CBCS Scheme

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15ME51

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Management and Engineering Economics

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use of chart is permitted.*

Module-1

1 a. Define Management and bring out its nature and characteristics. **(08 Marks)**
b. Explain the Modern Management Approaches. **(08 Marks)**

OR

2 a. Briefly explain the important steps in planning. **(08 Marks)**
b. What are the types of decision? Explain with example. **(08 Marks)**

Module-2

3 a. Briefly explain the principles of organization. **(08 Marks)**
b. What is Recruitment? Explain the recruitment process. **(08 Marks)**

OR

4 a. Explain the different leadership styles. **(08 Marks)**
b. Explain the essentials of a sound control system. **(08 Marks)**

Module-3

5 a. With the help of sketch, explain the problem solving process in decision making. **(08 Marks)**
b. A Professor is planning for his retired life, he has 15 more years of service. He would like to deposit 20% of salary, which is Rs 15000 at the end of First year and thereafter he wishes to increase his deposit by Rs 2500 more every year along with Rs 15000 for the next 14 years. What will be the maturity amount of this deposit, if the interest rates are 10% and 14% per year? **(08 Marks)**

OR

6 a. Briefly explain the law of supply and demand. Enlist the demand determinants. **(08 Marks)**
b. Determine the effective interest rate for a nominal annual rate of 8% that is compounded :
i) Daily (Assume 365 days/year) ii) Monthly iii) Quarterly iv) Semi – Annually. **(08 Marks)**

Module-4

7 a. Explain the conditions for present worth comparisons. **(08 Marks)**
b. The lease on a warehouse amounts to Rs 5000 per month for five years. If the payments are made on the first of each month, what is the future worth at the end of five years at 12% interest rate compounded monthly? **(08 Marks)**

OR

8 a. Explain IRR, ERR and MARR. Enlist the misconcepts of IRR. **(08 Marks)**
b. A farm house can be purchased for Rs 90,000 and expected resale value after 20 years is Rs 60,000. If the annual rental income is Rs 11800 and expenses Rs 4700. What will be the rate of return earned on this farm house? **(08 Marks)**

Module-5

9 a. Explain how the selling price is fixed for a job, giving all the components of cost, with suitable example. **(08 Marks)**

b. A firm is producing 100 units per day. The direct material cost is found to be Rs 160. The direct labour cost is Rs 200. The factory overheads chargeable to it is Rs 250. If the selling expenses are 40% of the factory cost, what must be the selling price of each unit to realize a profit of 15% of selling price? **(08 Marks)**

OR

10 a. What is Depreciation? List and discuss the causes of depreciation. **(08 Marks)**

b. The initial cost of machine is Rs 25000 and it will have a salvage value of Rs 2000 after a period of six years. Using reducing balance method, calculate the book value of the machine at the end of each year and plot a graph of depreciation against number of years. **(08 Marks)**

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CBCS Scheme

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15ME52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the equilibrium with respect to two force of three force member. **(02 Marks)**

b. A four link mechanism with the following dimensions is acted upon by a force 80N 150° on the link DC. Determine the input torque on the link AB for the static equilibrium of the mechanism for the given configuration. AB = 400mm ; BC = 1000mm, CD = 750mm and DE = 350mm, AD = 500mm. **(14 Marks)**

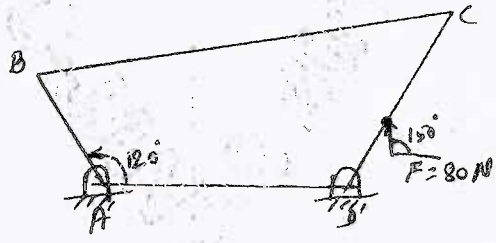

Fig. Q7(b)

OR

2 a. State 'D' Alembert's principle. **(08 Marks)**

b. The crank and connecting rod of a vertical single cylinder gas engine running at 1800 rpm are 60mm and 240mm respectively. The diameter of the Piston is 80mm and the mass of the reciprocating is 1.2kg. At a point during the power stroke when the Piston has moved 20mm from the top dead centre position, the pressure on the Piston is 800 kN/m^2. Determine :

i) Net force on the piston
ii) Thrust in the connecting rod
iii) Thrust on the sides of cylinder wall
iv) Engine speed at which the above values are zero. **(08 Marks)**

Module-2

3 For masses m_1 = 100kg, m_2 = 175kg, m_3 = 200kg and m_4 = 125kg are fixed to the crank of 200mm radius and revolve in planes Ist, IInd, IIIrd respectively. The angular position of the planes IInd, IIIrd and and IVth with respect to Ist plane are 75°, 135° and 240° take in the same sense. Distance of plane II^{n}, IIIrd and IVth from Ist are 600mm, 1800mm and 2400mm. Determine the magnitude and position of the balancing masses at the radius 500mm in planes L and M located in the middle of Ist and IInd and in the middle of IIIrd and IVth respectively. **(16 Marks)**

OR

4 The piston of a 4 cylinder vertical inline engine reach their upper most position at 90° interval in order of their axial position, pitch of the cylinder = 0.35m ; length of the connecting rod = 0.42m. the engine runs at 600 rpm. If the reciprocating parts of each engine has a mass of 2.5kg. Find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. **(16 Marks)**

Module-3

5 a. Derive an expression for gyroscopic couple. **(06 Marks)**

b. A porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and the mass of the central load on the sleeve is 25kg. The radius of rotation of the ball is 150mm when the governor begins to lift and 200mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor. **(10 Marks)**

OR

6 a. Define: i) Sensitiveness ii) Isochronism. **(04 Marks)**

b. A turbine rotor of a ship has a mass of 2.2 and Tonnes and rotates at 1800rpm clockwise when viewed from the stern. The radius of gyration of the rotor is 320mm. Determine the gyroscopic couple and its effect when the

i) Ship turns right at a radius of 250m with a speed of 25km/hr.

ii) Ship pitches with bow rising at on angular velocity of 0.8 rad/sec.

iii) Ship rolls at on angular velocity of 0.1 rad/sec. **(12 Marks)**

Module-4

7 a. Briefly explain, Free, Forced, damped and undamped vibration. **(08 Marks)**

b. Split up the harmonic motion $X = 6 \cos(wt + 45°)$ into two harmonic motions. One of them having phase angle of zero degree and other having phase angle of 60°. Check solution by graphically. **(08 Marks)**

OR

8 a. Obtain the equivalent stiffness of spring when springs are connected in series and parallel. **(08 Marks)**

b. Obtain the natural frequency of the system shown in Fig Q8 (b). **(08 Marks)**

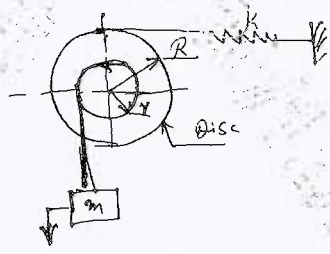

Fig. Q8(b)

Module-5

9 a. Define logarithmic decrement and derive the equation for same. **(08 Marks)**

b. Vibration system consisting of a mass 3kg a springs of stiffness 100kN/m and damper. Damping coefficient 30Ns/m. Determine Damping factor, critical damping coefficient logarithmic decrements, Ratio of two consecutive amplitudes.
Number of cycles after which the initial amplitude is reduced to 20%? **(08 Marks)**

OR

10 a. Derive an expression for magnification factor or amplitude ratio for spring mass system with viscous damping subjected to harmonic force. **(08 Marks)**

b. A vibratery body of mass 150kg supported on springs of total striffness 1050kN/m has a rotating unbalance force fo 525N at a speed of 6000rpm. If the damping factor is 0.3. Determine :

i) The amplitude caused by the unbalance and its phase angle

ii) The transmissibility

iii) The actual force transmitted and its phase angle. **(08 Marks)**

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15ME53

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Turbo Machines

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define and give the significance of specific speed, head coefficient and power coefficient with respect to turbo machines. **(06 Marks)**

b. Explain the effect of Reynold number on the performance analysis of turbomachines. **(04 Marks)**

c. It is desired to deliver 5 m^3/sec at a head of 640 m in a single stage pump.
i) If the specific speed is not to exceed 40, what should be the speed of the impellers?
ii) If the speed is reduced to 1450 rpm, how many stages are required? **(06 Marks)**

OR

2 a. Explain static and stagnation state for a fluid. Obtain an expression relating static and stagnation temperature for a perfect gas. **(06 Marks)**

b. An axial flow compressor has eight stages of equal pressure ratio of 1.35 and the flow rate through the compressor and the overall efficiency are 50 kg/sec and 0.82 respectively. If the conditions of air at the entry are 1.0 bar and 300 K. Determine:
i) The state of air at the compressor exit
ii) Polytropic efficiency
iii) Efficiency of each stage
iv) Power required to drive the compressor assuming mechanical efficiency of 90%. **(10 Marks)**

Module-2

3 a. Draw the velocity triangles at inlet and outlet of a turbo machine and derive the Euler turbine equation with usual notations. **(08 Marks)**

b. In an inward flow water turbine, the water enters the runner through a guide vane at an angle of 30° and at a velocity of 30 m/sec. The inner diameter is 1.8 m and the outlet diameter is half the inlet diameter. The water leaves the runner at an absolute velocity of 3 m/sec at an angle of 130° to the wheel tangent with a slight positive whirl. Find the power developed by the turbine if the discharge is 0.4 m^3/sec and also the blade angles at inlet and outlet, if the speed of the turbine is 300 rpm. **(08 Marks)**

OR

4 a. A radial outward flow turbo machine has no inlet whirl. The blade speed at the exit is twice that at inlet. Radial velocity is constant throughout. Taking the inlet blade angle as 45°, show that the degree of reaction is given by $R = \frac{2+\cot\beta_2}{4}$ where β_2 is the blade angle at exit with respect to tangential direction. **(10 Marks)**

b. The impeller of a centrifugal pump has an outer diameter of 1.5 m. It lifts water at a rate of 2000 kg/sec. The blade is making an angle is 145° with the direction of motion at outlet and the speed being 3000 rpm. Radial velocity of flow is 3m/sec. Find the power required to drive the impeller. **(06 Marks)**

Module-3

5 a. Define and explain diagram efficiency and stage efficiency. **(04 Marks)**

b. A velocity compounded impulse wheel has two rows of moving blades with a mean diameter of 70 cm. The speed of rotation is 3000 rpm and the nozzle angle is 16° and the estimated steam velocity at the nozzle outlet is 610 m/sec. The mass of steam passing through the blades per second is 5.5 kg. Assuming that the energy loss in each row of blades (moving and fixed) is 24% of the kinetic energy of the steam entering the blades. The outlet angles of the blades are:

1. First row of moving blades = 18°
2. Intermediate guide blades = 22°
3. Second row of moving blades = 38°

Draw the diagram of relative velocities and derive the following:

i) Blade inlet angles
ii) Power developed in each row of moving blades
iii) Efficiency of the wheel as a whole. **(12 Marks)**

OR

6 a. For a 50% reaction steam turbine, show that $\alpha_1 = \beta_2$ and $\alpha_2 = \beta_1$ where β_1 and β_2 are the inlet and outlet blade angles, α_1 and α_2 are the angles with respect to fixed blades. **(08 Marks)**

b. A certain stage of a Parsons turbine consists of one row of fixed blades and one row of moving blades. The details of the turbine are as follows:
Mean blade speed = 107 m/sec
Mass of steam passing per second = 13.5 kg
Steam velocity at exit from fixed blades = 143.7 m/sec
Nozzle inlet angle = 20°
Calculate the power developed in the stage and gross efficiency, assuming carry over coefficient as 0.74 and the efficiency of conversion of heat energy into kinetic energy in the blade channels as 0.92. **(08 Marks)**

Module-4

7 a. Derive an expression for the hydraulic efficiency of a Pelton wheel turbine interms of jet velocity, V_1, blade velocity, U and blade angles. **(08 Marks)**

b. The supply to a single jet pelton wheel is from a reservoir 310 m above the nozzle centre (C_V of nozzle = 0.97) through a pipe 67.5 cm diameter, 5.6 km long. Take friction coefficient for the pipe = 0.008. Jet diameter = 9 cm. The blade speed ratio = 0.47 and buckets deflect the water through 170°. The relative velocity of water is reduced by 15% in passing over the buckets. If the mechanical efficiency = 85%. Determine the power given to runner, hydraulic efficiency and overall efficiency. **(08 Marks)**

OR

8 a. With a neat sketch, explain the working of a Kaplan turbine. Draw the velocity triangles at inlet and outlet of the turbine. Also explain the function of draft tube. **(08 Marks)**

b. The following data is given for a Francis turbine. Net head = 70 m, speed = 600 rpm, shaft power = 368 KW, overall efficiency, η_0 = 85% and hydraulic efficiency, η_h = 95%, flow ratio = 0.25, breadth ratio = 0.1, outer diameter of runner = 2 x inner diameter of runner, velocity of flow is constant at inlet and outlet and the thickness of the vanes occupy 10% of the circumferential area of the runner and discharge is radial at outlet. Determine:

i) Guide blade angle
ii) Runner vane angles at inlet and outlet
iii) Diameter of the runner at inlet and outlet
iv) Width of wheel at inlet. **(08 Marks)**

Module-5

9 a. Show that the pressure rise in the impeller of a centrifugal pump when frictional and other losses in the impeller are reflected is given by

$$\frac{1}{2g}\left[V_{f_1}^2 + U_2^2 - V_{f_2}^2 \operatorname{cosec}^2\beta_2\right]$$

where V_{f_1} and V_{f_2} are the velocity of flow at inlet and outlet, U_2 = tangential velocity of impeller at outlet, β_2 = vane angle at outlet. **(06 Marks)**

b. A three stage centrifugal pump has impeller 40 cm in decimeter and 2.5 cm wide at outlet. The vanes are curved back at an angle of 30° and reduces the circumferential area by 15%. The manometric efficiency = 85% and overall efficiency = 75%. Determine the head generated by the pump when running at 1200 rpm and discharges 0.06 m^3/sec. Find the shaft power also. **(10 Marks)**

OR

10 a. Explain the phenomenon of (i) surging (ii) chocking in the centrifugal compressor. **(06 Marks)**

b. Define work done factor for an axial flow compressor. **(02 Marks)**

c. An axial flow compressor of 50% reaction design has blades with inlet and outlet angles with respect to axial direction as 45° and 10° respectively. The compressor is to produce a pressure ratio of 6:1 with an overall isentropic efficiency of 0.85 when the inlet static temperature is 37°C. The blade speed and axial velocity are constant throughout the compressor. Assuming a value of 200 m/sec for blade speed find the number of stages required if the work done factor is 0.87 for all stages. **(08 Marks)**

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15ME54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Use of design data hand book is allowed.
3. Assume suitable missing data.

Module-1

1 a. Define standards and codes. **(04 Marks)**

b. A circular rod of diameter 50 mm is subjected to loads as shown in Fig.Q1(b). Determine the nature and magnitude of stresses at the critical points.

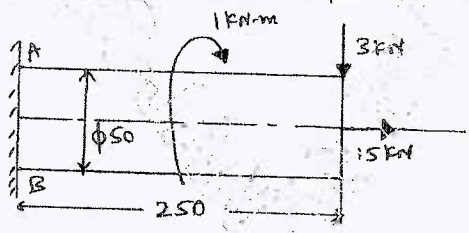

Fig.Q1(b) **(12 Marks)**

OR

2 a. Briefly explain the phases of design process (Shigley's). **(04 Marks)**

b. A flat bar shown in Fig.Q2(b) is subjected to an axial load of 100 kN. Assuming that the stress in the bar is limited to 200 N/mm^2, determine the thickness of bar.

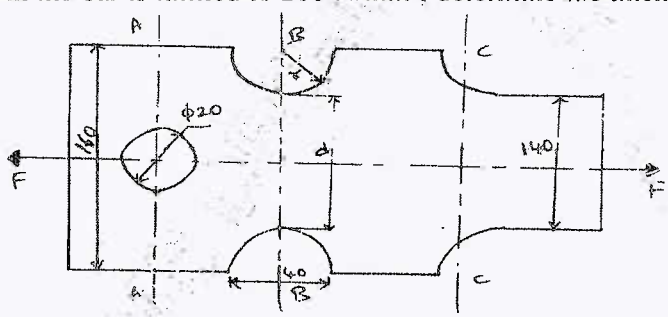

Fig.Q2(b) **(12 Marks)**

Module-2

3 a. A cantilever beam of span 800 mm has a rectangular cross section of depth 200 mm. The free end of the beam is subjected to a transverse load of 1 kN that drops on to it from a height of 40 mm. Selecting C40 steel (σ_y = 328.6 MPa) and FoS = 3, determine the width of rectangular cross section.

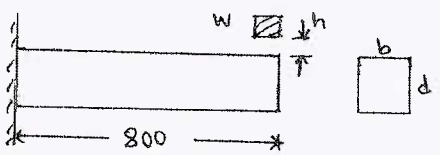

Fig.Q3(a) **(08 Marks)**

b. A rectangular cross section bar 200 mm long is subjected to an impact by a load of 1 kN that falls on to it from a height of 10 mm from rest. Determine the cross section dimension of rectangular bar, if the allowable stress of material of bar is 125 N/mm^2. Assume the thickness depth is twice width. Also find the deformation due to impact. **(08 Marks)**

OR

4 A round rod of diameter 1.2 d is reduced to a diameter 'd' with a fillet radius of 0.1 d. This stepped rod is to sustain a twisting moment that fluctuates between 2.5 kN-m to 1.5 kN-m together with a bending moment of +1 kN-m to −1 kN-m. The rod is made of carbon steel C40 (σ_y = 328.6 MPa; σu = 620 MPa). Determine suitable value for 'd'. **(16 Marks)**

Module-3

5 A solid steel shaft running at 600 rpm is supported on bearings 600 mm apart. The shaft receives 40 KW through a 400 mm diameter pulley weighing 400 N located 300 mm to the right of left bearing by a vertical flat belt drive. The power is transmitted from the shaft through another pulley of diameter 600 mm weighting 600 N located 200 mm to the right of right bearing. The belt drives are at right angles to each other and ratio of belt tension is 3. Determine the size of shaft necessary, if the allowable shear stress in the shaft material is 40 MPa and the loads are steady. **(16 Marks)**

OR

6 Design a flange coupling to connect the shafts of a motor and centrifugal pump for the following specifications: Pump output = 3000 liters/minute, total head = 20 m, pump speed = 600 rpm, pump efficiency = 70%. Select C40 steel (σ_y = 328.6 MPa) for shaft and C35 steel (σ_y = 304 MPa) for bolts with factor of safety 2. Use allowable shear stress in cast iron flanges equal to 15 N/mm^2. **(16 Marks)**

Module-4

7 a. A double riveted lap joint is to be made between 9 mm plates. If the safe working stresses in tension, crushing and shear are 80,120 and 60 N/mm^2 respectively, design the riveted joint. **(08 Marks)**

b. Determine the diameter of rivet for the joint shown in Fig.Q7(b). The allowable stress in the rivet is 100 N/mm^2.

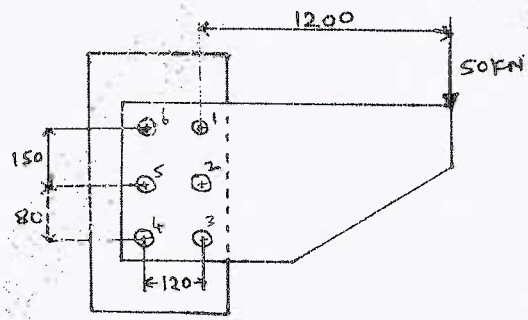

Fig.Q7(b) **(08 Marks)**

OR

8 a. A 16 mm thick plate is welded to a vertical support by two fillet welds as shown in Fig.Q8(a). Determine the size of weld, if the permissible shear stress for the weld material is 75 MPa.

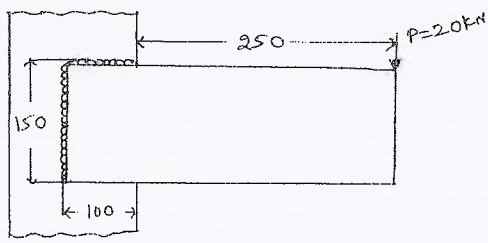

Fig.Q8(a) **(08 Marks)**

b. Determine the allowable stress in the joint shown in Fig.Q8(b), if size of weld is 10 mm.

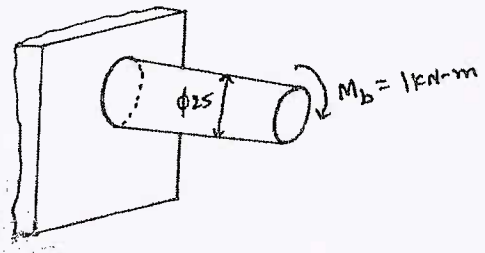

Fig.Q8(b). **(08 Marks)**

Module-5

9 a. The structure in Fig.Q9(a) is subjected to eccentric load P = 10 kN with eccentricity of 500 mm. All holts are identical mode of carbon steel having yield strength in tension is 400 MPa and factor of safety is 2.5. Determine size of bolt.

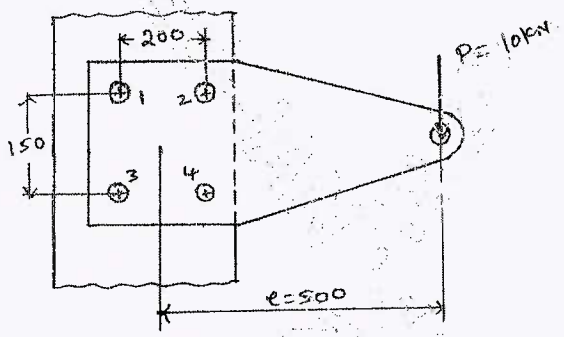

Fig.Q9(a) **(08 Marks)**

b. A bracket is fixed to wall by 4 bolts and loaded as shown in Fig.Q9(b). Calculate the size of bolts if the load is 10 kN and allowable shear stress in bolt material is 40 MPa.

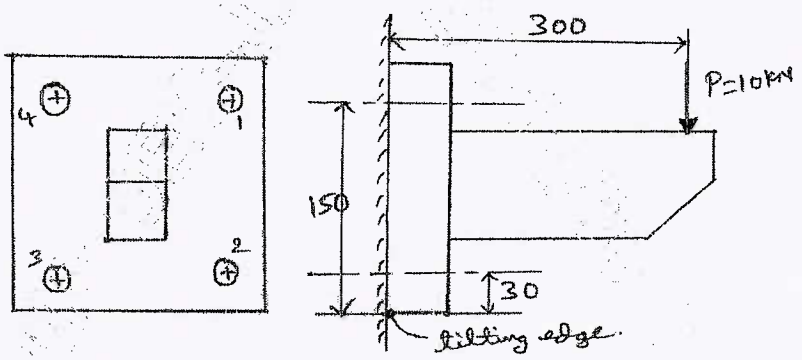

Fig.Q9(b) **(08 Marks)**

OR

10 Design a Screw Jack (complete design) with a lift of 300 mm to lift a load of 50 kN. Select C40 steel (σ_y = 328.6 MPa) for the screw and soft phosphor bronze (σ_{ut} = 345 MPa and σ_y = 138 MPa) for nut. **(16 Marks)**

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CBCS Scheme

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15ME554

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Non – Traditional Machining

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Differentiate between Traditional and Non-traditional machining process. **(08 Marks)**

b. Explain the need for Non-Traditional machining processes. **(08 Marks)**

OR

2 a. Classify the NTM processes on the basis of type of energy, mechanism of metal removal, transfer media, energy source. **(10 Marks)**

b. Write in brief note on the selection of non-traditional machining processes. **(06 Marks)**

Module-2

3 a. Sketch and explain the principle, equipment and operation of ultrasonic machining process. **(10 Marks)**

b. Discuss the influence of the following parameter on USM process :
   i) Amplitude and frequency of vibration
   ii) Abrasive gain size
   iii) Effect of slurry **(06 Marks)**

OR

4 a. Explain the process variables that influence the metal removal rate in abrasive jet machining. **(10 Marks)**

b. What are applications of water jet machining process? **(06 Marks)**

Module-3

5 a. Explain with a neat sketch, the Electro chemical Grinding process. **(08 Marks)**

b. Explain the effect of following parameters on Electrochemical machining process.
   i) Current density
   ii) Tool feed rate
   iii) Type of electrolyte
   iv) Velocity of electrolyte flow. **(08 Marks)**

OR

6 a. Explain with a neat sketch, the sequence of process steps involved in chemical blanking process. **(10 Marks)**

b. Briefly explain the process characteristics in chemical machining process. **(06 Marks)**

Module-4

7 a. Explain with the help of neat sketches the different types of Flushing used in EDM process. **(10 Marks)**

b. What are the essential requirements of a dielectric fluid, used in EDM process? What functions does the dielectric fluid performs? **(06 Marks)**

OR

8 a. With a neat sketch, explain the construction and working of plasma arc machining process. **(08 Marks)**

b. Write the applications and advantages of plasma Arc machining. **(08 Marks)**

Module-5

9 a. Draw a neat sketch of Laser Beam machining (LBM). And explain briefly. **(10 Marks)**

b. What are the advantages and limitations of LBM process? **(06 Marks)**

OR

10 a. Explain with sketch, the working of Electron Beam Machining (EBM). **(10 Marks)**

b. Write the applications and limitations of Electron Beam Machining (EBM). **(06 Marks)**

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CBCS SCHEME

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15ME562

Fifth Semester B.E. Degree Examination, June/July 2018
Energy and Environment

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Briefly explain, what are the primary and secondary sources of energy. **(06 Marks)**

b. Compare energy production and consumption of India with world scenario. **(10 Marks)**

OR

2 a. Discuss factors affecting India's energy development. **(08 Marks)**

b. Summarize some of the social and environmental aspects of energy demand. **(08 Marks)**

Module-2

3 a. Describe various types of thermal energy storage systems. Mention their relative merits and limitations. **(10 Marks)**

b. What is energy management? Explain its benefits of operational changes. **(06 Marks)**

OR

4 a. What are the various steps in the implementation of energy audit in an organization? **(10 Marks)**

b. Describe the steps involved in economic analysis of an energy investment project. **(06 Marks)**

Module-3

5 a. Explain, what is the need for public awareness about the environment. **(08 Marks)**

b. Describe the concept of an ecosystem. **(08 Marks)**

OR

6 a. List some of the institutions which protect environment in our country. **(08 Marks)**

b. Write about energy flow in an ecosystem. **(08 Marks)**

Module-4

7 a. Discuss types and sources of air pollution. **(10 Marks)**

b. What are the possible sources of ground water pollution? **(06 Marks)**

OR

8 a. Discuss about causes, effects and control measures of urban and industrial wastes. **(10 Marks)**

b. What is the role of an individual in prevention of pollution? **(06 Marks)**

Module-5

9 a. What is green house effect? Which gas is mainly responsible for global warming? **(04 Marks)**

b. Why does ozone layer important for living being on the earth? What are the harmful effects of ozone layer depletion? **(08 Marks)**

c. What is nuclear holocaust? What are its effects on the ecosystem? **(04 Marks)**

OR

10 a. Discuss the issues involved in enforcement of environment legislation. **(10 Marks)**

b. Briefly discuss the Wildlife Protection Act. **(06 Marks)**

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10ME52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Design of Machine Elements – I

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Use of design data handbook is permitted.
3. Missing data may suitably be assumed.

PART – A

1 a. Briefly explain important mechanical properties of materials. **(06 Marks)**

b. A round rod of 60 mm diameter is subjected to bending moment of 900 Nm and a twisting moment of 1200 Nm. Determine the maximum normal and shear stresses induced in the rod. **(08 Marks)**

c. A 1 mm thick steel hacksaw blade is bent into circular arc of radius 500 mm. Determine the bending moment applied and the stress induced. The width of blade is 15 mm. Modulus of elasticity is 200 GPa. **(06 Marks)**

2 a. A steel shaft having yield strength of 328.6 MPa is subjected to the following stresses. σ_x = 90 MPa, σ_y = 60 MPa and τ_{xy} = 30 MPa. Find the factor of safety according to the following theories of failure: (i) Rankine's theory, (ii) Guest's theory. **(06 Marks)**

b. A stepped shaft with diameters ratio as 1:2 and a fillet radius of 10% of smaller diameter is required to transmit 30 kW at 600 rpm. Find the diameter of the shaft taking stress concentration into account. The allowable shear stress is 60 MPa. **(06 Marks)**

c. Describe expression for maximum stress induced in axial impact. **(08 Marks)**

3 a. Derive Soderberg's relation for ductile materials. **(06 Marks)**

b. A cantilever beam of rectangular cross section having a span of 1200 mm and depth of 200 mm is subjected to a transverse load at its end that fluctuates between 60 kN upward to 120 kN downward. It is made of steel having endurance stress of 270 MPa, ultimate stress of 550 MPa and yield stress of 400 MPa. Find the width of the section taking factor of safety as 2.5. The size and surface factors are 0.9 and 0.95 respectively. **(14 Marks)**

4 a. A bolt is subjected to a tensile load of 12 kN and a tightening load of 3 kN. It is made of steel having allowable tensile stress of 120 MPa. A soft copper gasket is used. Find the size of the bolt. **(06 Marks)**

b. A bracket is bolted as shown in Fig.Q4(b). All the bolts are identical and have allowable stress of 60 MPa. Determine the size of the bolt.

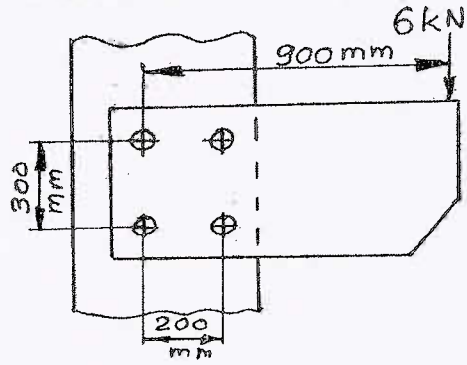

Fig.Q4(b) **(14 Marks)**

PART – B

5 a. Write the advantages of hallow shafts over solid shafts. (04 Marks)

b. A shaft is supported on two bearings at a distance of 900 mm. A pulley 600 mm diameter weighing 1200 N is mounted on it at 300 mm to the left of right bearing and receives a power of 9 kW at 450 rpm. The power is given out through a pinion 270 mm diameter mounted at 300 mm to the right of left bearing. The belt drive is horizontal and the pinion drives with a downward tangential force. The belt tensions ratio is 3:1. The combined shock and fatigue factors in bending and torsion may be taken as 2 and 1.5 respectively. Find suitable diameter of the shaft taking allowable tensile and shear stresses as 75 MPa and 54 MPa respectively. (16 Marks)

6 a. Design a knuckle joint to sustain a tensile load of 90 kN. The allowable stresses for rods and pin are 90 MPa in tension, 60 MPa in shear and 150 MPa in crushing. (10 Marks)

b. Design a CI flange coupling to transmit 15 KW at 1200 rpm. The allowable shear stress for CI flange is 3 MPa and for shaft, keys and bolts is 75 MPa. The allowable bearing stress for key is 150 MPa. (10 Marks)

7 a. Design a double riveted double strap butt joint for the longitudinal seam of a boiler of diameter 1.2 m and a steam pressure of 2 MPa. The following stresses may be used:
Allowable tensile stress for plates = 90 MPa
Allowable shear stress for rivets = 60 MPa
Allowable crushing stress for rivets = 135 MPa.
Assume a joint efficiency of 75%. (10 Marks)

b. Determine the size of weld for a bracket welded as shown in Fig.Q7(b). The allowable stress in the weld is 75 MPa.

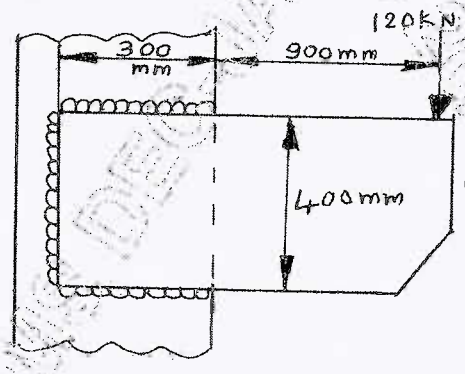

Fig.Q7(b) (10 Marks)

8 a. Derive expression for maximum efficiency of a square threaded screw. (05 Marks)

b. The lead screw of a lathe machine has a single start ISO trapezoidal threads of 30 mm outside diameter and 6 mm pitch. It drives a tool carriage against a cutting force of 6 kN at a speed of 720 mm/min. The end of the screw is carried on a thrust washer of outside and inside diameters of 50 mm and 30 mm. the coefficient of thread friction is 0.12 and that for collar is 0.15. Find:
i) The torque required to drive the carriage.
ii) Power of motor.
iii) The efficiency.
iv) Compressive stress induced in the screw.
v) Length of bronze not required taking allowable bearing pressure in the threads as 1.5 MPa. (15 Marks)

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10ME53

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Energy Engineering

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. ***Missing data may be assumed suitably.***

PART – A

1 a. What is pulverized coal? **(02 Marks)**

b. Explain with sketch overfeed and underfeed principle of firing coal. **(09 Marks)**

c. Sketch and explain a cyclone Burner with advantages and disadvantages. **(09 Marks)**

2 a. Explain the Velox steam generator, with a neat sketch. **(06 Marks)**

b. Classify different types of Draughts and explain with a neat sketch the balanced draught. **(06 Marks)**

c. Calculate the mass of flue gases flowing through the chimney when the draught produced is equal to 2 cm of water. temperature of flue gases is 300°C and ambient temperature is 20°C. The flue gases formed per kg of fuel burnt are 25 kg. Neglect the losses and take the diameter of the chimney as 1.9 metre. **(08 Marks)**

3 a. Draw a line diagram to show the layout of diesel power plant. **(05 Marks)**

b. Explain different methods of starting the diesel engine. **(07 Marks)**

c. For a diesel power station. Discuss briefly about the following:
(i) Cooling system (ii) Lubricating system. **(08 Marks)**

4 a. How are the hydro-electric power plant classified? With a neat sketch, explain the pumped storage plant. **(08 Marks)**

b. The run off data of a river at a particular site is tabulated below:

Month	Mean discharge per month (millions of cu.m)
January	40
February	25
March	20
April	10
May	0
June	50
July	75
August	100
September	110
October	60
November	50
December	40

i) Draw a hydrograph and find the mean flow.
ii) Draw the flow duration curve.
iii) Find the power in MW available at mean flow, if the head available is 90 m and overall efficiency of generation is 86%.
Take each month of 30 days. **(12 Marks)**

PART – B

5 a. What is Nuclear fusion? How does it differ from nuclear fission? **(04 Marks)**

b. Explain the Boiling water reactor, with a neat sketch. **(08 Marks)**

c. Explain :

(i) Thermal utilization factor.

(ii) Multiplication factor.

(iii) Disposal of radioactive wastes. **(08 Marks)**

6 a. Sketch and explain the working of Pyranometer. **(06 Marks)**

b. Sketch and explain the principle of working of solar pond. **(08 Marks)**

c. Calculate the angle made by beam radiation with the normal to a flat-plate collector on May 1 at 0900h (local apparent time). The collector is located in New Delhi (28°35'N, 77°12'E). It is tilted at an angle of 36° with the horizontal and is pointing down South. **(06 Marks)**

7 a. What are the advantages and limitations of Tidal power generation? **(08 Marks)**

b. With a neat sketch, explain the closed cycle OTEC plant. **(08 Marks)**

c. Briefly write a note on geothermal energy. **(04 Marks)**

8 a. What are the factors affecting biogas generation? Explain any two factors. **(05 Marks)**

b. Explain with neat sketch of Indian Bio-gas plant. **(10 Marks)**

c. In brief write a note on energy plantation. **(05 Marks)**

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10ME54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain principle of virtual work with an example. **(04 Marks)**

b. In the following Fig. Q1 (b) a 4-bar mechanism is shown. Calculate the required value of T_2 and various forces on links for the equilibrium of the system. **(16 Marks)**

AB = 50 mm, BC = 66 mm, CD = 55 mm. CE = 25 mm, CF = 30 mm, BAD = 60° and AD = 100 mm

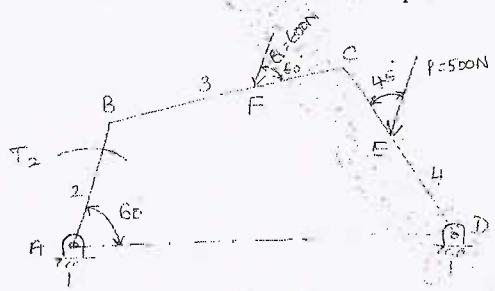

Fig. Q1 (b)

2 a. Explain the function of flywheel and show how its size and mass may be calculated by the aid of turning moment diagram. **(06 Marks)**

b. A punching press is required to punch 40 mm diameter holes in a plate of 15 mm thickness at the rate of 30 holes per minute. It requires 6 N-m of energy per mm^2 of sheared area. If the punching takes $\frac{1}{10}$ of a second and the rpm of the flywheel varies from 160 to 140. Determine the mass of the flywheel having radius of gyration of 1 metre. **(14 Marks)**

3 a. Derive an expression for frictional torque in a conical pivot bearing. Assume uniform pressure across the bearing surface. **(06 Marks)**

b. A belt drive is required to transmit 10 kW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density of 0.001 gm/mm^3. Safe stress in the belt is not to exceed 2.5 N/mm^2. Diameter of the driving pulley is 250 mm whereas the speed of the driven pulley is 220 rpm the two shafts are 1.25 m apart. The coefficient of friction is 0.25. Determine the width of the belt. **(14 Marks)**

4 a. Explain the procedure for balancing several masses rotating in the same plane by analytical method. **(04 Marks)**

b. A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70°C and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm. Find their magnitudes and angular positions. **(16 Marks)**

PART – B

5 a. What are in-line engines and state how they are balanced? **(06 Marks)**

b. A four cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm, 200 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and relative angular positions of the cranks in order that the engine may be in complete primary balance. **(14 Marks)**

6 a. Define height of the governor and derive an expression for the height of the Hartwell governor. **(06 Marks)**

b. The arms of a porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation. The lower arms are attached to a sleeve at a distance of 400 mm from the axis of rotation the mass of the load on the sleeve in 70 kg and the mass of each ball is 10 kg. Determine the equilibrium speed when the radius of rotation of the balls is 200 mm. If the friction is equivalent to a load of 20 N at the sleeve. What will be the range of speed for this position? **(14 Marks)**

7 a. Explain the effect of Gyroscopic couple on Navalship when it is steering and pitching. **(06 Marks)**

b. Each wheel of a four wheeled, rear engine automobile has a moment of inertia of 2.4 kgm^2 and an effective diameter of 660 mm. The rotating parts of the engine have a moment of inertia of 1.2 kgm^2. The gear ratio of engine of the back wheel is 3 to 1. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The mass of the vehicle is 2200 kg and the centre of the mass is 550 mm above the road level. The tack width of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around a curve with 80 m radius so that all the four wheels maintain contact with the road surface. **(14 Marks)**

8 The following particulars relate to symmetrical circular cam operating a flat faced follower least radius = 16 mm, nose radius = 3.2 mm, distance between cam shaft centre and nose centre = 25 mm, angle of action of cam = 150°, and cam shaft speed = 600 rpm. Assuming that there is no dwell between ascent and descent. Determine the lift of the value, the flank radius and acceleration and retardation of the follower at the beginning of lift and apex of the nose. **(20 Marks)**

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10ME55

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Manufacturing Process – III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Differentiate clearly between wrought product and cast product. **(05 Marks)**

b. State the advantages and limitations of metal working processes. **(05 Marks)**

c. Show tri-axial stress system, with a neat figure and also represent the same in a matrix form. **(05 Marks)**

d. What is flow stress? Name the methods to determine the flow stress. **(05 Marks)**

2 a. Explain the effect of friction, lubrication and strain rate on metal working process. **(06 Marks)**

b. What is hydrostatic pressure? Explain the importance in achieving a successful forming operation without fracture. **(06 Marks)**

c. Discuss the concept of deformation zone geometry in metal working. **(08 Marks)**

3 a. Derive an expression for forging pressure and load in open die forging by slab analysis (considering sliding occurs at interface). Hence draw the friction hill. **(10 Marks)**

b. A rectangular bar of length 200 mm, width 100 mm and thickness 40 mm is compressed between two flat dies in plane strain condition such that the plane sections remain same and dimension 200 mm does not change. If the yield strength of the work material is 75 N/mm^2 and coefficient of friction $\mu = 0.08$, determine the minimum, average and maximum die pressure at the beginning of compression. **(10 Marks)**

4 a. Explain the following with neat figures:
i) Four high rolling mill
ii) Cluster rolling mill
iii) Tandum mill
iv) Planetary rolling mill **(12 Marks)**

b. Determine the maximum possible reduction for cold rolling of a 300 mm thick slab when $\mu = 0.08$ and roll diameter is 600 mm. What is the maximum reduction on the same mill for hot rolling when $\mu = 0.5$? **(08 Marks)**

PART – B

5 a. What is drawing process? Draw the cross section of a drawing die and explain the different elements of drawing die. **(08 Marks)**

b. What is redundant work in drawing? How it is estimated? **(08 Marks)**

c. A steel wire is drawn from an initial diameter of 6 mm to a final diameter of 5.2 mm. the angle die is 18°, the coefficient of friction at the die-wire interface is 0.15 and the yield strength of the material is 255 N/mm^2. Calculate the drawing stress in the absence of back tension. **(04 Marks)**

6 a. How seamless pipes and tubes can be produced by extrusion? Explain with a neat sketch. **(08 Marks)**

b. Briefly explain four extrusion defects with their causes and remedies. **(08 Marks)**

c. It is required to extrude a cylindrical aluminium billet of 50 mm diameter to 10 mm diameter. The length of the billet is 75 mm and the average tensile yield stress for aluminium material is 170 N/mm^2. Calculate the force required for extrusion. Assume $\mu = 0.15$ and semi-die angle = 45°. **(04 Marks)**

7 a. Explain briefly the rubber forming process with respect to sheet metal forming. **(05 Marks)**

b. Explain with neat sketch progressive die. **(05 Marks)**

c. Explain the effect of anisotropy on limited draw ratio (LDR) in deep drawing. **(05 Marks)**

d. A 25 mm square hole is to be cut in sheet metal of 0.75 mm thick. The shear strength of the material is 2.86×10^5 kN/m^2. Calculate the cutting force. **(05 Marks)**

8 a. Discuss the principle and application of electro hydraulic forming. **(08 Marks)**

b. What are the advantages and disadvantages of high energy rate forming (HERF)? **(06 Marks)**

c. Discuss briefly the processing stages of powder metallurgy. **(06 Marks)**

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10ME56

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Turbomachines

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. Use of Thermodynamic data hand book is permitted.

PART – A

1 a. Define turbo machines. Give at least 6 different classifications of turbomachines. **(08 Marks)**

b. Define specific speed of pumps. Show that specific speed of pump is given by,

$$N_S = \frac{N\sqrt{Q}}{H^{3/4}}.$$ **(06 Marks)**

c. A turbine model of 1 : 10 develops 2.0 kW under a head of 6 m at 500 rpm. Find the power developed by the prototype under a head of 40 m. Also find the speed of prototype and its specific speed. Assume the turbine efficiencies to remain same. **(06 Marks)**

2 a. For power generating turbo machine, define (i) total-to-total efficiency (ii) total-to-static efficiency. **(04 Marks)**

b. With the help of h-s diagram, show that the preheat factor in a multi stage compressor is less than unity. **(06 Marks)**

c. Air flows through an air turbine where its stagnation pressure is reduced in the ratio 5 : 1 the total-to-total efficiency is 80%. The air flow in 5 kg/s. If the total power output is 500 kW, find (i) inlet total temperature (ii) actual exit total temperature (iii) actual exit static temperature if the flow velocity is 100 m/s (iv) total-to-static efficiency. **(10 Marks)**

3 a. Derive alternate form of Euler's turbine equation and explain the significance of each energy component. **(10 Marks)**

b. The velocity of fluid flow from the nozzle in an axial flow impulse turbine is 1200 m/s. The nozzle angle is 22°. If the rotor blades are equiangular and the rotor tangential speed is 400 m/s, find : (i) The rotor blade angles, (ii) The tangential force on the blade ring (iii) Power output (iv) Utilization factor. Assume $V_{r_1} = V_{r_2}$. **(10 Marks)**

4 a. Define degree of reaction for an axial flow machine. Prove that degree of reaction for an axial flow device (assuming constant velocity of flow) is given by,

$$R = \frac{V_f}{U}\left[\frac{\tan\beta_1 + \tan\beta_2}{\tan\beta_1 \times \tan\beta_2}\right].$$ **(10 Marks)**

b. An axial flow compressor of 50% reaction design has blades with inlet and outlet angles of 44° and 13° respectively. The compressor is to produce a pressure ratio 5 : 1 with an overall isentropic efficiency of 87% when the inlet temperature is 290 K. The mean blade speed and axial velocity are constant throughout the compressor. Assume that blade velocity is 180 m/s and work input factor is 0.85. Find the number of stages required and the change of entropy. **(10 Marks)**

PART – B

5 a. What is the necessity for compounding steam turbines? Discuss any two methods of compounding with neat sketches. (10 Marks)

b. Steam issues from the nozzle of a Delaval turbine with a velocity of 1000 m/s. The nozzle angle is 20° and the mean blade velocity 400 m/s. Inlet and outlet angles are equal. Mass of steam flowing through the turbine is 1000 kg/h. Calculate (i) Blade angles (ii) Relative velocity of steam entering the blades. (iii) Axial thrust (iv) Power developed (v) Blade efficiency. Assume K = 0.8. (10 Marks)

6 a. Explain the functions of a draft tube in a reaction hydraulic turbine. (04 Marks)

b. Draw the inlet and outlet velocity triangles for a Pelton wheel. Derive an expression for the maximum hydraulic efficiency of a Pelton wheel in terms of bucket velocity co-efficient and discharge blade angle. (08 Marks)

c. A Kaplan turbine develops 10 MW under an effective head of 8 m. The overall efficiency is 0.86, the speed ratio is 2.00 and the flow ratio is 0.6. The hub diameter is 0.35 times the outside diameter of the wheel. Find the diameter and speed of the turbine. (08 Marks)

7 a. Explain the following, with reference to the centrifugal pump:
(i) Slip and it effects
(ii) Cavitation, its effect and remedies to it
(iii) Difference between manometric head and NPSH. (10 Marks)

b. The outer diameter of the impeller of a centrifugal pump is 40 cm, and width of the impeller at outlet is 5 cm. The pump is running at 800 rpm and is working against a total head of 15 m. The vane angle at outlet is 40° and manometric efficiency is 75%. Determine (i) Velocity of flow at outlet (ii) Velocity of water leaving the vane (iii) Angle made by the absolute velocity at outlet with the direction of motion at outlet. (iv) Discharge. (10 Marks)

8 a. What is radial equilibrium in an axial flow compressor? Derive an expression for radial equilibrium in terms of flow velocity and whirl velocity of a fluid. (10 Marks)

b. A centrifugal compressor runs at a speed of 15000 rpm and delivers air at 20 kg/s. Exit radius is 0.35 m, relative velocity and vane angles at exit are 100 m/sec and 75° respectively. Assuming axial inlet and inlet stagnation temperature and stagnation pressure as 300 K and 1 bar respectively. Calculate : (i) the torque (ii) the power required to drive the compressor (iii) the ideal head developed (iv) the work done and (v) the exit total pressure. Take C_p of air = 1.005 kJ/kg-K. (10 Marks)

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CBCS Scheme

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15ME53

Fifth Semester B.E. Degree Examination, June/July 2018
Turbo Machines

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define with appropriate expressions: i) flow coefficient ii) head coefficient iii) power coefficient iv) specific speed. **(08 Marks)**

b. A model of a centrifugal pump absorbs 5 KW at a speed of 1500 rpm, pumping water against a head of 6m. The large prototype pump is required to pump water to a head of 30 m. The scale ratio of diameter is 4. Assume same efficiency and similarities. Find: (i) Speed (ii) Power of prototype (iii) The ratio of discharge of prototype and model. **(08 Marks)**

OR

2 a. Show that polytropic efficiency for compressor is given by $\eta_p = \left(\frac{\gamma-1}{\gamma}\right)\times\left(\frac{n}{n-1}\right)$. **(08 Marks)**

b. Air enters a compressor at a static pressure of 1.5 bar, a static temperature of 15°C and a flow velocity of 15 m/s. At the exit the static pressure is 3 bar the static temperature is 100°C and the flow velocity is 100 m/s. The outlet is 1 m above the inlet. Evaluate :

i) The isentropic change in enthalpy

ii) The actual change in enthalpy and efficiency of the compressor. **(08 Marks)**

Module-2

3 a. Define utilization factor and write the expression. Derive relation between degree of reaction and utilization factor. **(08 Marks)**

b. The following data refers to a turbomachine. Inlet velocity of whirl = 16 m/s, velocity of flow = 10 m/s, blade speed = 33 m/s, outlet blade speed = 8 m/s. Discharge is radial with an absolute velocity of 16 m/s. If water is the working fluid flowing at the rate of 1 m^3/s. Calculate the following:

i) Power in KW

ii) Change in total pressure in kN/m^2

iii) Degree of reaction

iv) Utilization factor **(08 Marks)**

OR

4 a. Derive theoretical head capacity relation in case of centrifugal pumps.

$$H = \frac{u_2^2}{g_c} - \frac{u_2^2 Q \cot\beta_2}{A_2 g_c}$$

where β_2 discharge blade angle with respect to tangential direction. **(08 Marks)**

b. A hydraulic reaction turbine of the radial inward flow type works under a head of 160 m of water. At the point of fluid entry, the rotor blade angle is 119° and diameter of the runner is 3.65 m. At the exit, the runner diameter is 2.45 m. If the absolute velocity of the wheel outlet is radially directed with a magnitude of 15.5 m/s and the radial component of velocity at the inlet is 10.3 m/s. Find the power developed by the machine, assuming that the 88% of the available head of the machine is converted into work and the flow rate is 110 m^3/s. Find also the degree of reaction and the utilization factor. **(08 Marks)**

Module-3

5 a. Define compounding. List different types of compounding. Explain any one method of compounding with neat sketch showing variations of pressure and velocity of steam. **(08 Marks)**

b. The following particulars refer to a stage of a parsons steam turbine. Mean diameter of blade ring = 70 cm, steam velocity at inlet of moving blades = 160 m/s, outlet blade angles of moving blade $\beta_2 = 20°$. Steam flow through the blades = 7 kg/s and speed 1500 rpm, $\eta = 0.8$. Draw the velocity diagram and find the following: i) Blade inlet angle ii) Power developed in the stage iii) Available isentropic enthalpy drop. **(08 Marks)**

OR

6 a. Derive the condition for maximum efficiency of an impulse steam turbine and show that the maximum efficiency is $\cos^2\alpha_1$. **(08 Marks)**

b. In a stage of an impulse turbine provided with single row wheel, the mean diameter of the blade ring is 80 cm and speed of rotation is 3000 rpm. The steam issues from the nozzles with a velocity of 300 m/s and the nozzle angle is 20°. The rotor blades are equiangular and blade velocity coefficient is 0.85. What is the power developed in the blades when the axial thrust on the blade is 140 N. **(08 Marks)**

Module-4

7 a. Show that for a maximum efficiency of peltan wheel, the bucket velocity is equal to half of the jet velocity. **(08 Marks)**

b. A double over hung peltan wheel unit is to produce 30000 KW at the generator under an effective head of 300 m at base of the nozzle. Find the size of the jet, mean diameter of the runner, speed and specific speed of the each peltan turbine. Assume generator efficiency = 93%, peltan wheel efficiency = 0.85, speed ratio = 0.46, jet velocity coefficient = 0.97 and jet ratio 12. **(08 Marks)**

OR

8 a. Show that pressure at the exit of the reaction turbine with draft tube is less than atmospheric pressure. **(08 Marks)**

b. A Kaplan turbine produces 30000 KW under a head of 9.6 m, while running at 65.2 rpm. The discharge through the turbine is 350 m^3/s. The tip diameter of the runner is 7.4 m. The hub diameter is 0.432 times the tip diameter. Calculate: i) Turbine efficiency ii) Specific speed of the turbine iii) Speed ratio (based on tip diameter) iv) Flow ratio. **(08 Marks)**

Module-5

9 a. Show that pressure rise in impeller of a centrifugal pump when the frictional and other losses in impeller are neglected is given by $\frac{1}{2g}\left[v_{f_1}^2 + u_2^2 - v_{f_2}^2 \operatorname{cosec}^2\beta_2\right]$ where v_{f_1} and v_{f_2} are flow velocities at inlet and outlet of the impeller. u_2 = tangential speed of impeller at exit, β_2 = exit blade angle. **(08 Marks)**

b. A centrifugal pump has its impeller diameter 30 cm and a constant area of flow 210 cm^2. The pump runs at 1440 rpm and delivers 90 LPS against a head of 25 m. If there is no whirl velocity at entry, compute the rise in pressure head across the impeller and hydraulic efficiency of pump. **(08 Marks)**

OR

10 a. Explain the working principle of the axial flow compressor along with a neat sketch of compressor with inlet guide vane. **(08 Marks)**

b. A 4 stage centrifugal pump has 4 identical impellers keyed to the same shaft. Speed of the shaft is 500 rpm. Total manometric head developed from 4 impellers is 50 m. The width at exit is 5 cm and diameter at exit is 60 cm. Whirl velocity at exit is 10 m/s, radial flow velocity at exit is 2 m/s. Calculate: i) Discharge ii) Exit vane angle iii) Manometric efficiency. **(08 Marks)**

CBCS SCHEME

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15ME54

Fifth Semester B.E. Degree Examination, June/July 2018
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 80

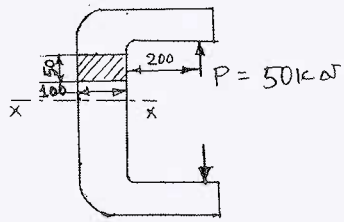
Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Use of design data handbook is permitted.
3. Assume missing data, if any, suitably.

Module-1

1 a. Briefly explain the process of mechanical engineering design. **(03 Marks)**

b. Explain the importance of standards in design and list different standards used. **(03 Marks)**

c. Determine extreme fiber stresses at section x - x of the machine member loaded as shown in Fig.Q1(c). Also show the distribution of stresses at this section. **(10 Marks)**



All dimensions are in mm.

Fig.Q1(c)

OR

2 a. State and explain following theories of failure:
(i) Maximum normal stress theory
(ii) Maximum shear stress theory **(06 Marks)**

b. A shaft made of C40 steel is subjected to a bending moment of 10 kN-m and a twisting moment of 8 kN-m. Factor of safety used is 2.5. Determine the required diameter of the shaft according to :
(i) Maximum shear stress theory of failure
(ii) Maximum distortion energy theory of failure. **(10 Marks)**

Module-2

3 a. Derive Soderberg equation for designing members subjected to fatigue loading. **(06 Marks)**

b. Machine member is in the form of a simply supported beam of length 1 m and cross section 50mm × 60mm. It is made of steel having permissible stress of 120 MPa. Determine the safe height from which a mass of 10 kg may be allowed to fall at the midpoint of the beam. **(10 Marks)**

OR

4 A transmission shaft carries a gear midway between two bearings. The bending moment at the gear varies from – 300 N-m to +500 N-m, as the twisting moment varies from 100 N-m in c.w. direction to 200 N-m in c.c.w direction. The frequencies of variation of bending and torsional moments are equal to the shaft speed. The shaft is made of C30 steel. The endurance limit may be taken as 50% of ultimate strength. Determine the diameter of the shaft taking size factor as 0.85, surface finish factor as 0.88 and factor of safety of 2. **(16 Marks)**

Module-3

5 A power transmission shaft 1400 mm long is supported at its extreme ends. The shaft receives a power of 50 kW through a gear drive located 500 mm to the right of the left end of the shaft at a rated speed of 600 rpm. PCD of gear is 200 mm, pressure angle 20° and weight 500 N. This gear receives power from another gear directly behind. This power is delivered through a belt drive located a distance of 400 mm to the left of the right support. The belt pulley has a pitch diameter of 350 mm and weighs 800 N. The belt moving on the pulley is directed towards the observer, below the horizontal and inclined at 45° to it. The ratio of belt tensions is 3. Selecting carbon steel C40, factor of safety of 2.5 design the solid circular shaft consider the loading to have minor shocks. **(16 Marks)**

OR

6 a. A cast iron protected type flange coupling is used to connect two shafts of 80 mm diameter. The shaft runs at 300 rpm and transmits a power of 150 kW. The permissible shear stress for shaft and bolt materials is 50 MPa and permissible shear stress for flange is 10 MPa. design the coupling and draw the sketch. **(08 Marks)**

b. Design a knuckle joint for a tie rod of circular cross section to sustain a maximum tensile load of 75 kN. The material used for the joint has the following permissible stresses: 120 MPa in tension 80 MPa in shear and 180 MPa in crushing. **(08 Marks)**

Module-4

7 a. Design a double riveted double strap longitudinal butt joint with unequal straps for a pressure vessel. The ID of the pressure vessel is 1.2 m and vessel is subjected to an internal pressure of 2.5 MPa. The pitch of the rivet in the outer row is to be double the pitch in the inner row. The allowable tensile stress for the plate material is 120 MPa. The allowable shearing and crushing stress for rivet material are : 80 MPa and 170 MPa respectively. The strength of the rivet in double shear is to be taken as 1.875 times that in single shear. Assume efficiency of the joint as 85%. **(08 Marks)**

b. Determine the size of rivets required for the eccentrically loaded joint as shown in Fig.Q7(b). The allowable shear stress for the rivet material is 60 MPa. **(08 Marks)**

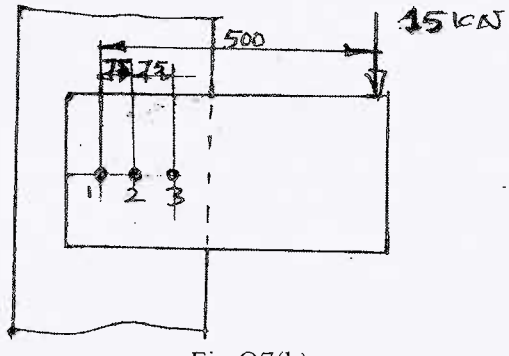


Fig.Q7(b)

OR

8 a. What are the advantages and disadvantages of welded joint over riveted joints? **(03 Marks)**

b. What is a 'Lozange' joint? Where is it used? **(03 Marks)**

c. Determine the size of the weld required for a flat plate welded to a steel column and loaded as shown in Fig.Q8(c). The permissible shear stress for the weld material is 70 MPa. **(10 Marks)**

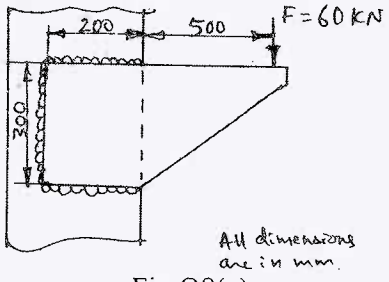


Fig.Q8(c)

Module-5

9 a. The cylinder head of a steam engine is subjected to a pressure of 0.6 MPa. It is held in position by means of 12 bolts. Each bolt is subjected to an initial tension of 5 kN. A soft copper gasket is used to make the joint leak proof. Effective diameter of the cylinder is 250 mm. Find the size of bolts so that the stress in the bolt is not to exceed 100 MPa. **(08 Marks)**

b. A bracket is fixed to the support using four bolts as shown in Fig.Q9(b). Select the suitable size for bolts if the allowable tensile stress in the bolts is 120 MPa. **(08 Marks)**

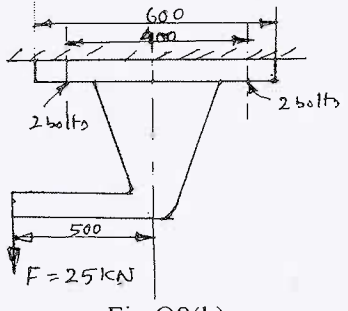


Fig.Q9(b)

OR

10 a. Explain self locking in power screws and its importance. **(03 Marks)**

b. A screw jack is to lift a load of 100 kN through a height of 400 mm. Screw is made of steel with allowable stresses of 100 MPa in tension and compression, 60 MPa in shear. The material for the nut in phosphor bronze for which the allowable stress in tension is 30 MPa, in compression it is 60 MPa and in shear 25 MPa. The bearing pressure between nut and screw is not to exceed 18 MPa. Design the screw and nut. Also check whether the screw is self locking. Take coefficient of friction between screw and nut threads as 0.14 and for collar 0.1. **(13 Marks)**

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10ME52

Fifth Semester B.E. Degree Examination, June/July 2018

Design of Machine Elements – I

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of design data hand book is permitted.***

PART – A

1 a. What are the basic requirements of machine elements? Explain briefly. **(04 Marks)**

b. The state of stress at a point in a strained member is shown in Fig.Q1(b). The tensile principal stress is known to be 84 N/mm^2. Determine:
i) Maximum shearing stress at the point and orientation of its plane
ii) Shearing stress τ_{xy}.

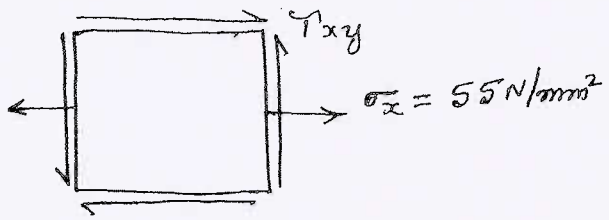

Fig.Q1(b) **(08 Marks)**

c. A bar of 50 mm diameter fixed at one end is subjected to a torsional load of 1 kN-m in addition to an axial pull of 15 kN. Determine the principal stresses if the length of the shaft is 250 mm. **(08 Marks)**

2 a. Explain the following theories of failure and state when they are used:
i) Maximum principal stress theory.
ii) Maximum shear stress theory. **(05 Marks)**

b. Determine the maximum stress induced in the semi circular grooved shaft in Fig.Q2(b) if it is subjected to :
i) An axial load of 40 kN
ii) A bending moment of 400 Nm
iii) A twisting moment of 500 Nm.

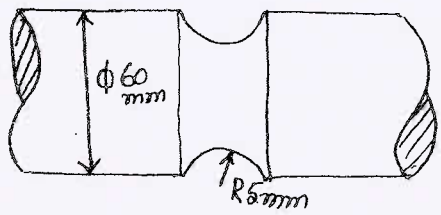

Fig.Q2(b) **(10 Marks)**

c. Derive an expression for stress induced in a rod due to the axial impact of a weight 'W' dropped from a height 'h' on to a collar attached at the free end of the rod. What is the stress due to suddenly applied load? **(05 Marks)**

3 a. Derive Goodman's relation. **(05 Marks)**

b. A steel cantilever member shown in Fig.Q3(b) is subjected to a transverse load at its end that varies from 45 N up to 135 N down as an axial load varies from 110 N compression to 450 N tension. Determine the required diameter at the change of section for infinite life using a factor of safety of 2. The strength properties of the material are σ_u = 550 MPa, σ_y = 470 MPa and σ_{-1} = 275 MPa. Notch sensitivity index q = 1.

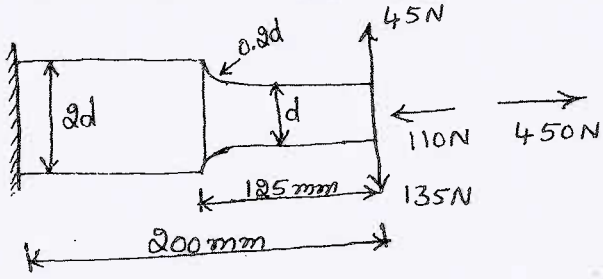

Fig.Q3(b) **(15 Marks)**

4 a. A flat circular plate is used to close the flanged end of a pressure vessel of internal diameter 300 mm. The vessel carries a fluid at a pressure of 0.7 N/mm^2. A safe copper gasket is used to make the joint leak proof. Twelve bolts are used to fasten the cover plate on to the pressure vessel. Find the size of bolts so that the stress in the bolts is not to exceed 100 N/mm^2. **(08 Marks)**

b. The structural connection shown in Fig.Q4(b) is subjected to an eccentric load P of 10 kN with an eccentricity of 500 mm. The centre distance between bolts at 1 and 3 is 150 mm and the centre distance between bolts at 1 and 2 is 200 mm. All bolts are identical. The bolts are made of plain carbon steel having yield strength in tension of 400 MPa and the factor of safety is 2.5. Determine size of bolts.

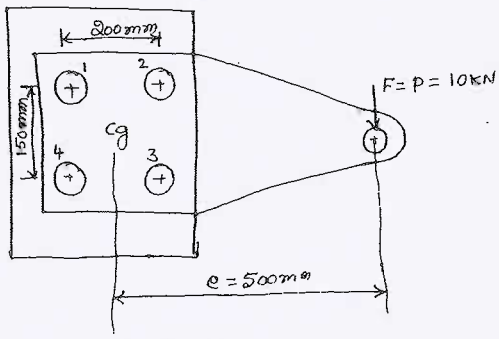

Fig.Q4(b) **(12 Marks)**

PART – B

5 A transmission shaft running at 500 rev/min is supported on bearings 800 mm apart. 20 KW power is supplied to the shaft through a 450 mm diameter pulley which is located 400 mm to the right of right bearing and receives power from a motor placed directly below the shaft. The shaft further transmits this power to a spur gear of 300 mm pitch circle diameter, which is located at 400 mm to the right of left bearing. The gear has 20° involute teeth and ratio of belt tensions is 3:1. The gear drives another gear which is placed directly above the shaft. The gear and pulley are keyed to the shaft. Selecting the material as steel having σ_{ut} = 700 MPa and σ_{yt} = 460 MPa as per ASME code, determine the diameter of shaft. Assume shock factors for bending and torsion as 1.5. **(20 Marks)**

6 a. A rectangular sunk key 14 mm wide × 10 mm thick × 75 mm long is required to transmit 1200 Nm torque from a 50 mm diameter solid shaft. Determine whether the length is sufficient or not if the permissible shear stress and crushing stress are limited to 56 MPa and 168 MPa respectively. **(06 Marks)**

b. Design a flange coupling to connect the shafts of a motor and centrifugal pump for the following specifications Pump output = 3000 litres/minute; total head = 20 m; pump speed = 600 rpm; pump efficiency = 70%. Select C40 steel (σ_y = 328.6 MPa) for shaft and C35 steel (σ_y = 304 MPa) for bolts with factor of safety 2. Use allowable shear stress in cast iron flanges equal to 15 N/mm^2. **(14 Marks)**

7 a. Design a double riveted butt joint with two cover plates for the longitudinal Seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.9 MPa. Assume joint efficiency as 75%. Allowable stress in tension for the plate is 83 MPa in compression 138 MPa and shear stress in rivets may be assumed as 55 MPa. Assume chain riveted joint. **(10 Marks)**

b. Determine the size of weld required for the joint shown in Fig.Q7(b), if the allowable shear stress in the weld is limited to 80 N/mm^2.

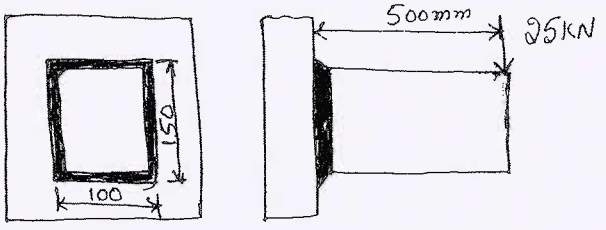

Fig.Q7(b) **(10 Marks)**

8 a. Explain self locking and over hauling in power screws. **(04 Marks)**

b. A screw jack is to lift a load of 80 kN through a height of 400 mm. Ultimate strength of screw material in tension and compression is 200 N/mm^2 and in shear 120 N/mm^2. The material for the nut is phosphor bronze for which the ultimate strength is 100 N/mm^2 in tension and 90 N/mm^2 in compression and 80 N/mm^2 in shear. The bearing pressure between the nut and the screw is not to exceed 18 N/mm^2. Design the screw and nut and check for the stresses. Take FOS = 2. Assume 25% overhead for screw rod design. **(16 Marks)**

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CBCS Scheme

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15ME52

Fifth Semester B.E. Degree Examination, June/July 2018
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. State the condition for static equilibrium of a body subjected to a system of,
(i) Two forces (ii) Three forces (iii) Member with two forces and a torque. **(06 Marks)**

b. For the mechanism shown in Fig. Q1 (b), find the required input torque for the static equilibrium. The length of OA and AB are 250 mm and 650 mm respectively. F = 500 N. **(10 Marks)**

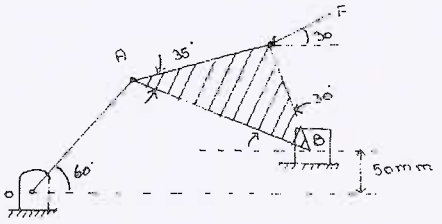

Fig. Q1 (b)

OR

2 a. Explain in brief D'Alembert's principle and state why it is used. **(06 Marks)**

b. In a vertical double acting engine, the connecting rod is 4.5 times the crank. Stroke of the piston is 400 mm and the mass of the reciprocating parts is 100 kg. The engine runs at 250 rpm. If the net load on the piston due to steam pressure is 25 kN when the crank has turned through an angle of 120° from the top dead centre, determine
(i) Piston effort.
(ii) Thrust in the connecting rod
(iii) Pressure on slide bars.
(iv) Crank pin effort
(v) Thrust on crank shaft bearing
(vi) Turning moment on the crank shaft. **(10 Marks)**

Module-2

3 a. Briefly explain the static and dynamic balancing. **(04 Marks)**

b. Four masses A, B, C and D are carried by a rotating shaft at a radii 100 mm, 125 mm, 200 mm and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B,C and D are 10 kg, 5 kg and 4 kg respectively. Find the required mass 'A' and the relative angular positions of the four masses. So that the shaft shall be in complete balance. **(12 Marks)**

OR

4 a. What do you mean by primary and secondary unbalance in reciprocating engines? **(04 Marks)**

b. The Cranks and connecting rod of a 4 cylinder in line engine running at 1800 rpm, are 50 mm, 250 mm each respectively and the cylinders are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end and the cranks appear at intervals of 90° in an end view in the order 1 – 4 – 2 – 3. The reciprocating masses corresponding to each cylinder is 1.5 kg. Determine
(i) Unbalanced primary and secondary forces if any.
(ii) Unbalanced primary and secondary couples with reference to central plane of engine. **(12 Marks)**

Module-3

5 a. Derive the expression for speed of a porter governor with usual notations taking friction in to account. **(06 Marks)**

b. In a porter governor, the upper and lower arms are 200 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of central load is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 24 N at the sleeve. If the limiting inclinations of the upper arms to the verticals are 30° and 40°. Find the range of speed taking friction in to account. **(10 Marks)**

OR

6 a. Explain the effect of Gyroscopic couple of a ship under,
(i) Steering (ii) Pitching (iii) Rolling **(08 Marks)**

b. Analyse the stability of a two wheel vehicle turning right. Derive the necessary equation. **(08 Marks)**

Module-4

7 a. Define the following terms:
(i) Simple harmonic motion (ii) Resonance.
(iii) Degrees of freedom (iv) Phase difference. **(04 Marks)**

b. With a neat sketch, explain the beats phenomenon and obtain it's resultant motion. **(06 Marks)**

c. Add the following motions analytically and check the solution graphically,
$x_1 = 2\cos(\omega t + 0.5)$; $x_2 = 5\sin(\omega t + 1.0)$ **(06 Marks)**

OR

8 a. Explain energy method of finding natural frequency of a spring mass system. **(06 Marks)**

b. Find the natural frequency of the system shown in Fig. Q8 (b), by using Newtons method and Energy method. **(10 Marks)**

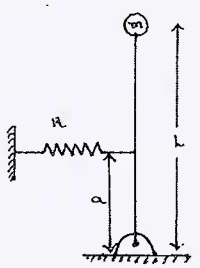

Fig. Q8 (b)

Module-5

9 a. Set up the differential equation for a spring mass Damper system and obtain complete solution for the under damped system. **(10 Marks)**

b. For a spring mass damper system of mass 3.5 kg; spring of stiffness 2.5 N/mm and damping co-efficient of 0.018 N-S/mm. Find
(i) Logarithmic decrement (ii) Ratio of any two successive amplitude
(iii) Number of cycles after which original amplitude reduces to 20%. **(06 Marks)**

OR

10 a. Derive expression for steady state amplitude of vibration of mass in a spring mass damper system, when the mass is subjected to harmonic excitation. Also find phase angle. **(10 Marks)**

b. A pump of 200 kg is driven through a belt by an electric motor at 3000 rpm. The pump is mounted on isolators with total stiffness 5 MN/m and damping 3.125 kN-S/m. Determine the vibratory amplitude of the pump at the running speed due to harmonic force of 1 kN. Also determine maximum amplitude when the pump is switched on and the motor speed passes through resonant condition. **(06 Marks)**

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USN 2VD13ME411

10ME54

Fifth Semester B.E. Degree Examination, June/July 2018
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. What are the conditions for a body to be in equilibrium under the action of (i) two forces (ii) three forces (iii) two forces and a torque? **(06 Marks)**

b. A four bar mechanism shown in Fig.Q1(b) is acted by a force F = 2000 N. Calculate the required torque on link $AB(T_2)$ for equilibrium of the mechanism. Given AB = 200mm. BC = 370 mm, DC = 250 mm, AD = 215 mm, CE = 100 mm, ∠DAB = 110°, ∠CEF = 45°. **(14 Marks)**

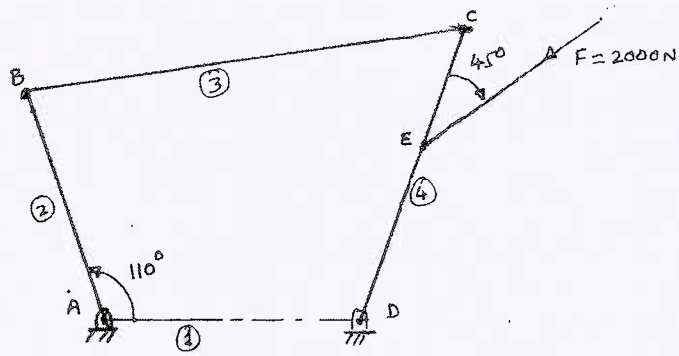

Fig.Q1(b)

2 a. Derive an expression for the size of flywheel. **(06 Marks)**

b. During one revolution of the crank of a multicylinder engines the areas above and below the mean turning moment line taken in order are +0.36, – 0.81, +0.75, – 0.64, +0.92, – 0.58 cm^2. Horizontal scale of diagram 1 cm = 45°, vertical scale 1 cm = 7200 Nm, speed of engine 150 rpm, total fluctuation of speed 2% of mean speed. Find
(i) Mass of flywheel (ii) Area of cross section of rim.
Neglect the effect of arms and boss. Take density of rim material as 7260 kg/m^3 and peripheral speed (mean) as 1000 m/min. **(14 Marks)**

3 a. Derive an expression for centrifugal tension in a belt passing around a pulley rim. **(06 Marks)**

b. A leather belt drive is required to transmit 10 kW from a motor running at 600 RPM. The belt is 12mm thick and has mass density of 0.001 gm/mm^3. Safe stress in the belt not to exceed 2.5 N/mm^2. Diameter of driving pulley is 250 mm whereas speed of the driven pulley is 220 RPM. Two shafts are 1.25 m apart. The coefficient of friction is 0.25. Determine the width of the belt. **(14 Marks)**

4 a. Explain the procedure for balancing several masses rotating in the same plane. **(06 Marks)**

b. A shaft carries four masses A, B, C and D of magnitude 200 kgs, 300 kgs, 400 kgs, and 200 kgs respectively revolving at radii 80 mm, 70 mm, 60 mm and 80 mm respectively. The distances of the planes in which masses B, C, D are revolving as measures from the plane of rotation of mass A is 300 mm, 400 mm and 700 mm. The angles between the cranks measured counter clockwise are A to B 5°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between planes A and X is 100 mm and that between planes X and Y is 400 mm. The distance between planes Y and D is 200 mm. If the balancing masses revolve at radius of 100 mm, determine their magnitude and angular positions. **(14 Marks)**

PART – B

5 a. Show that for a 90° engine the primary forces can be balanced by a single rotating balance mass. **(06 Marks)**

b. A four cylinder vertical engine has cranks 300 mm long. The planes of rotation of first, third and fourth cranks are 750mm, 1050mm and 1650 mm respectively from that of the second crank and their reciprocating masses are 150 kg, 400 kg and 250 kg respectively. Find the mass of reciprocating parts for the second cylinder and the relative angular position of the cranks in order that the engine may be in complete primary balance. **(14 Marks)**

6 a. Each arm of a porter governor is 300 mm long and pivoted on the axis of rotation. Each ball has a mass of 6 kg and the mass of the sleeve is 18 kg. Radius of rotation of the ball is 200mm when the governor begins to lift and 250 mm when the speed is maximum. Determine the maximum and minimum speed of the governor. **(10 Marks)**

b. In a spring loaded governor of Harmell type rotating masses are each 1.5 kg and rotate at a radius of 120 mm when the equilibrium speed is 550 RPM. At this speed the arms of bell crank lever are 100 mm and 75 mm respectively are vertical and horizontal when the equilibrium speed is 575 RPM, the rotating masses are at maximum radius of 145 mm. Determine the rate of spring and compression of spring at 550 RPM. **(10 Marks)**

7 a. Describe the effect of gyroscopic couple on an aeroplane. **(06 Marks)**

b. A ship is propelled by a turbine rotor of mass 500 kg and has a speed of 2400 RPM. The rotor has a radius of gyration of 0.5 m and rotates in clockwise direction when viewed from stern. Find the gyroscopic effect when

(i) The ship pitches ± 5° from the horizontal position with a time period of 20 sec with SHM. Bow descending with max velocity.

(ii) Ship runs at speed of 15 knots (1 knot = 1.860 km/hr) and steers to the left in a curve of 60 m radius.

(iii) Ship rolls with angular velocity of 0.04 rad/sec clockwise when viewed from the stern. **(14 Marks)**

8 A symmetrical cam with convex flanks operating a flat faced follower has a base circle diameter of 75 mm and nose radius of 10 mm. The lift the follower is 20 mm. The cam is symmetrical and the total angle of action is 120°. Determine (i) Principal dimensions of the cam (ii) Acceleration of the follower at the beginning of lift, at the end of contact with circular flank, at the beginning of contact with the nose and at the apex of the nose. Speed of cam shaft is 600 RPM. **(20 Marks)**

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CBCS Scheme

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15ME562

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Energy and Environment

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain briefly world energy scenario with respect to production and consumption using relevant statistics. **(08 Marks)**

b. Elaborate the effect of various social and environmental aspects on India's energy development. **(08 Marks)**

OR

2 a. Discuss briefly the various key energy trends in India. **(12 Marks)**

b. List and explain various forms of energy in a brief manner. **(04 Marks)**

Module-2

3 a. List the different types of thermal energy storage systems. Explain any two of them. **(08 Marks)**

b. Elaborate the different phases involved in detailed energy audit methodology. **(08 Marks)**

OR

4 a. A power plant of 210 MW installed capacity has the following particulars:
Capital cost = Rs.18000/KW installed
Interest and depreciation = 12%
Annual load factor = 60%
Annual capacity factor = 54%
Annual running charges = Rs.2×10^8
Energy consumed by auxiliaries = 6%.
Calculate the cost of power generation per kWh. **(10 Marks)**

b. What are the general characteristics of capital investments? **(06 Marks)**

Module-3

5 a. Identify the need for public awareness on environment management. Discuss the effort of important institutions and people in environment management. **(10 Marks)**

b. Discuss how carbon is utilized in the ecosystem with the help of a simple flow diagram. **(06 Marks)**

OR

6 a. Define ecosystem. Explain the different types of forest ecosystems in India. **(10 Marks)**

b. Explain the following terms:
i) Food chain
ii) Food web
iii) Ecological pyramid **(06 Marks)**

Module-4

7 a. Explain the main sources and effects of air pollution. **(10 Marks)**

b. Discuss the role of an individual in prevention of pollution. **(06 Marks)**

OR

8 a. Discuss strategy and techniques involved in solid waste management. **(10 Marks)**

b. Illustrate a case study related to environmental pollution in detail. **(06 Marks)**

Module-5

9 a. Write a short note on Global warming. **(06 Marks)**

b. What is the need for wasteland reclamation? Explain the methods for reclaiming wasteland. **(10 Marks)**

OR

10 a. What are the objectives of Water (prevention and control of pollution) Act? Explain its salient features and penalties for violation. **(10 Marks)**

b. Explain the role of environment impact Assessment (EIA) in Enforcing Environmental Legislation. **(06 Marks)**

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CBCS Scheme

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15ME61

Sixth Semester B.E. Degree Examination, June/July 2018
Finite Element Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define FEM. Discuss various applications of FEA in different domain. **(04 Marks)**

b. Explain convergence requirements of a displacement field. **(04 Marks)**

c. Using minimum potential energy determine the nodal displacement of a spring system shown in Fig. Q1(c). **(08 Marks)**

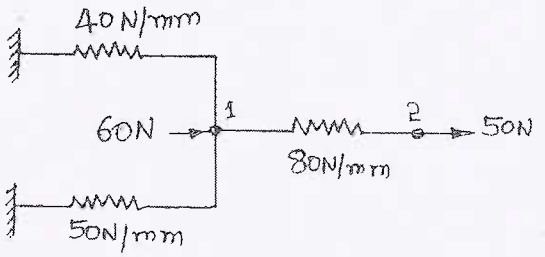

Fig.Q1(c)

OR

2 a. Using Rayleigh – Ritz method, determine the displacement at midpoint and stress variation in a one dimensional rod as shown in Fig.Q2(a). **(09 Marks)**

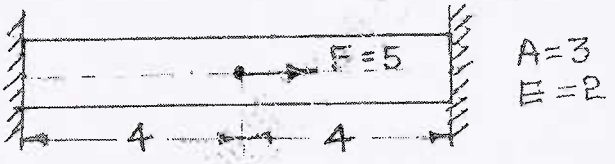

Fig.Q2(a)

b. Write stress-strain relations for plain stress and plain strain conditions. **(04 Marks)**

c. What do you mean by simplex, complex and multiplex elements? **(03 Marks)**

Module-2

3 a. What are higher order element? Derive shape function for 1D quadratic element in natural co-ordinates. **(06 Marks)**

b. Deduce expression for shape function for four noded tetrahedral element (TET4) using Lagrange interpolation functions. **(06 Marks)**

c. Evaluate $\int_{-1}^{+1} (x^2 + \sin\frac{\pi x}{2})\,dx$ using suitable Gauss points numerical integration. **(04 Marks)**

OR

4 a. For the stepped bar shown in Fig.Q4(a). Determine the nodal displacements, stress in each element and left support reaction. **(10 Marks)**

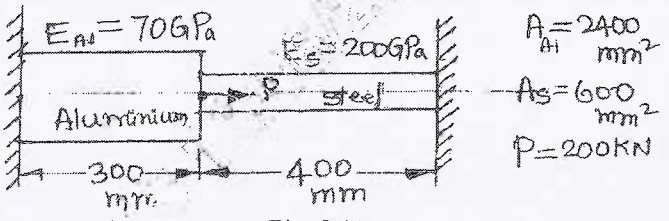

Fig.Q4(a)

b. With assumptions, deduce element stiffness matrix used for analysis of trusses. **(06 Marks)**

Module-3

5 a. Derive Hermite shape function for a beam element. **(08 Marks)**

b. For the beam and loading as shown in Fig.Q5(b), determine deflection, slope and support reaction. Take E = 110GPa, I = $5 \times 10^{-4} m^4$. **(08 Marks)**

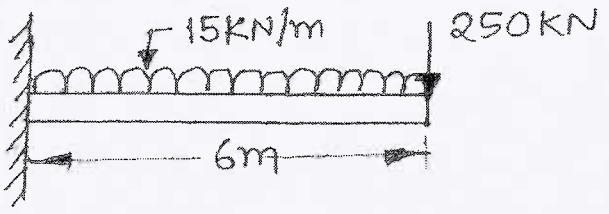

Fig.Q5(b)

OR

6 a. Derive torsional stiffness matrix for a circular shaft subjected to pure torsion. **(06 Marks)**

b. For the circulars stepped shaft shown in Fig.Q6(b) determine stresses and angle of twist. **(10 Marks)**

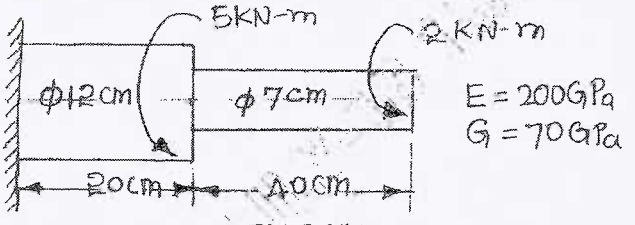

Fig.Q6(b)

Module-4

7 a. Briefly describe rate equations and boundary conditions in heat transfer analysis. **(06 Marks)**

b. Determine the temperature distribution through composite wall shown in Fig.Q7(b) when the convective heat loss occurs on the right surface. Take K_1 = 6W/m°C and K_2 = 20 W/m°C. **(10 Marks)**

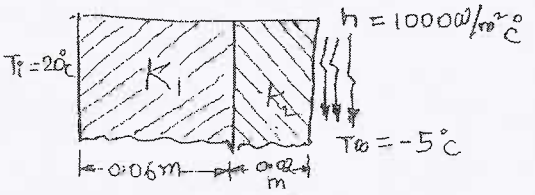

Fig.Q7(b)

OR

8 a. Deduce the governing differential equation for one-dimensional fluid flow through a process medium. **(06 Marks)**

b. For the smooth pipe of variable c/s shown in Fig.Q8(b). Determine the potential at the junction the velocities in each section of pipe and the volumetric flow rate. The potential at the left end is $P_1 = 12m^2/S$ and that at right end is $P_4 = 3\ m^2/S$. Take $K_x = 1$. **(10 Marks)**

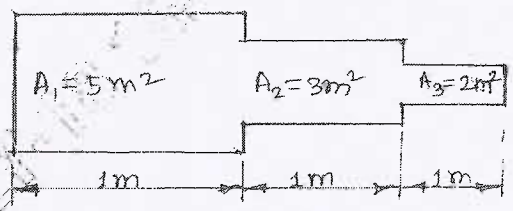

Fig.Q8(b)

Module-5

9 a. What is an axisymmetric element? Derive Jacobian matrix for axisymmetric triangular element. **(08 Marks)**

b. For the element of an axisymmetric body rotating with constant angular velocity W = 1000 rev/min as shown in Fig.Q9(b). Determine the body force vector including weight of material with specific density is 7850 kg/m^3. **(08 Marks)**

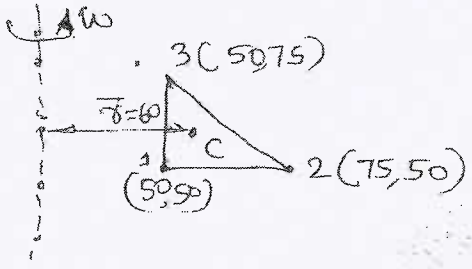

Fig.Q9(b)

OR

10 a. Derive an expression of element mass matrix for a bar element. **(06 Marks)**

b. For the stepped bar shown in Fig.Q10(b) determine the eigen values and eigen vector. Take $A_1 = 400mm^2$, $A_2 = 200mm^2$, $\rho = 7850\ kg/m^3$, E = 200GPa. **(10 Marks)**

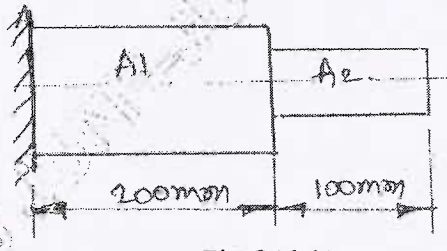

Fig.Q10(b)

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CBCS SCHEME

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15ME62

Sixth Semester B.E. Degree Examination, June/July 2018
Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define automation. Distinguish between fixed and programmable automation with examples. **(08 Marks)**

b. State and explain the different reasons for automation. **(08 Marks)**

OR

2 a. Explain upper bound and lower bound approach with respect to automated transfer lines. **(08 Marks)**

b. The average part produced in a certain batch manufacturing plant must be processed through an average of 8 machines, 15 new batches are launched each week. Operating time is 8 min, average set up time is 8 hours, batch size is 30 minutes, average non-operation time is 15 hrs/machine. Number of machines available in the plant is 20. The plant operates on an average of 80 production hrs/week. Determine (i) manufacturing lead time (ii) production rate (iii) plant utilization (iv) Work-in-process. **(08 Marks)**

Module-2

3 a. State and explain the different steps in computer aided design process. **(08 Marks)**

b. Explain the functions of a graphics package. **(08 Marks)**

OR

4 a. Define computer aided process planning. With a block diagram explain variant approach type of CAPP system. **(08 Marks)**

b. What do you mean by material requirement planning (MRP)? What are MRP inputs and outputs? **(08 Marks)**

Module-3

5 a. Define flexible manufacturing system? List and explain the different types of flexibility. **(08 Marks)**

b. Explain in brief with diagram the structure of AS/RS system. What are the advantages of it? **(08 Marks)**

OR

6 a. Explain the terminology with formulas:
(i) Minimum rational work element
(ii) Cycle time (iii) Precedence constraints and precedence diagram. **(06 Marks)**

b. A project has the following tasks. Its immediate predecessor and task times are given below. Using largest candidate rule balance the line and determine
(i) Number of work stations
(ii) Balance delay of line and
(iii) Line efficiency
Take cycle time = 1 min.

Tasks	1	2	3	4	5	6	7	8	9	10	11	12
Proceded by	-	-	1	1, 2	2	3	3	3, 4	6, 7, 8	5, 8	9, 10	11
T_e(min)	0.2	0.4	0.7	0.1	0.3	0.11	0.32	0.6	0.27	0.38	0.5	0.12

(10 Marks)

Module-4

7 a. With a sketch explain the classification of NC/CNC's system based on motion control systems. **(09 Marks)**

b. Write a manual part programme for machining the profile as shown in the Fig.Q7(b)? **(07 Marks)**

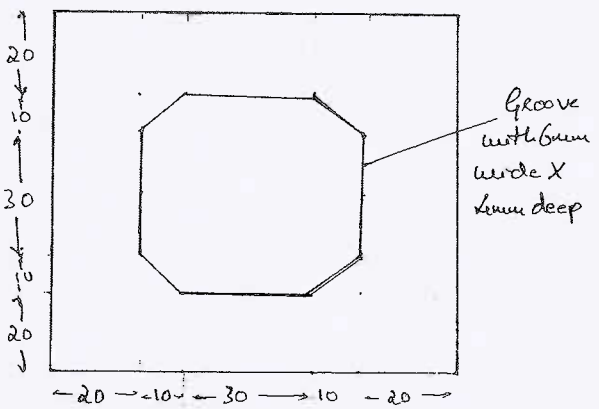

Fig.Q7(b)

OR

8 a. Explain with a neat sketch the robot configuration. **(07 Marks)**

b. Explain briefly with diagram if necessary :
(i) Slip sensors (ii) Range sensors (iii) Advantages and disadvantages. **(09 Marks)**

Module-5

9 a. Explain briefly the different steps involved in additive manufacturing system. **(08 Marks)**

b. With a neat sketch, explain the working principle of selective laser sintering. Discuss the advantages for it. **(08 Marks)**

OR

10 a. Explain the components of Industry 4.0. **(08 Marks)**

b. List and explain IOT applications in manufacturing. **(08 Marks)**

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CBCS SCHEME

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15ME63

Sixth Semester B.E. Degree Examination, June/July 2018
Heat Transfer

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Use of Heat transfer data hand book, steam table are permitted.

Module-1

1 a. What do you mean by boundary condition of 1st, 2nd and 3rd kind? **(06 Marks)**

b. Explain briefly the mechanism of conduction, convection and radiation of heat transfer. **(06 Marks)**

c. A mild steel tank of wall thickness 20 mm is used to store water at 95°C. Thermal conductivity of mild steel is 45 W/m °C, and the heat transfer coefficient inside and outside the tank are 2850 W/m^2 °C and 10 W/m^2 °C respectively. If surrounding air temperature 20°C, calculate Rate of heat transfer per unit area of the tank. **(04 Marks)**

OR

2 a. Derive the general three dimensional heat conduction equation in Cartesian coordinate and state the assumption made. **(08 Marks)**

b. The wall of a house in cold region consists of three layers, an outer brick work 15 cm thick, the inner wooden panel 1.2 cm thick, the intermediate layer is insulator of 7 cm thick. The 'k' for brick and wood are 0.7 and 0.18 W/mK. The inside and outside temperature of wall are 21 and – 15°C. If insulation layer offer twice the thermal resistance of the brick wall, calculate (i) heat loss per unit area (ii) 'k' of insulator. **(08 Marks)**

Module-2

3 a. Derive the expression for critical thickness of insulation for cylinder. **(06 Marks)**

b. Differentiate between effectiveness and efficiency of fins. **(04 Marks)**

c. A rod [k = 200 W/mK] 5 mm in diameter and 5 cm long has its one end maintained at 100°C. The surface of the rod is exposed to ambient air at 25°C with convection heat transfer coefficient of 100 W/m^{2}K. Assuming other end is insulated. Determine (i) the temperature of rod at 20 mm distance from the end at 100°C (ii) Heat dissipation rate from the surface of rod (iii) Effectiveness. **(06 Marks)**

OR

4 a. Derive the expression for temperature variation and heat flow using Lumped Parameter Analysis. **(06 Marks)**

b. Explain significance of Biot and Fourier number. **(04 Marks)**

c. The average heat transfer coefficient for flow of 100°C air over a flat plate is measured by observing the temperature time history of a 3 cm thick copper slab exposed to 100°C air, in one test run, the initial temperature of slab was 210°C and in 5 min the temperature is decreased by 40°C. Calculate the heat coefficient for this case. Assume ρ = 9000 kg/m^3 ; C = 0.38 kJ/kgK , K = 370 W/mK. **(06 Marks)**

Module-3

5 a. Explain formulation of differential equation 1-D steady heat conduction. **(06 Marks)**

b. Explain different solution method used in numerical analysis of heat conduction. **(06 Marks)**

c. Explain applications and computation error of numerical analysis heat conduction. **(04 Marks)**

OR

6 a. Define (i) Blackbody (ii) Planks law (iii) Wein displacement law (iv) Lamberts law. **(06 Marks)**

b. Prove that emissive power of the black body in hemispherical enclosures in π terms of intensity of radiation. **(06 Marks)**

c. The temperature of black surface of 0.2 m^2 area is 540°C. calculate (i) the total rate of energy emission (ii) the intensity of normal radiation (iii) the wavelength of maximum monochromatic emission power. **(04 Marks)**

Module-4

7 a. Explain with neat sketches (i) Velocity Boundary layer (ii) Thermal boundary layer. **(08 Marks)**

b. Air flows over a flat plate at 30°C, 0.4m wide and 0.75m long with a velocity of 20m/s. Determine the heat transfer from the surface of plate assuming plate is maintained at 90°C.

Use $N_{UL} = 0.664\ R_e^{0.5}\ Pr^{0.33}$ for laminar

$N_{UL} = \left[0.036\ R_e^{0.8} - 0.836\right] Pr^{0.333}$ for turbulent. **(08 Marks)**

OR

8 a. Explain the physical significance of the following dimensionless number:
(i) Reynold's number (ii) Prandtl number (iii) Nusselt number
(iv) Stantor number. **(06 Marks)**

b. A stream pipe 5 cm in diameter is lagged with insulating material of 2.5 cm thick. The surface temperature is 80°C and emissivity of the insulating material surface is 0.93. Find the total heat loss by natural convection and radiation. The temperature of the air surrounding the pipe is 20°C. Also find the overall heat transfer coefficient. **(10 Marks)**

Module-5

9 a. Derive expression for LMTD for parallel flow heat exchanger and state the assumption made. **(08 Marks)**

b. Water enters a counter flow heat exchanger at 15°C flowing at a rate of 1300 kg/h. It is heated by oil [c_p = 2000 J/kgK] flowing at the rate of 550 kg/h with an inlet temperature of 94°C for an area 1 m^2 and overall heat transfer coefficient of 1075 W/m^2K. Determine the total heat transfer and outlet temperature of water and oil. **(08 Marks)**

OR

10 a. Explain different regimes of pool boiling with neat sketches. **(08 Marks)**

b. Draw saturated stream at a pressure of 2.0 bar condenses on the surface of vertical tube of height 1 m. The tube surface is kept at 117°C. Estimate the thickness of the condensate film and heat transfer coefficient at a distance of 0.2 m from the upper end of the tube. Assume the condensate film to be laminar. Also calculate the average heat transfer coefficient over the entire length of the tube. **(08 Marks)**

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CBCS SCHEME

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15ME64

Sixth Semester B.E. Degree Examination, June/July 2018
Design of Machine Elements – II

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the compounding in cylinders. **(04 Marks)**

b. The C-frame of a 100 kN capacity press is shown in Fig. Q1 (b). The material of the frame is grey cast iron FG200 and the factor of safety is 3. Determine the dimensions of the frame. **(12 Marks)**

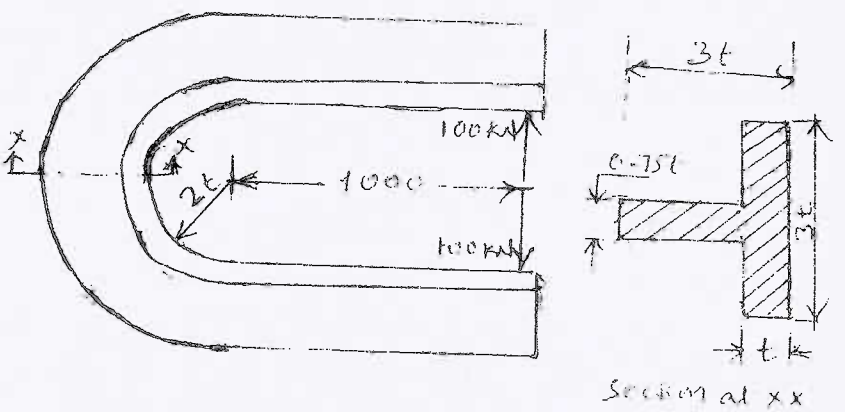


Fig. Q1 (b)

OR

2 a. Differentiate between a straight beam and a curved beam. **(04 Marks)**

b. The inner diameter of a cylinder is 250 mm. The pressure is limited to 15 MPa. The cylinder is made of plain Carbon steel with $\sigma_{ut} = 340$ N/mm^2 and $\mu = 0.27$. Taking the factor of safety as 5, calculate the cylinder wall thickness if,

(i) The ends are closed.
(ii) The ends are open. **(12 Marks)**

Module-2

3 a. Enumerate the objectives of chain lubrication. **(04 Marks)**

b. A leather belt drive transmitting 15 kW power with the help of a flat belt made of leather of mass density 0.95 g/cc. The centre distance between the pulleys is twice the diameter of the bigger pulley. The smaller pulley rotates at 1440 rpm and the speed of bigger pulley is 480 rpm. The belt should operate at a velocity of 20 m/s approximately and the stresses in the belt should not exceed 2.25 N/mm^2. The coefficient of friction is 0.35. The thickness of the belt is 5 mm. Calculate

(i) The diameter of the pulleys.
(ii) The length and width of the belt.
(iii) The belt tensions. **(12 Marks)**

OR

4 a. Explain the advantages of regular-lay ropes. **(04 Marks)**

b. Determine the percentage increases in power capacity made possible in changing over from a flat belt to a V-belt drive. The diameter of the flat pulley is the same as the pitch diameter of the grooved pulley. The pulley rotates at the same speed as the grooved pulley. The coefficient of friction for the flat belt and the V-belt is the same, 0.3. The V-belt pulley groove angle is 60°. The belts are of the same material and have the same cross section area. In each case the angle of wrap is 150°. **(04 Marks)**

c. A helical compression spring made of circular wire, is subjected to an axial force, which varies from 2.5 kN to 3.5 kN. Over this range of force, the deflection of the spring should be approximately 5 mm. The spring index can be taken as 5. The spring has square and ground ends. The spring is made of patented and cold-drawn steel wire with ultimate tensile strength of 1050 N/mm^2 and modulus of rigidity of 81370 N/mm^2. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Calculate
(i) Wire diameter (ii) Mean coil diameter (iii) Number of active coils (iv) Total number of coils (v) Solid length of the spring (vi) free length of the spring (vii) required spring rate ; and (viii) actual spring rate. **(08 Marks)**

Module-3

5 It is required to design a pair of spur gears with 20° full-depth involute teeth based on the Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10 kW, 1440 rpm motor. The starting torque of the motor is 150% of the rated torque. The speed reduction is 4 : 1. The pinion as well as the gear is made of plain carbon steel with $\sigma_d (\text{or } \sigma_0) = 200$ N/mm^2. Take number of teeth on pinion = 18. Design the gears specify their dimensions and suggest suitable hardness. Assume carefully cut gears (Class II). **(16 Marks)**

OR

6 A pair of bevel gears with 20° pressure angle, consists of a 20 teeth pinion meshing with a 30 teeth gear. The module is 4 mm, while the face width is 20 mm. The material for the pinion and gear is steel (σ_0 = 250 N/mm^2). The gear teeth are lapped and ground (Class 3) and the surface hardness is 400 BHN. The pinion rotates at 500 rpm and receives 2.5 kW power from the electric motor. The starting torque of the motor is 150% of the rated torque. Determine the factor of safety against bending failure and against pitting failure. **(16 Marks)**

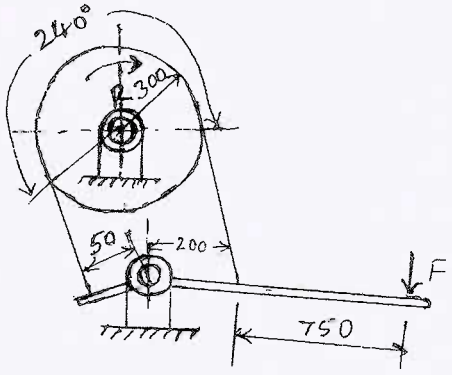
Module-4

7 Complete the design and determine the input power capacity of a worm gear speed reduces unit composed of a hardened steel worm and a phosphor bronze gear having 20° stub involute teeth. The center distance C is to be 200 mm, the transmission ratio is to be 10, and the worm speed is to be 1750 rev/min. **(16 Marks)**

OR

8 a. An automotive plate clutch consists of two pairs of contacting surfaces with asbestos friction lining. The maximum engine torque is 250 Nm. The coefficient of friction is 0.35. The inner and outer diameters of friction lining are 175 mm and 250 mm respectively. The clamping force is provided by nine springs, each compressed by 5 mm to give a force of 800 N, when the clutch is new:
(i) What is the factor of safety with respect to slippage when the clutch is brand new?
(ii) What is the factor of safety with respect to slippage after initial wear has occurred?
(iii)How much wear of friction lining can take place before the clutch will slip? **(08 Marks)**

b. A differential band brake is shown in Fig. Q8 (b). The width and thickness of the steel band are 100 mm and 3 mm respectively and the maximum tensile stress in the band is 50 N/mm^2. The co-efficient of friction between the friction lining and the brake drum is 0.25. Calculate (i) The tensions in the band (ii) The actuating force and (iii) The torque capacity of the brake. Find out whether the brake is self locking. **(08 Marks)**



All dimensions are in mm
Fig. Q8 (b)

Module-5

9 a. List the applications of anti-friction bearings. **(04 Marks)**

b. A 75 mm long full journal bearing of diameter 75 mm supports a load of 12 kN on a journal turning at 1800 rpm. Assuming a $\frac{\gamma}{C}$ ratio of 1000, and an oil having viscosity of 0.01 kg/mS at the operating temperature, determine the coefficient of friction by using (i) the McKee equation, (ii) the Raimondi and Boyd curve (iii) also determine the amount of heat generated using the co-efficient of friction as calculated by the McKee equation. **(12 Marks)**

OR

10 a. Define hydrodynamic lubrication. Explain the principle of hydrodynamic lubrication. **(06 Marks)**

b. A single row deep groove ball bearing is subjected to a radial force of 7 kN and thrust force of 2.2 kN. The shaft rotates at 1200 rpm. The expected life L_{10h} of the bearing is 20000h. The minimum acceptable diameter of the shaft is 75 mm. Select a suitable ball bearing for this application. Take X = 0.56 and Y = 1.8. **(10 Marks)**

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15ME653

Sixth Semester B.E. Degree Examination, June/July 2018
Metal Forming

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. How are metal forming processes classified? Explain with simple sketches. **(08 Marks)**

b. Discuss the advantages , limitations and applications of hot forming processes. **(08 Marks)**

OR

2 a. Derive an expression for true strain in terms of engineering strain. **(08 Marks)**

b. A tensile specimen having initial dimension of 12mm diameter and 50mm gauge length reaches a maximum load of 90kN and fractures at 70kN. The maximum diameter at fracture is 10mm. Find i) The engg. stress at maximum load and true fracture stress.
ii) True strain and engg. strain at fracture. **(08 Marks)**

Module-2

3 a. Discuss the effects of strain rate and deformation zone geometry on metal forming, with neat sketches. **(08 Marks)**

b. Explain Plastic deformation by slip and twining, with neat sketches. **(08 Marks)**

OR

4 a. Derive a relationship for the die pressure under compressive loading with sticking friction. Hence show the pressure distribution with sticking friction using a neat sketch in forging. **(08 Marks)**

b. What is the forging load required to convert a cylindrical bloom of 1m diameter into a square section of the same area of cross section? The average tensile yield strength of the metal is 104MPa and coefficient of friction is 0.5. Assume plane strain condition for forging. **(08 Marks)**

Module-3

5 a. With neat sketches, explain the different types of rolling mill arrangements. **(08 Marks)**

b. Discuss the maximum possible reduction in the rolling process, with a neat sketch. **(08 Marks)**

OR

6 a. With neat sketches, explain any two types of tube drawing process. **(08 Marks)**

b. A steel wire is drawn from an initial diameter of 6mm to a final diameter of 5.2mm. The die angle is 18^0, coefficient of friction at the die – wire interface is 0.15. Yield strength of the material is $255N/m^2$. Calculate the drawing stress in the absence of back tension. **(08 Marks)**

Module-4

7 a. Explain Direct and Indirect extrusion, with neat sketches. **(08 Marks)**

b. Discuss the defects in extrusion products. Explain the causes and possible remedies. **(08 Marks)**

OR

8 a. Explain the following sheet metal forming processes, with neat sketches :
i) Roll bending ii) Deep drawing. **(08 Marks)**

b. A circular blank of 30mm diameter is to be cut from a 2mm thick steel sheet. Determine the die and punch sizes. Estimate the punch force and stripping force needed. Shear strength of steel is 310 MPa. **(08 Marks)**

Module-5

9 a. How are High Energy Rate Forming [HERF] processes classified? Explain any two methods, with suitable sketches. **(08 Marks)**

b. Discuss the advantages, limitations and applications of High Energy Rate Forming [HERF] methods. **(08 Marks)**

OR

10 a. Explain the operations involved in making powder metallurgy parts with the help of a flow chart. **(08 Marks)**

b. Explain Hot Isostatic Pressing [HIP], with a neat sketch. **(08 Marks)**

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15ME655

Sixth Semester B.E. Degree Examination, June/July 2018
Automobile Engineering

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. List the components of automotive engine. Mention their functions and materials used for manufacturing. **(06 Marks)**

b. With neat sketch explain the working of thermosiphon cooling system. **(06 Marks)**

c. What is the necessity of engine cooling? **(04 Marks)**

OR

2 a. What is the purpose of lubrication for an IC engine? Explain any one type of lubrication system. **(07 Marks)**

b. What is the difference between a dry liner and wet liner? **(06 Marks)**

c. What are the functions of piston rings to perform in an engine? **(03 Marks)**

Module-2

3 a. What are the requirements of a clutch? And with neat sketch explain the working of cone clutch. **(07 Marks)**

b. Explain the purpose and operation of antilock braking system. **(06 Marks)**

c. What is the principle of automatic transmission? **(03 Marks)**

OR

4 a. Explain with neat sketch:
(i) Propeller shaft (ii) Universal joint. **(08 Marks)**

b. With neat sketch, briefly describe the construction and working of hydraulic brake. **(08 Marks)**

Module-3

5 a. Explain the working of power steering. **(04 Marks)**

b. What are the differences between Battery ignition system and Magneto ignition system? **(06 Marks)**

c. Explain with neat sketch: (i) Leaf spring (ii) Coil spring **(06 Marks)**

OR

6 a. What are the types of ignition systems? Describe with diagram the battery ignition system. **(08 Marks)**

b. A motor car has a wheel base of 2.743 m and pivot centre of 1.065 m. The front and rear wheel track is 1.217 m. Calculate the correct angle of outside lock and turning circle radius of the outer front and inner rear wheels, when the angle of inside lock is 40°. **(08 Marks)**

Module-4

7 a. Distinguish between supercharging and turbocharging. **(06 Marks)**

b. List out the various alternative fuels and briefly explain on cetane and octane numbers. **(10 Marks)**

OR

8 a. Explain different methods of supercharging. **(08 Marks)**

b. With a neat sketch, explain the different circuits of Carter carburetor. **(08 Marks)**

Module-5

9 a. Briefly explain different types of emission from IC engines. **(08 Marks)**

b. What are different emission standards? Explain Briefly. **(08 Marks)**

OR

10 a. What are catalytic converters? How they are helpful in reducing HC, CO and NO_x emissions. **(08 Marks)**

b. Write a note on Motor vehicle act. **(08 Marks)**

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15ME664

Sixth Semester B.E. Degree Examination, June/July 2018
Total Quality Management

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define TQM. List out the six basic approaches to TQM. **(04 Marks)**
b. Sketch and explain TQM framework. **(08 Marks)**
c. Define quality and brief on historical review of quality control. **(04 Marks)**

OR

2 a. Explain briefly the contribution of Guru's of TQM. **(07 Marks)**
b. What are the obstacles associated with the implementation of TQM? Explain any five. **(05 Marks)**
c. What are the benefits of TQM? **(04 Marks)**

Module-2

3 a. List seven habits of highly effective people. **(02 Marks)**
b. Explain Deming's 14 points. **(14 Marks)**

OR

4 a. Explain the characteristics of quality leaders. **(06 Marks)**
b. Explain the role of TQM leaders. **(10 Marks)**

Module-3

5 a. Explain customer perception of quality. **(06 Marks)**
b. With a neat sketch, explain how a KANO model helps in translating needs into requirements. **(10 Marks)**

OR

6 a. What is motivation? Explain Maslow's hierarchy of needs with a block diagram. **(10 Marks)**
b. Brief on performance appraisal. **(06 Marks)**

Module-4

7 a. Sketch the continuous process improvement cycle. **(03 Marks)**
b. Brief on PDSA cycle with a sketch. **(03 Marks)**
c. Sketch and explain Juran's triology. **(10 Marks)**

OR

8 Explain the following briefly with necessary diagrams:
a. Pareto diagram
b. Process flow diagram
c. Cause - and - effect diagram
d. Scatter diagrams. **(16 Marks)**

Module-5

9 Discuss briefly the following quality management tools:
a. Nominal group technique
b. Why Why analysis
c. Affinity diagram
d. Activity network diagram. **(16 Marks)**

OR

10 a. What is Benchmarking? Explain the process of benchmarking. **(08 Marks)**
b. What are the advantages of quality of design? **(04 Marks)**
c. Discuss the 4-stages of Failure mode effect analysis. **(04 Marks)**

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10ME61

Sixth Semester B.E. Degree Examination, June/July 2018
Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO full questions from each part.***

PART – A

1 a. Define Manufacturing Lead Time (MLT). How is it computed for batch production and job shop situations? **(06 Marks)**

b. Sketch and explain the model showing information processing activities required for a typical manufacturing firm. **(06 Marks)**

c. A part is processed in a batch production plant must be processed through average of 6 machines. There are 20 new batches of parts launched each week.
Given:

Average operation time	= 6 min
Average setup time/batch	= 5 hr,
Average batch size	= 25 parts,
Average non operation time/batch	= 10 hr,
Number of machines in the plant	= 18, and

Plant operates average of 70 hours/week,
Determine:
i) Manufacturing lead time.
ii) Plant capacity.
iii) Plant utilization and
iv) Work in process. **(08 Marks)**

2 a. What are pallet fixtures? Discuss the advantages and applications of pallet fixtures in automated flow lines. **(06 Marks)**

b. Distinguish between synchronous and asynchronous methods of transfer of work parts in flow lines. What are their relative advantages and applications? **(06 Marks)**

c. List and explain control functions used in an automated flow line. **(08 Marks)**

3 a. Explain with examples upper bound and lower bound approaches used to analyze the transfer lines. Derive appropriate relations to compute frequency of line stops in above approaches. **(12 Marks)**

b. Discuss the problems faced by flow lines without work part storage buffers and how it is minimized by storage buffer. **(08 Marks)**

4 a. Briefly explain the following terms in line balancing:
i) Zoning constraint
ii) Precedence constraint
iii) Total work content
iv) Minimum rational work element. **(08 Marks)**

b. The following table defines the precedence relationships and element times:

Element	1	2	3	4	5	6	7	8
Time (min)	10	5	8	3	12	2	5	15
Immediate predecessor	-	-	1, 2	2	3	3, 4	4	5, 6, 7

Using Ranked positional weights method.

i) Construct precedence diagram and compute RPW.

ii) Assign work elements to stations considering ideal cycle time of 15 mins.

iii) Calculate balance delay. **(12 Marks)**

PART – B

5 a. With neat sketches, explain horizontal and vertical part placement devices used in dial indexing table. **(08 Marks)**

b. What are AGVs? Explain various types of AGVs and their applications. **(12 Marks)**

6 a. With the help of a diagram explain the working of retrieval type CAPP system. How is it different from generative CAPP approach? **(10 Marks)**

b. With the help of a block diagram of structure of MRP system, explain the working of material requirement planning system. Also discuss the benefits of computerized MRP system. **(10 Marks)**

7 a. Distinguish between the following with respect to CNC systems:

i) Absolute and incremental coordinates.

ii) Fixed zero and floating zero.

iii) Contouring and straight cut CNC systems.

iv) Closed loop and open loop CNC systems. **(08 Marks)**

b. Prepare a manual part program to machine the profile of the part shown below. Assume suitable machining parameters.

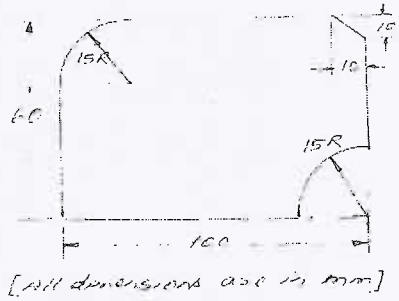

Fig.Q.7(b)

Program should be complete in all respects. Add comments at the end of each block. (Plate thickness is 15mm). **(12 Marks)**

8 a. With the help of a neat sketch. Illustrate six degrees of freedom of a polar Robot. **(06 Marks)**

b. Distinguish between:

i) Walk through and lead through programming.

ii) MCL and VAL programming of Robot. **(08 Marks)**

c. Discuss the Robot applications in ARC welding. **(06 Marks)**

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10ME62

Sixth Semester B.E. Degree Examination, June/July 2018

Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Plot the stress distribution about section A-B of the hook as shown in Fig.Q1(a).

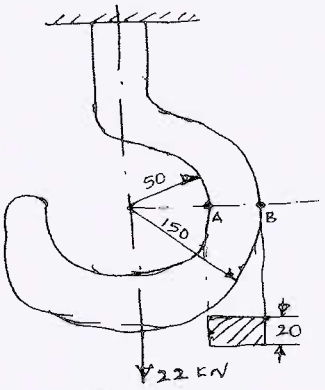

Fig.Q1(a) **(10 Marks)**

b. A carbon steel C50 barrel with diameter 25 mm and 50 mm is to be shrink fitted into another barrel with diameter 50 mm and 75 mm. The tangential stress developed at the inner fiber of the outer barrel due to shrink fitting may be limited to 70 N/mm^2. Determine:
i) Contact pressure
ii) Original diameter at contact before shrink fitting
iii) Resulting stress due to shrink fitting.
Take E = 21 × 10^4 N/mm^2, V = 0.28. **(10 Marks)**

2 a. Two shafts 1 metre apart are connected by a V-belt to transmit 90 KW at 1200 rpm of a driver pulley of 300 mm effective diameter. The driven pulley rotates at 400 rpm. The angle of groove is 40° and the coefficient of friction between the belt and pulley rim is 0.25. The area of cross section is 400 mm^2 and permissible stress is 2.1 MPa. Density of belt material is 1100 kg/m^3. Calculate the number of belts required and length of belt. **(10 Marks)**

b. A roller chain is to transmit 66.24 KW from a 17 tooth sprocket to a 34 tooth sprocket at a pinion speed of 300 rpm. The loads are moderate shock. The equipment is to run 18 hours/day. Specify the length and size of the chain required for a centre distance about 25 pitches. **(10 Marks)**

3 a. Design a helical compression spring for a maximum load of 1200 N for a deflection of 25 mm. Spring index is 5. Permissible shear stress is 400 MPa and G = 85 GPa. **(10 Marks)**

b. A semi-elliptic leaf spring 1.5 m long is composed of 18 graduated leaves and one full length leaf. The leaves are 60 mm wide and is acted upon by a central load of 30 kN which causes a deflection of 100 mm. Determine the thickness of the leaves and the maximum bending stress in the full length leaf, assuming with and without prestressed and also determine stress in the graduated leaf without prestress. Assume E = 210 GPa. **(10 Marks)**

4 A pair of spur gears having 20° full depth involute system is to transmit 12 KW at 300 rpm of the pinion. The allowable static stress for cast iron gear is 60 MPa and for the steel pinion is 105 MPa. Design the gear and check strength for dynamic and wear condition. Assume surface endurance strength as 580 MPa and velocity ratio is 3:1. **(20 Marks)**

PART – B

5 Design a worm gear to transmit 40 KW at 1000 rpm of the worm. The desired velocity ratio is 25:1. The worm is of hardened steel and the worm wheel is of phosphor bronze having allowable stress of 75 MPa. **(20 Marks)**

6 a. A multi-plate clutch is used to transmit 5 KW power at 1440 rpm. The inner and outer diameters of contacting surfaces are 50 mm and 80 mm respectively. The coefficient of friction and the average allowable pressure intensity for the lining may be assumed as 0.10 and 350 kPa respectively. Determine:
   i) Number of friction plates and pressure plates
   ii) Axial force required to transmit power
   iii) The actual average pressure
   iv) Actual maximum pressure intensity after wear. **(10 Marks)**

   b. A cast iron flywheel rotating at 600 rpm is brought rest by a brake in 2 sec. the flywheel may be considered as a solid circular disc having a diameter 400 mm and thickness 100 mm. The density of cast iron is 7200 kg/m^3. Determine:
   i) Energy absorbed by brakes
   ii) Number of turns the drum rotates before coming to rest
   iii) The braking torque. **(10 Marks)**

7 a. Derive the Petroff's equation and state the assumptions. **(10 Marks)**

   b. A 75 mm long full journal bearing of 75 mm diameter supports a load of 12 kN at the shaft speed of 1800 rpm. Assume ratio of diameter to the diametral clearance as 1000. The viscosity of oil is 0.01 Pa.S at the operating temperature. Determine:
   i) Summerfield number
   ii) The coefficient of friction based on McKee equation
   iii) Amount of heat generated **(10 Marks)**

8 Design a cast iron piston for a single acting four stroke engine for the following data:
Cylinder bore = 100 mm
Stroke = 125 mm
Max gas pressure = 5 N/mm^2
Indicated mean effective pressure = 0.75 N/mm^2
Mechanical efficiency = 80%
Fuel consumption = 0.15 kg per brake power per hour
Higher calorific value of fuel = 42×10^3 kJ/kg
Speed = 2000 rpm. **(20 Marks)**

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10ME63

Sixth Semester B.E. Degree Examination, June/July 2018
Heat and Mass Transfer

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO full questions from each part.*
2. Use of HMT data book is permitted.

PART – A

1 a. State and explain the governing laws of conduction, convection and radiation heat transfer modes. **(09 Marks)**

b. Write a note on thermal contact resistance. **(03 Marks)**

c. A hollow spherical form is used to determine the thermal conductivity of material. The inner diameter is 20cm and the outer diameter is 50cm. A 30W heater is placed inside and under steady state conditions, the temperature at 15 and 20cm radii were found to be 80 and 60°C. Determine the thermal conductivity of the material. Also find the outside temperature. If the surrounding is at 30°C, determine convection heat transfer coefficient over the surface. **(08 Marks)**

2 a. Show that for a hollow cylinder with variable thermal conductivity and one dimensional steady state heat conduction, the temperature variation is given by

$$T = -\frac{1}{\alpha} + \sqrt{\left(\frac{1}{\alpha} + T_1\right)^2 - \frac{Q \log_e \frac{r}{r_1}}{\pi K_0 L \alpha}}$$

where α = constant

K_o = thermal conductivity at zero degree temperature. **(10 Marks)**

b. A rod (K = 200 W/mK) 5mm in diameter and 5cm long has its one end maintained at 100°C. The surface of the rod is exposed to ambient air at 25°C with convection heat transfer coefficient of 100W/m^{2}K. Assuming other end is insulted, determine:

i) The temperature of the rod at 20mm distance from the end at 100°C.
ii) Heat dissipation rate from the surface of the rod.
iii) Effectiveness.
iv) Efficiency of fin. **(10 Marks)**

3 a. Derive the expressions of temperature variation, instantaneous heat transfer and total heat transferred for one dimensional transient heat conduction. **(10 Marks)**

b. A thermo couple is used to measure the temperature in a gas stream. The junction is approximated as a sphere with thermal conductivity of 25W/mK. The properties of the junction are ρ = 9000 kg/m^3, C = 0.35 kJ/kg K, h = 250 W/m^{2}K. Calculate the diameter of the junction if thermocouple measures 95% of the applied temperature difference in 3 sec. **(04 Marks)**

c. Water pipes are to be buried underground in a wet soil ($\alpha = 2.78 \times 10^{-5}$ m^2/h) which is initially at 4.5°C. The soil surface temperature suddenly drops to -5°C and remains at this value for 10 hrs. Calculate the minimum depth at which the pipes are laid if the surrounding soil temperature is to be maintained above 0°C. The soil may be considered as semi-infinite solid. Treat the present conditions as the condition of an semi infinite solid. **(06 Marks)**

4 a. Derive the correlation for natural convection heat transfer in terns of Grashoff, Prandtle and Nusselt number using dimensional analysis. **(10 Marks)**

b. Air at 20°C and atmospheric pressure is flowing over a flat plate at a velocity of 3m/s. If the plate is 30cm wide and at a temperature of 60°C, calculate at x = 0.3m.

i) Thickness velocity and thermal boundary layers.
ii) Local and average friction coefficients.
iii) Local and average heat transfer coefficients.
iv) Total drag force on the plate. **(10 Marks)**

PART – B

5 a. Define and mention the significance of following dimensionless numbers:

i) Reynolds Number
ii) Prandtle Number
iii) Nusselt Number
iv) Stanton Number
v) Peclet Number. **(10 Marks)**

b. Consider air at atmospheric pressure and 100°C enters a 2m long tube of 4cm diameter with a velocity of 9m/s. A 1kW electric heater is wound on the outer surface of the tube, find: i) Exit temperature of air ii) Mass flow rate of air iii) Wall temperature. Assume that the rate of heat absorption by air per unit area is uniform throughout the length of the tube. **(10 Marks)**

6 a. Classify heat exchangers. **(04 Marks)**

b. Define the following:

i) Fouling and fouling factor.
ii) Effectiveness of heat exchanger.
iii) Capacity rate and capacity ratio. **(06 Marks)**

c. Calculate the exit temperature of the hot fluid and inlet temperature of the cold fluid for a counter flow heat exchanger having the following specifications.

Mass flow rate of hot and cold fluids	= 3 and 0.75 kg/s
C_p for hot and cold fluids	= 1.05 and 4.2 kJ/kg K
Inlet temperature of hot fluid	= 500°C
Exit temperature of cold fluid	= 85°C
Overall heat transfer coefficient	= 450 W/m^2 K
Total surface area	= 1m^2

(10 Marks)

7 a. List out the assumptions made in Nusselt theory of Laminar film condensation on vertical plate. **(05 Marks)**

b. With a neat sketch, explain the regimes of pool boiling. **(08 Marks)**

c. A vertical square plate 30cm × 30cm is exposed to steam at atmospheric pressure. The plate temperature is 98°C. Calculate the heat transfer and mass of steam condensed per hour. **(07 Marks)**

8 a. Briefly explain the concept of black body. **(04 Marks)**

b. For black body show that the intensity of normal radiation is $1/\pi$ times the emissive power. **(10 Marks)**

c. Liquid air boiling at -153°C is stored in a spherical container of diameter 320mm. The container is surrounded by concentric spherical shell of diameter 360mm in a room at 27°C. The space between the two spheres is evacuated. The surface of the sphere are flashed with aluminium ($\epsilon = 0.3$). Taking the latent heat of vapourization of liquid air as 210 kJ/kg, find the rate of evaporation of liquid air. **(06 Marks)**

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10ME64

Sixth Semester B.E. Degree Examination, June/July 2018
Finite Element Methods

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Write the equilibrium equations in elasticity subjected to body force. **(04 Marks)**

b. Describe the steps involved in FEM. **(08 Marks)**

c. Write a note on node numbering and half Band width. **(08 Marks)**

2 a. For the spring system shown in Fig. Q2 (a), using the principle of minimum potential energy. Determine the nodal displacement. **(10 Marks)**

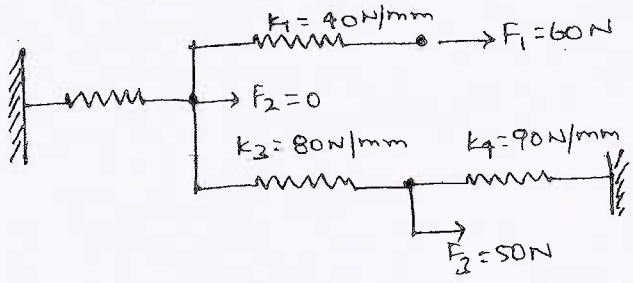


Fig. Q2 (a)

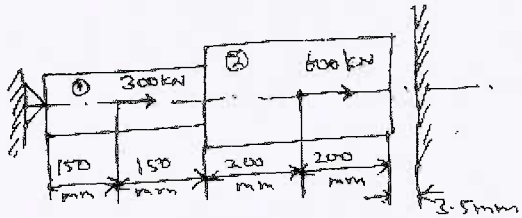
b. A simply supported beam of length 'L' is subjected to UDL of P_0 N/m. Determine the maximum deflection using Galerkin's method. **(10 Marks)**

3 a. Derive the shape functions of CST element in natural coordinate. **(10 Marks)**

b. What is the purpose of Pascal's triangle? Represent the 2D Pascal's triangle upto 5^{th} order. **(05 Marks)**

c. Write a note on simplex, complex and multiplex elements. **(05 Marks)**

4 a. For the Bar shown in Fig. Q4 (a), determine the nodal displacement, element stresses and support reactions. **(12 Marks)**



$A_1 = 250\ mm^2$
$A_2 = 400\ mm^2$
$E_1 = E_2 = 200\ GPa$

Fig. Q4 (a)

b. Solve the following equations using Gauss-elimination technique.

$$5x_1 - 4x_2 + x_3 = 0$$
$$-4x_1 + 6x_2 - 4x_3 + x_4 = 1$$
$$x_1 - 4x_2 + 6x_3 - 4x_4 = 0$$
$$x_2 - 4x_3 + 5x_4 = 0$$

(08 Marks)

PART – B

5 a. Obtain the shape functions of 8-noded rectangular element in Lagrangian. **(08 Marks)**

b. Explain the following with neat sketches:-

(i) Iso-parametric element.

(ii) Sub-parametric element.

(iii) Super-parametric element. **(06 Marks)**

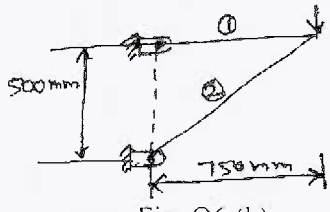
c. Find $I = \int_{-1}^{1} (a_0 + a_1\xi + a_2\xi^2 + a_3\xi^3)\,d\xi$. Use 2-point formula a's are constants. **(06 Marks)**

6 a. Derive the stiffness matrix for a truss element. **(10 Marks)**

b. A truss shown in Fig. Q6 (b), is made of 2 bars, determine

(i) Nodal displacement.

(ii) Stresses in each element. **(10 Marks)**



$E_1 = E_2 = 200$ GPa
$A_1 = 1000$ mm^2
$A_2 = 1200$ mm^2

Fig. Q6 (b)

7 a. Derive the Hermite shape function for a beam element. **(12 Marks)**

b. A Cantilever beam subjected to point load of 250 KN as shown in Fig. Q7 (b). Determine deflection at tip and support reactions.

$E = 200$ GPa, $I = 4 \times 10^6$ mm^4, $l_e = 0.8$m. **(08 Marks)**

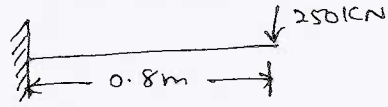


Fig. Q7 (b)

8 a. Calculate the temperature distribution in a 1-D fin with the physical properties given in Fig. Q8 (a). There is a uniform generation of heat inside the wall of $\overline{Q} = 400$ W/m^3. **(10 Marks)**

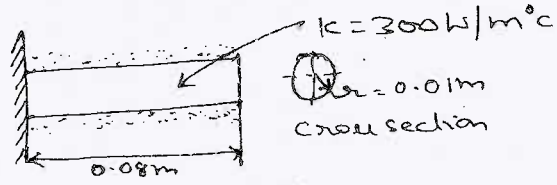


Fig . Q8 (a)

b. Determine the temperature distribution through the composite wall as shown in Fig. Q8 (b). Convection heat loss occurs on the right surface. Assume a unit area. **(10 Marks)**

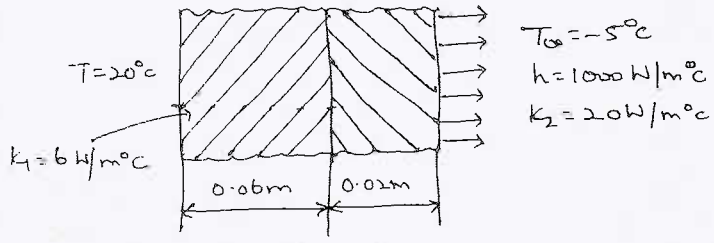


Fig. Q8 (b)

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