CBCS Scheme

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

15ME51

Fifth Semester B.E. Degree Examination, June/July 2018
Management and Engineering Economics

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions, choosing one full question from each module.***
2. ***Use of "Compounding interest factor" tables are permitted.***

Module-1

1 a. Define Management and explain the various functional areas of Management. **(08 Marks)**
b. List and brief the principles of scientific management. **(08 Marks)**

OR

2 a. Define Planning and list the importance of planning. **(08 Marks)**
b. Explain the various steps in a decision making process, with a block diagram. **(08 Marks)**

Module-2

3 a. Define Organization. What are the principles of Organization? **(08 Marks)**
b. Explain briefly the selection process of personnel for the organization. **(08 Marks)**

OR

4 a. Define Motivation and explain the various leadership styles. **(08 Marks)**
b. Explain the Maslow's hierarchy of needs theory. **(08 Marks)**

Module-3

5 a. List the differences between Micro and Macro Economics. **(08 Marks)**
b. Explain briefly the following : **(08 Marks)**
i) Law of Demand ii) Law of Supply iii) Equilibrium point iv) Income Elasticity.

OR

6 a. Define the Law of Return and explain the three phases of Law of return. **(08 Marks)**
b. Explain how cash flow diagram is helpful to the decision maker and draw C.F.D from borrowers and lenders point of view. **(08 Marks)**

Module-4

7 a. A person takes a loan of Rs 1200/- from a bank at an interest of 18% p.a. Find the amount if the interest is compounded : i) Annually ii) Half yearly iii) Quarterly iv) Monthly. **(08 Marks)**
b. Find the compound amount of Rs 5000/- at 6% for 4, 8 and 12 years and compare the result does doubling the time doubles the amount of interest earned. **(08 Marks)**

OR

8 a. Define Rate of Return and explain minimum Acceptable rate of Return and internal rate of Return. **(06 Marks)**
b. Two types of power converter Alpha and Beta are under considerations for a particular application. An economic comparison is to be made at an interest rate of 10%. Following cost estimation has been obtained. Determine the Annual equivalent costs of two systems. Select the best converter. **(10 Marks)**

Cost particulars	Alpha	Beta
Purchase price	Rs 10,000/-	Rs 25,000/-
Estimated service life	8 years	9 year
Salvage value	Rs 3000/-	Rs 5000
Annual operating cost	Rs 2500/-	Rs 1200

Module-5

9 a. Briefly explain "Components of Costs" and explain with diagram indirect cost estimation with depreciation. **(08 Marks)**

b. Explain how the selling price is fixed for a product and show all the components of costs. **(08 Marks)**

OR

10 a. Define Depreciation and explain the various causes of depreciation. **(08 Marks)**

b. Determine the material cost for fig. Q10(b), density of the material is 7.009 gram/cc and material cost is Rs 20/kg. **(08 Marks)**

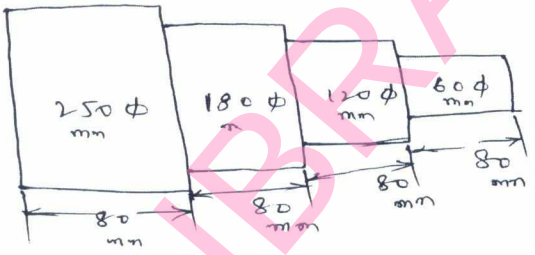


Fig.Q10(b)

* * * * *

CBCS Scheme

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

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)**

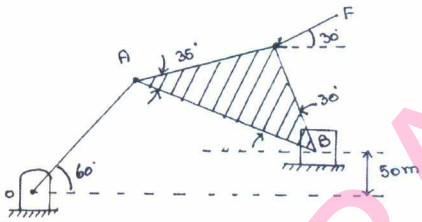


Fig. Q1 (b)

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)**

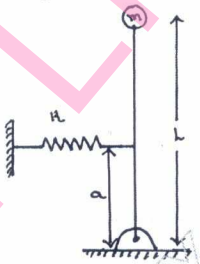


Fig. Q8 (b)

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)**

* * * * *

CBCS Scheme

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

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

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

15ME54

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

Time: 3 hrs. Max. Marks: 80

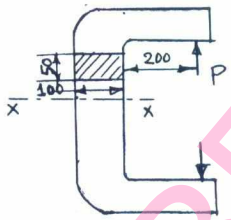
Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Use of design data handbook is permitted.
3. Assume missing data, if any, suitably.

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)**

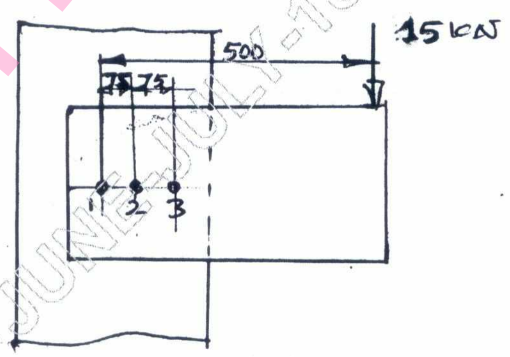


Fig.Q7(b)

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)**

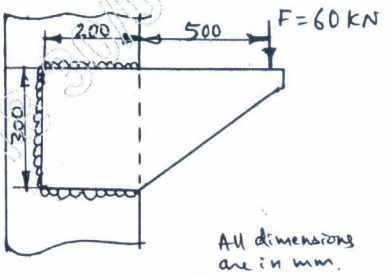


Fig.Q8(c)

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)**

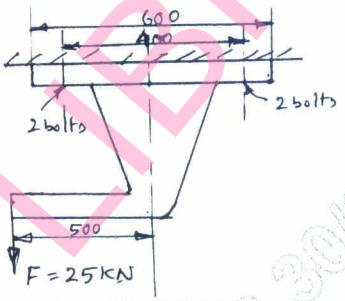


Fig.Q9(b)

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)**

* * * * *