factor of safety = 1.5, design of gear based on Lewis equation & using velocity factor to account for dynamic load. **(10)**

(OR)

4. a) Explain following : **(8)**

i) Herring bone-gear

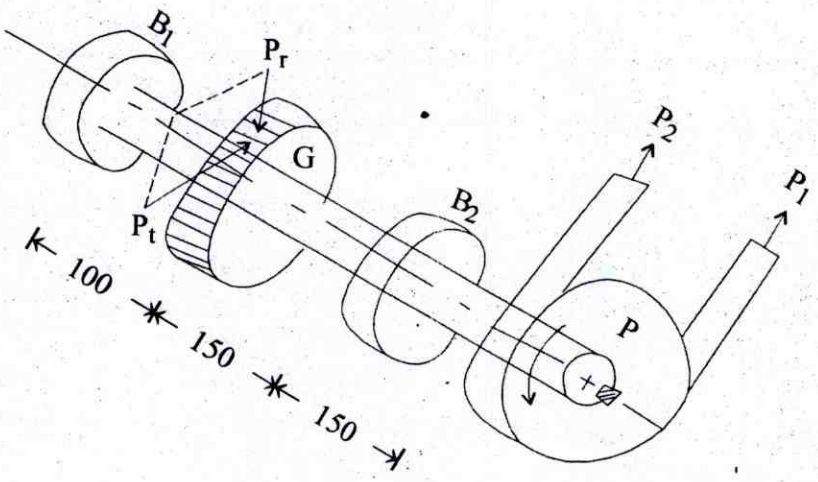
ii) Wear strength of helical gear

b) A pair of parallel helical gears consisting of a 20teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720rpm. The normal pr. angle is 20°. While helix angle is 25°. The face width is 40mm and the normal module is 4mm. The pinion as well as gear made of 40C8 (S_{ut} = 600N/mm^2). and heat treated to surface hardness of 300BHN. The service factor and factor of safety are 1.5 and 2 respectively. Assume velocity factor account for dynamic load and calculate power transmitting capacity of gears. **(8)**

Unit-V

5. a) Write short note on Mounting of Bearings. **(6)**

b) A transmission shaft rotating at 720rpm and transmitting power from the pulley p to the spur gear G as shown in fig. the Belt tensions and gear tooth forces are as follows $P_1 = 498N$, $P_2 = 166N$, $P_t = 497N$, $P_r = 181N$. The weight of the pulley is 100N. The diameter of shaft at Bearing B_1 & B_2 is 10mm & 20mm respectively. The load factor is 2.5and the expected life for 90% of Bearing is 8000 hrs. Select single row deep groove ball bearings at B_1 & B_2. **(10)**



(OR)

5. a) Derive Petroff's equation for sliding contact Bearings. **(8)**

b) The following data is given for a 360° Hydrodynamic bearings.

radial load = 10kN

Viscosity of Lub. = 30 mPa–S

Journal speed = 1440 rpm

Unit Bearing pr. = 1000 kPa

Clearance ratio (r/c) = 800

Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing calculate- **(8)**

i) Dimensions of bearings

(6)

ii) Coeff. of friction

iii) Power lost in friction

iv) Total oil flow

v) Side leakage and

vi) Temperature rise

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B.Tech. VI Semester (Main & Back) Examination, April/May-2017

Mechanical Engineering

6ME2A Newer Machining Methods

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.*

Unit-I

1. a) Why newer machining methods are also known as unconventional machining method? Elaborate your answer. **(8)**

b) Classify modern machining processes and show mechanism of metal removal, energy source of various modern machining processes. **(8)**

OR

1. a) Explain the abrasive action in Abrasive Flow Machining (AFM) process. **(8)**

b) Describe briefly Magnetic Abrasive Finishing (MAF) process for finishing internal surface of hollow cylindrical surface/workpiece. **(8)**

Unit-II

2. a) What is abrasive slurry in ultra sonic Machining (USM)? State clearly the functions of liquid medium in USM. **(8)**

b) Explain how Amplitudes and frequency of vibrations effect the material removal rate (MRR) of USM. **(8)**

OR

2. a) Discuss the effect of stand off distance (SOD) on material removal rate (MRR) in abrasive jet machining (AJM). Also discuss the parameters of nozzle design for AJM. **(8)**

b) What is the principle of water jet machining (WJM). Explain the role of pump and nozzle in WJM. **(8)**

Unit-III

3. a) Elaborate the mechanism of metal removal in EDM process. **(8)**

   b) Briefly describe the Generators in EDM process. **(8)**

OR

3. a) How electron beam in generated in Electron Beam Machining (EBM) process. State the role of magnetic deflection coil with suitable sketch. **(8)**

   b) What is plasma torch in Plasma Arch Machining (PAM) process? Discuss the generation of plasma in PAM. **(8)**

Unit-IV

4. a) Explain the role of Tool-work gap in Electro Chemical Machining (ECM) with neat sketch. **(8)**

   b) Briefly discuss the electrochemical machining of iron using sodium chloride as electrolyte stating the chemical processes. **(8)**

OR

4. a) What are the important factors for designing the tool in ECM process. Explain with proper diagram. **(8)**

   b) Describe the working principle of Electro Chemical Grinding (ECG) process. **(8)**

Unit-V

5. a) Briefly explain Micro drilling and Micro milling. **(8)**

   b) What are benefits & special features of Nano machining. **(8)**

OR

5. a) Discuss with proper sketches the evaluation of subsurface damages in Nano and Micro machining. **(8)**

   b) Write short notes on **(8)**

      i) Nano scale cutting

      ii) Micro turning

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B.Tech. VI Semester (Main/Back) Examination, April/May-2017

Mechanical Engineering

6ME3A Mechatronics

ME,PI

Time : 3 Hours **Maximum Marks : 80**
Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit-I

1. a) What is 'Mechatronics'? Explain the components of a mechatronic system. **(8)**

b) Describe in detail MEMS. **(8)**

OR

1. a) What is control system? Give the comparison between 'Open-loop' and 'Closed-loop' control systems. **(8)**

b) Explain in detail the scope and importance of mechatronic system. **(8)**

Unit-II

2. a) Give classification of sensors and transducers. List main characteristics of generally used transducers. **(8)**

b) Write a short note on Hydraulic and pneumatic actuators. **(8)**

OR

2. a) List various types of temperature sensors. Give the comparison between RTD and thermocouple. **(8)**

b) Write a short note on electrical and mechanical actuators. **(8)**

Unit-III

3. a) Discuss in detail the role of controls in mechatronic system. What do you mean by digital control system. **(8)**

   b) Explain in detail the digital signal processing. What are the operations used in digital signal processing? **(8)**

OR

3. a) Explain an artificial neural network with suitable examples. List the major advantages of neural network. **(8)**

   b) What is adaptive control system? Also explain the fuzzy systems. **(8)**

Unit-IV

4. a) What is the necessity of 'Signal conditioning'? Explain briefly the processes usually adopted in signal conditioning. **(8)**

   b) Write down the performance specifications and common applications of digital to analog converters. **(8)**

OR

4. a) What is 'Data acquisition system'? Explain single channel data acquisition system with a neat block diagram. **(8)**

   b) What is data logger? Explain the computer based instrumentation system. **(8)**

Unit-V

5. a) Explain the design of an elevator system with neat block diagram. **(8)**

   b) Discuss the design and working of an aeroplane. **(8)**

OR

5. a) Discuss the design of a tank fluid level control system with neat sketch. **(8)**

   b) Write a short note on CNC lathe, describing its working and control methods. **(8)**

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B.Tech. VI Semester (Main & Back) Examination, April/May-2017

Mechanical Engineering

6ME4A Vibration Engineering

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly.) Units of quantities used/calculated must be stated clearly.*

Unit-I

1. a) Enlist the major noise sources in industrial environment. What control measures can be adopted for noise control at the source? **(8)**

   b) What do you understand by sound pressure dependent human response? Derive the relationship between sound power level and sound intensity level. **(8)**

OR

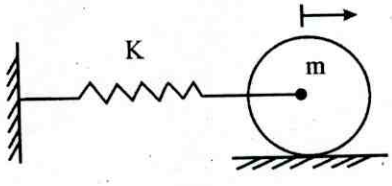
1. a) For the complex numbers $z_1 = (1 + 2i)$ and $z_2 = (3 - 4i)$, find the ratio z_1/z_2 and express the result in the form of $Ae^{i\theta}$. **(8)**

   b) Find the sum of the two harmonic motions $x_1(t) = 5 \cos (3t + 1)$ and $x_2(t) = 10 \cos (3t + 2)$ using trignometric relations. **(8)**

Unit-II

2. a) A spring-mass system k_1, m_1 has a natural frequency 'f_1'. Calculate the value of k_2, another spring which when connected to k_1 in series decreases the frequency by 20%. **(8)**

   b) A circular cylinder of mass 4kg and radius 12cm is connected by a spring of stiffness 6000 N/m as shown in figure. It is free to roll on horizontal rough surface without slipping, determine the natural frequency. **(8)**



OR

2. a) A vibrating system is defined by the following parameters : m = 3kg, k = 100 N/m and c = 3 N-sec/m. Determine **(8)**

   i) the damping ratio

   ii) the natural frequency of damped vibration

   iii) logarithmic decrement

   iv) the number of cycles after which the original amplitude is reduced to 20 percent.

   b) A body of mass m = 1kg, lies on a dry horizontal plane and is connected by spring to a rigid support. The body is displaced from the unstressed position by an amount equal to 0.25 m with the tension of 50 N in the spring for this new position. How many complete cycles of motion will be performed after being released from this position. How much time it will take to perform this motion if the coefficient of friction is 0.25? **(8)**

Unit-III

3. a) Derive the relation for force transmissibility and draw a neat plot of the force transmissibility ratio with frequency ratio for different values of damping. **(8)**

   b) A 70 kg machine is mounted on a springs of stiffness $k = 14 \times 10^5$ N/m with an assumed damping factor of $\zeta = 0.20$. A 2kg piston within the machine has a reciprocating motion with a stroke of 0.08m and a speed of 2700 rpm. Assuming the motion of the piston to be harmonic, calculate the amplitude of vibration of the machine and the vibratory force transmitted to the foundation. **(8)**

OR

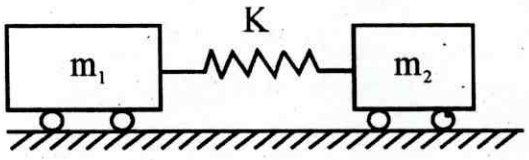
3. a) A 100 kg machine is mounted at the midspan of a 2.0 m long simply supported beam of elastic modulus $E = 200 \times 10^9$ N/m^2 and cross section moment of inertia $I = 2 \times 10^{-6}$ m^4. This system during an experiment was subjected to a harmonic excitation magnitude 2000 N at different excitation frequency. The largest steady-state amplitude recorded during experiment was 2.4 mm. Determine the damping ratio of the system. **(8)**

   b) A spring - man - damper system is subjected to a harmonic force. The amplitude is found to be 20 mm at resonance and 10 mm at a frequency 0.75 times the resonant frequency. Find the damping ratio of the system. **(8)**

Unit-IV

4. a) With the help of suitable mathematical derivation explain the principle of undamped dynamic vibration absorber. **(8)**

b) Determine the natural frequencies and mode shaper of the system shown in figure. **(8)**



$m_1 = 5$ kg

$m_2 = 10$ kg

$k = 3000$ N/m

Comment on the rigid body mode obtained.

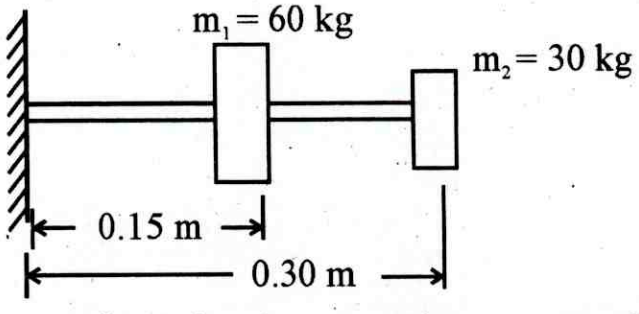
OR

4. a) Derive the mathematical relationship between the deflection of the geometric centre and the eccentricity with other system parameter for a single rotor shaft with damping. **(8)**

b) A rotor has a mass of 10 kg mounted midway on a 24 mm diameter horizontal shaft supported at the ends by two bearings which are 1m apart. The shaft rotates at 2400 rpm. If the centre of mass m of the rotor is 0.12mm away from geometric centre of the rotar due to certain manufacturing defects, find the amplitude of the steady state vibration and dynamic force transmitted to the bearing. Take $E = 200$ GN/m^2. **(8)**

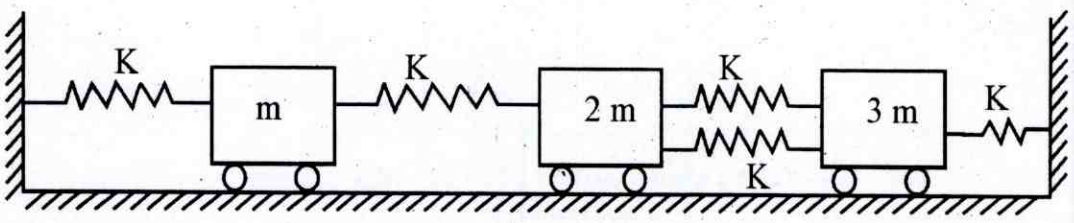
Unit-V

5. a) Find the lowest natural frequency of the system shown in figure using dunkerley's method. **(8)**



Take $E = 2 \times 10^{11}$ N/m^2 and cross section moment of inertia of the beam $I = 4 \times 10^{-7}$ m.

b) Draw the free body diagram of each of the mass shown in the following many degrees of freedom system shown in figure. Derive the governing differential equation of motion using Newton's law of motion. Arrange thus obtained equation in matrix form. **(8)**



OR

5. Derive the governing equation of motion for the torsional vibration of a shaft. Obtain the frequency equation and mode shape for the shaft fixed at one end while free at the other end. **(16)**

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B.Tech. VI Semester (Main/Back) Examination, April/May - 2017

Mechanical Engineering

6ME5A Steam Engineering

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1) Steam table & Mollier chart *2) Property table*

Unit-I

1. a) List the advantages and disadvantages of fire-tube and water-tube Boilers. **(8)**

b) What is circulation? Differentiate between natural and forced circulation boiler. **(8)**

(OR)

1. a) What are the function of steam drum? **(4)**

b) Write short note on : **(4+4+4=12)**

i) Economizers.

ii) Pre heater

iii) Steam super heater

Unit-II

2. a) Discuss following : **(3+3=6)**

i) Steady flow energy equation in nozzles.

ii) Momentum equation for the flow through steam nozzle.

b) A convergent - Divergent nozzle expands steam from 14 bar and 300°c to 6 bar. If the flow rate is 1 kg/s. Find the throat and exit area. What should be the coefficient of velocity if the exit velocity is 550m/s? **(10)**

(OR)

2. a) Explain the physical significance of chocked flow. Discuss about the flow through convergent divergent nozzle. **(8)**

   b) Explain the term nozzle and diffuser efficiency. Mention the types of nozzle you know. **(8)**

Unit-III

3. a) What is the principle of operation of steam turbine. **(6)**

   b) Give the classification of steam Turbines. **(10)**

(OR)

3. a) What do you mean by throttle governing in steam Turbine? **(6)**

   b) The data pertaining to an impluse turbine is as follow : **(10)**

   Blade speed, 300 m/s; isentropic enthalpy drop, 450 kJ/kg; Nozzle efficiency, 0.9; Nozzle angle 20°; blade velocity coefficient, 0.85; blade exit angle, 25°.

   Calculate for a mass flow 1Kg/s

   i) The inlet angle of moving blade

   ii) Axial thrust

   iii) Driving force and power

Unit-IV

4. a) Explain stage velocity and force diagram for a impulse-reaction turbine with neat sketch. **(8)**

   b) What is the condition of maximum gross stage efficiency in parson's reaction turbine? **(8)**

(OR)

4. a) Discuss the saving in Heat Rate from regenerative heating. **(4)**

   b) Dry and saturated steam enters a steam turbine at 40bar and exhausts at 0.07 bar. It is planned to use a regenerative feed heating system employing three heaters.**(12)**

   i) Design suitable extraction points and estimate the mass of steam taken by the heater per kg of feed.

ii) Find efficiency of the regenerative cycle.

Unit-V

5. a) Explain with neat sketch reheat-regenerative feed heating cycle. Also draw T-s & h-s diagram. **(8)**

b) Steam is supplied to a turbine at a pressure of 32 bar and a temperature of 410°C. If the steam is reheated at 5.5 bar to a temperature of 395°C and then expands isentropically to a pressure of 0.08 bar. What is the dryness fraction at the end of expansion and Thermal efficiency of the cycle? **(8)**

(OR)

5. a) With the help of diagram explain Regenerative water extraction cycle. Derive expression for its efficiency. **(8)**

b) Draw neat sketch following : **(4+4=8)**

i) Pass out Turbine.

ii) Binary Vapour cycle.

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B.Tech. VI Semester (Main /Back) Examination, April/May-2017
Mechanical Engineering
6ME6.1A Non Destructive Evaluation and Testing
ME, PI

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any five **questions**, selecting **one question** from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit-I

1. a) Explain the principle of visual inspection and its applications. **(8)**
   b) Explain various types of defects in non-destructive evaluation. **(8)**

(OR)

1. a) Explain liquid penetrant testing with its limitations and applications. **(8)**
   b) NDT methods used for evaluation of materials and composites. **(8)**

Unit-II

2. a) Describe the principle of X-ray radiography and explain the equipments used in it. **(8)**
   b) Explain the radiographic procedure used in industries and also mention its limitations and applications. **(8)**

(OR)

2. a) Describe the X-ray film processing. **(8)**
   b) What are the general procedure of radiographic **(8)**

Unit-III

3. a) Describe the ultrasonic testing with neat sketch and its applications. **(8)**
   b) What is scanning and its types. **(8)**

(OR)

3. a) Explain the principle of wave propagation. **(8)**

   b) Explain welding inspection and Tube inspection. **(8)**

Unit-IV

4. a) Explain magnetic particle inspection technique with neat sketch. **(8)**

   b) Describe the Interpretation and evaluation. **(8)**

(OR)

4. Describe the Acoustic emission testing and Thermography. **(16)**

Unit-V

5. a) Explain the principle of eddy current testing. **(8)**

   b) What is the application of eddy current NDT. **(8)**

(OR)

5. Write short notes on : **(16)**

   a) Factor affecting the eddy current testing

   b) Standardization and calibration

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6E3053

B.Tech. VI Semester. (Back) Examination, April / May-2017

Mechanical Engineering.

6ME5(O) Hydraulic Machines & Hydroelectric Power Plant

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) Show that when a jet of water impinges on a series of curved vanes, maximum efficiency is obtained when the vane is semicircular in section and the velocity of the vane is half that of the jet. **(7)**

b) A jet of water of 75mm diameter with a velocity of 20m/sec strikes a flat smooth plate. Determine the thrust on the plate, if the plate is moving in the same direction as the jet with a velocity of 5m/s. Also find the work done per second on the plate and the efficiency of the jet. **(9)**

OR

1. a) Obtain an expression for unit speed, unit discharge and unit power for a turbine. **(6)**

b) A Pelton wheel is revolving at a speed of 190 rpm and develops 5150.25 KW when working under a head of 220m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. The speed ratio for the turbine is given as 0.47. Find the speed, discharge and power when this turbine is working under a head of 140 m. **(10)**

Unit - II

2. a) Describe briefly the functions of various main components of Pelton turbine. **(7)**

b) Design a Pelton wheel with the following data **(9)**

Shaft power = 11772 kW, Head = 380 m, Speed = 750 rpm,

Overall efficiency 86%, D/d = 6, Cv = 0.985, $\phi = 0.45$

Determine D, d and no of jets.

OR

2. a) What is Governing? Explain the methods of Governing of impulse turbine. **(8)**

b) A Pelton wheel is having a mean bucket diameter of 1 m and is running at 1000 rpm. The net head on the Pelton wheel is 700m. If the jet deflection angle is 165° and discharge through nozzle is 0.1 m^3/s, find : **(8)**

i) Power available at the nozzle, and

ii) Hydraulic efficiency of the turbine.

Unit - III

3. a) A Kaplan turbine runner is to be designed to develop 7357.5 kW shaft power. The net available head is 5.5 m. Assume the speed ratio is 2.09 and flow ratio is 0.68, and the overall efficiency is 60%. The diameter of the boss is $1/3^{rd}$ of the diameter of the runner. Find the diameter of the runner and its speed. **(8)**

b) A water turbine has a velocity of 6m/s at the entrance to the draft tube and a velocity of 1.2m/s at the exit. For friction losses of 0.1m and tail water 5m below the entrance to the draft tube, find the pressure head at the entrance. **(8)**

OR

3. a) An inward flow reaction turbine has external and internal diameters as 1m and 0.5m respectively. The velocity of flow through the runner is constant and is equal to 1.5m/s. Determine **(8)**

i) Discharge through the runner, and

ii) Width of the turbine at outlet if the width of the turbine at inlet = 200mm.

b) What do you understand by the characteristic curves of a turbine? Explain the important types of characteristics curves. **(8)**

Unit - IV

4. a) Obtain an expression for the saving in work done against friction without air vessel and with air vessel in a single acting reciprocating pump. **(8)**

   b) A double acting reciprocating pump, running at 50rpm, delivers 8.4 liters/s of water. The dia of piston is 150 mm and stroke length 300 mm. The static head of the pump is 25m. The suction pipe is 5m long and 100 mm in diameter. Find the percentage slip and power required to run the pump. Also calculate the acceleration head at the beginning of the suction stroke. **(8)**

OR

4. a) Differentiate between a hydraulic ram and a centrifugal pump. Obtain an expression for the efficiencies of the hydraulic ram. **(8)**

   b) How does a torque converter differ from a fluid coupling? Explain the working principle of torque converter with the help of neat sketch. **(8)**

Unit - V

5. a) What are the various components of hydroelectric power station? Explain with the help of neat & clean diagrams and layout. **(8)**

   b) What do you mean by hydrological cycle and hydrographs? Explain in detail. **(8)**

OR

5. a) What are the different parameters for selection of site for hydroelectric power plant? Explain. **(6)**

   b) Write a short note for present scenario of hydro-power in India. **(10)**

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B.Tech. VI Semester (Back) Examination, April/May-2017
Mechanical Engineering
6ME6(O) Numerical Methods and Applied Statistics

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. *Probability distribution table*
2. *t-distribution, F-distribution Normal distribution*

Unit-I

1. a) Apply Newton - Rephson method to solve the equation $2(x-3)=\log_{10} x$ correct to three decimal places. **(8)**

   b) Using the method of false-position, find the root of equation $xe^x - 2 = 0$. **(8)**

OR

1. a) Find all the roots of the equation $x^4 - 3x + 1 = 0$ by using Graeffe's methods. **(8)**

   b) Find the roots of the equation $x^3 - 9x + 1 = 0$ between $x = 2$ and $x = 4$ by the using bisection method. **(8)**

Unit-II

2. a) Solve the system of equations : **(8)**

   $x + y + z = 1, 4x + 3y - z = 6, 3x + 5y + 3z = 4$ by using partition methods. **(8)**

   b) Use Bessel formula to find y_{25} from the following data $y_{20} = 24$, $y_{24} = 32$, $y_{28} = 35$, $y_{32} = 40$. **(8)**

OR

2. a) Using Lagrange's formula; find the value of $f(5)$ from the following table: **(8)**

x	:	1	2	3	4	7
$f(x)$	:	2	4	8	16	128

b) Compute the largest eigen value and the corresponding eigen vector of the following matrix **(8)**

$$A=\begin{bmatrix} 3 & 1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$$

Unit-III

3. a) Use Simpson's $\frac{1}{3}$ and '3/8' rule to Evaluate the following $\int_0^1 \frac{dx}{1+x^2}$ Hence determine the value of π in each case. **(8)**

b) Use Picard's method to solve $\frac{dy}{dx}=1+xy$ with $x_0=2, y_0=0$. **(8)**

OR

3. a) Evaluate the following integral by using Gauss-three point quadrature rule $\int_0^1 \frac{dx}{1+x}$. **(8)**

b) Use Milne's p–c method to obtain $y(0.4)$ by solving $\frac{dy}{dx}=2e^x-y$ Given that $y(0)=2, y(0.1)=2.01, y(0.2)=2.04, y(0.3)=2.09$. **(8)**

Unit-IV

4. a) Calculate the first four moments about the mean for the following distribution: **(8)**

x:	6	7	8	9	10	11	12
y:	3	6	9	13	8	5	4

b) Derive mean and variance for Normal distribution. **(8)**

OR

4. a) Calculate Rank correlation coefficient for the following data : **(8)**

x	81	78	73	73	69	68	62	58
y	10	12	18	18	18	22	20	24

b) Six dice are thrown 729 times. How many time do you expect at least three dice to show a 5 or 6. **(8)**

Unit-V

5. a) If 'θ' is the acute angle between the two regression lines in case of two variable x and y show that $\tan\theta = \left(\frac{1-r^2}{r}\right)\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}$. Where $r, \sigma_x\sigma_y$ have their usual meanings. Explain the significance of the formula when $r = 0$ and $r = \pm 1$. **(8)**

b) Test made on the breaking strength of 10 pieces of a metal give the following results 578, 572, 570, 568, 572, 570, 572, 596, 570 and 584 kg. Test if the mean breaking strength of the wire can be assumed as 577 kg. **(8)**

OR

5. a) With the help of the following data : **(8)**

x	1	5	3	2	1	1	7	3
y	6	1	0	0	1	2	1	5

i) Fit the two regression lines.

ii) Calculate karl pearson coefficient.

iii) Find explained and unexplained variation.

b) Two random samples give the following data : **(8)**

Sample number	Size	Mean	Varience
1	8	9.6	1.2
2	11	16.5	2.5

Perform t - text to establish whether two samples have been drawn from the same normal population or not.