2015-16
B. E. (WINTER SEMESTER) EXAMINATION
MECHANICAL ENGINEERING
MACHINERY DYNAMICS
EME-315

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.

1 (a) For a reciprocating engine mechanism shown in Fig. 1, determine the couple C₂ to be applied on the crank for the equilibrium of the system. Further, determine the resultant force acting on the frame of the engine. [09]

1 (b) Discuss in brief the conditions, for a body to be in equilibrium under the action of two forces, three forces and two forces and a couple. [03]

2 (a) In a vertical double-acting steam engine, the connecting rod is 4.5 times the crank. Weight of the reciprocating parts is 120 kg and the stroke of the piston is 440 mm. The engine runs at 300 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) The thrust in the connecting rod
   ii) The pressure on slide bars
   iii) The tangential force on the crank pin
   iv) The thrust on the bearings
   v) The turning moment on the crankshaft [06]

2 (b) The turning moment diagram for a multi-cylinder Internal Combustion engine has been drawn to a vertical scale of 1 cm = 3000 Nm and a horizontal scale of 1 cm = 15°. During one revolution of the crank the areas above and below the mean

Contd.....2.
torque line taken in order are:
3.52, 3.77, 3.62, 4.35, 4.40 and 3.42 cm²

If the speed of the engine is 200 rpm, determine the coefficient of fluctuation of speed. The rotating parts have a mass of 55 kg and radius of gyration of 1 m.

OR

2 (b') Define the terms coefficient of fluctuation of speed and coefficient of fluctuation of energy. Further, derive a relation for the coefficient of fluctuation of speed in terms of coefficient of fluctuation of energy and the kinetic energy of the flywheel at mean speed.

3 (a) A rotating shaft carries three unbalance masses .5 kg, 4 kg and 3 kg at radial distances 80 mm, 86 mm and 53 mm and at angular positions of 45⁰, 135⁰ and 240⁰ respectively. The second and third masses are in the planes at 200 mm and 375 mm from the plane of first mass. The angular positions are measured counterclockwise from the reference line along x-axis and viewing the shaft from first mass end.

The shaft length is 800 between bearings and the distance between the plane of the first mass and the bearing at that end is 225 mm. Determine the amount of the counter masses in planes at 75 mm from the bearings for the complete balance of the shaft. The first countermass is to be placed in a plane between the first mass and the bearing and the second mass in a plane between the third mass and the bearing at that end.

OR

3 (a') The following data refer to a two cylinder uncoupled locomotive
Rotating mass per cylinder = 300 kg
Reciprocating mass per cylinder = 360 kg
Distance between wheels = 1200 mm
Distance between cylinder centres = 500 mm
Diameter of treads of driving wheels =1600 mm

Contd......3.
Crank radius = 300 mm
Radius of centre of balance mass = 600 mm
Locomotive speed = 50 km/hour

If the dead load on each wheel is 3 tonne and the angle between the cylinder cranks is 90°, determine:

i) the swaying couple
ii) the variation in tractive force
iii) the balance mass required in the planes of driving wheels if whole of the rotating and two-third of the reciprocating mass are to be balanced, and
iv) the maximum and minimum pressure on the rails.

3 (b) Define the following terms

i) Primary and secondary unbalance
ii) Static and dynamic balancing
iii) Swaying couple
iv) Hammer Blow

4 (a) Differentiate between a flywheel and a governor. Give a brief classification of Governors.

4 (b) In a Porter governor each of the four arms are 250 mm long. The upper and lower arms are pivoted to links of 40 mm and 50 mm respectively from the axis of rotation. Each ball has a mass of 5 kg and the sleeve mass is 50 kg. The force of friction on the sleeve of the governor is 40 N. Determine the range of speed of the governor for extreme radii of rotation of 125 mm and 150 mm.

5 Draw the profile of a cam operating a roller reciprocating follower with the following data:
Minimum radius of cam = 30 mm, Lift = 36 mm, Roller diameter = 15 mm

The cam lifts the follower for 120° with Simple harmonic Motion followed by a dwell period 20°. Then the follower lowers down during 160° of cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of 200 rpm, calculate the maximum velocity and acceleration of the follower during ascent period.

Contd...
OR

5' (a) What is meant by gyroscopic couple? Derive an expression for its magnitude. [06]

5' (b) Explain in brief the effect of the gyroscopic couple on the stability of a four wheeler while negotiating a curve. In what way the gyroscopic effect along with the centrifugal force limit the speed of the vehicle. [06]

Fig. 1
2015-2016
B.E. VI Semester Examination
(Mechanical)
Energy Conversion Systems
(EME322)

Maximum Marks: 60 (Credits: 04) Duration: Three Hours

NOTE: Answer all the questions, symbols have their usual meaning.
Assume suitable data if missing.
Steam table and Mollier chart are permitted.
Clearly write all the assumptions before starting the solution.

1(a). Define Stoichiometric air-fuel ratio and Enthalpy of formation.

1(b). The analysis of a sample of coal gives the following values by mass:

<table>
<thead>
<tr>
<th>Element</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>80.7%</td>
</tr>
<tr>
<td>Oxygen</td>
<td>5.3%</td>
</tr>
<tr>
<td>Sulphur</td>
<td>1.8%</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>4.9%</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

What is the air-fuel ratio by mass if 20% excess air is used in the combustion process?

2(a). What do you understand by mean temperature of heat addition? For a given \( T_2 \), show how the Rankine cycle efficiency depends on the mean temperature of heat addition.

2(b). In a reheat cycle, steam at 8 MPa and 350°C is supplied to a high pressure turbine. After expansion to 1.4 MPa, it is reheated at constant pressure to 350°C before expanding in low pressure turbine to 10 kPa. Determine the work output for high and low pressure turbines and thermal efficiency.

OR

2'. A binary vapour cycle operates on mercury and steam. Saturated mercury vapour at 4.5 bar is supplied to the mercury turbine, from which it exhausts at 0.04 bar. The mercury condenser generates steam at 1.5 bar which is expanded in a steam turbine at 0.04 bar. (a) Find the overall efficiency of the cycle. (b) If 50,000 kg/h of steam flows through the steam turbine, what is the flow \( y_g \) through the mercury turbine? (c) Assuming all the processes are reversible, what is the useful work done in the binary vapour cycle for the specified steam flow?

<table>
<thead>
<tr>
<th>( p_{\text{bar}} )</th>
<th>( t_1({}^\circ \text{C}) )</th>
<th>( h_r ) (kJ/kg)</th>
<th>( h_g ) (kJ/kg)</th>
<th>( s_r ) (kJ/kg K)</th>
<th>( s_g ) (kJ/kg K)</th>
<th>( y_r ) (m³/kg)</th>
<th>( y_g ) (m³/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>450</td>
<td>62.93</td>
<td>355.98</td>
<td>0.1352</td>
<td>0.5397</td>
<td>79.9 \times 10^{-6}</td>
<td>0.068</td>
</tr>
<tr>
<td>0.04</td>
<td>216.9</td>
<td>29.98</td>
<td>329.85</td>
<td>0.0808</td>
<td>0.6925</td>
<td>76.5 \times 10^{-6}</td>
<td>5.178</td>
</tr>
</tbody>
</table>

Contd.....2.
3(a). Define nozzle efficiency and critical pressure ratio.

3(b). What do you understand by overexpansion and underexpansion in nozzle. Show the pressure variation in convergent nozzle and elaborate it.

3(c). Gas expand in a propulsion nozzle from 3.5 bar and 425°C down to a back pressure of 0.97 bar, at the rate of 18 kg/s. Taking a coefficient of discharge of 0.99 and a nozzle efficiency of 0.94, calculate the required throat and exit areas of nozzle. For the gas take γ = 1.33 and cp = 1.11 kJ/kg K. Assume that the inlet velocity is negligible.

4(a). At a certain pair in a reaction turbine, the steam leaves the fixed blades at a pressure of 3 bar with a dryness fraction of 0.98 and a velocity of 130 m/s. The blades are 20 mm high and discharge angle for both the ring is 20°. The ratio of axial velocity of flow to the blade velocity is 0.7 at inlet and 0.76 at exit from the moving blade. If the turbine uses 4 kg of steam per second with 5% tip leakage, find the mean blade diameter and the power developed in the ring.

4(b). What are the methods of governing a steam turbine? Describe any one method of governing steam turbines.

OR

4'(a) Evaluate the blade speed ratio corresponding to the maximum efficiency for Parson’s type of turbine and hence determine the maximum efficiency.

4'(b) A reaction turbine runs at 300 rpm and its consumption is 15,400 kg/h. The pressure of steam at certain stage is 1.9 bar, its dryness 0.93 and power developed by the stage is 3.5 kW. The discharging blade tip angle is 20° for both fixed and moving blades and the axial velocity of flow is 0.72 times the blade velocity. Find the drum diameter and blade height. Take the tip leakage steam as 8% and neglect blade thickness.

5(a). Define the term vacuum efficiency of a condensing plant? How it varies with barometric pressure?

5(b). What are non-mixing types of condensers? Why they are preferred over mixing type? Describe briefly the central flow surface condenser with neat sketch.

5(c). Explain the working of forced draught cooling tower with a neat diagram.

5(d). A surface condenser is designed to handle 10,000 kg/h steam. The steam enters at 0.08 bar and 0.9 dryness and the condensate leaves at the corresponding saturation temperature. The pressure is constant throughout the condenser. Estimate the cooling water flow rate per hour, if the cooling water temperature rise is limited to 10°C.
2015-16  
B.E. (Mechanical Engineering)  
End-Semester-VI Examinations

IC Engines  
EME-324  
Credits: 04

Maximum Marks: 60  
Duration: Three Hours

Answer all the questions.  
Assume suitable data if missing.  
Notations used have their usual meaning.

Questions

1.  
   i) Classify IC engines on the basis of various parameters.  
      [04]
   ii) Define various engines performance parameters.  
       [04]
   iii) Define crankcase scavenged two-stroke engines. What are the advantages and disadvantages of two-stroke engines?  
        [04]

2.  
   i) What is the difference between air-standard cycle and fuel-air cycle analysis? Explain the significance of fuel-air cycle.  
      [06]
   ii) Why the actual cycle efficiency is much lower that the air-standard cycle efficiency? List the major losses and differences in actual and air-standard cycles.  
       [06]

OR

2'.  
   i) In an engine working on diesel cycle inlet pressure and temperature are 1 bar and 170°C respectively. Pressure at the end of adiabatic compression is 35 bar. The ratio of expansion i.e. after constant pressure heat addition is 5. Calculate the heat addition, heat rejection and the efficiency of the cycle. Assume $\gamma = 1.4$, $C_p = 1.004$ kJ/kg K and $C_v = 0.717$ kJ/kg K.  
      [06]
   ii) Explain the following: (a) time loss factor (b) heat loss factor (c) exhaust blowdown factor.  
       [06]

Contd.....2.
3. i) Explain various automotive air-fuel mixture requirements.

ii) Define carburetion? Explain the working of simple carburettor with neat sketch.

OR

3'. i) Define supercharging and turbocharging with neat sketch? What are the effects of supercharging on engine performance?

ii) Define multi-point fuel injection (MPFI) system and solid injection system.

iii) List the various types of combustion chambers used in SI and CI engines.

4. i) Define normal combustion in SI engines with the help of P-θ diagram

ii) Define abnormal combustion in CI engine with the help of P-θ diagram.

iii) Compare the factors of knocking in SI and CI engines.

5. i) Explain the ideal open gas turbine cycle and closed gas turbine cycle with the help of P-V and T-S plots.

ii) Discuss the ideal gas turbine cycle with intercooling, reheat and regeneration with the help of P-V and T-S plots.

iii) Write short notes on (a) ram jet engines (b) turboprop engines.

OR

5'. i) A simple jet carburetor is required to supply 5 kg of air and 0.5 kg of fuel per minute. The fuel specific gravity is 0.75. The air is initially at 1 bar and 300 K. Calculate the throat diameter of the choke for a flow velocity of 100 m/s. Velocity coefficient is 0.8. If the pressure drop across the fuel metering orifice is 0.80 of that of the choke, calculate orifice diameter assuming, C_{dr} = 0.60 and γ = 1.4.

ii) A gas-turbine power plant operating on an ideal Brayton cycle has a pressure ratio of 8. The gas temperature is 300 K at the compressor inlet and 1300 K at the turbine inlet. Utilizing the air-standard assumptions, determine (a) the gas temperature at the exits of the compressor and the turbine, (b) the back work ratio, (c) the thermal efficiency.
2015-16
Bachelor of Engineering (VI Semester) Examination

Mechanical
Manufacturing Technology- II
EME- 325

Maximum Marks- 60
Duration- 3 Hours

Attempt all questions.
All questions carry equal marks.
Attempt any two parts from each question.

Q. No.-1. [2*6=12]

(a) What do you understand by Mechanics of Metal Cutting? Explain with the help of neat sketch.

(b) Create a relationship between Cutting Ratio and the Shear Angle in the geometry of chip formation.

(c) Explain the following –
(i) High Speed Cutting Tool Material,
(ii) Different types of WEARS on Single Point Cutting Tools,
(iii) Liquid Cutting Fluid.

Q. No.-2. [2*6= 12]

(a) A hollow work piece of 60 mm outer diameter and 150 mm length is held on mandrel between centres and turned all over in 4 passes. If the approach length = 20 mm, over travel= 12 mm, average feed = 0.8 mm/revolution, cutting speed =30 m/min. Calculate the Machining Time.

Contd......2
(b) What are the important principles of Jigs design?

(c) Explain the following terms used in Press Tools-
   (i) Stripper Plate,
   (ii) Compound Die,
   (iii) Combination Die,
   (iv) Calculation of Shear Force,
   (v) Blank Development of a U shaped component, and
   (vi) Angular clearance.

Q. No.-3. [2*6= 12]

(a) A circular rod of diameter 30 mm is to be step turned at different diameter and different length as shown in figure-1. Make a CNC programme for the same.

(b) A plate 120 mm length, width 110 mm and 15 mm thick is shown in figure-2 is to be machined on CNC milling machine by an end mill cutter of diameter 8 mm and groove 2 mm deep. Make a CNC programme for making L shape groove as shown in fig.-2.

(c) Explain with the help of neat sketch the Main Components of a ROBOT.

Q. No.-4. [2*6= 12]

(a) Explain the END Standards in measurement.

(b) What do you mean by Airy Point? What are the conditions to achieve it?

(c) Explain the following terms-
   (i) Tolerance
   (ii) Allowance
   (iii) Deviation
   (iv) Hole basis & Shaft basis
(v) Snap Gauge and
(vi) Geometrical Tolerance

Q. No.-5. [2*6= 12]

(a) What do you mean by Acceptance Tests? Write down the different names of acceptance tests. Explain any one among them.

(b) What are salient features of a comparator and how are they achieved in the Sigma Comparator? Explain your answer with sketches.

(c) Explain the following-

(i) Meaning of Surface Texture in Surface Finish
(ii) LAY in surface finish
(iii) Thread Micrometer and
(iv) Pitch Diameter

Contd......4
2016-16
B.E. END SEMESTER EXAMINATION
(MECHANICAL ENGINEERING)
ECONOMICS & MANAGEMENT
(EME-340)

Maximum Marks: 60

Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Questions

1(a) State and explain the Law of Demand and Supply with relevant examples.

1(b) A man owns some real estate. He must decide which of the several alternatives to select in trying to obtain a desirable return on his investment. After much study and calculation, he decides that the two best alternatives are as given in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Service station</th>
<th>Utility Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>First cost (Rs.)</td>
<td>20,00,000</td>
<td>36,00,000</td>
</tr>
<tr>
<td>Annual property taxes (Rs.)</td>
<td>80,000</td>
<td>1,50,000</td>
</tr>
<tr>
<td>Annual income (Rs.)</td>
<td>8,00,000</td>
<td>9,80,000</td>
</tr>
<tr>
<td>Life of building (years)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Salvage value (Rs.)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Evaluate the alternatives based on the future worth method at i = 12%.

OR

1(b') Machine A costs $30,000, lasts 15 years, and will have a salvage value of $4,500. Its annual maintenance cost is $3,500. Machine B costs $40,000, will last 20 years, and will have a salvage value of $2,000 after 20 years. The annual maintenance cost for this machine is $3,000. Both machines produce 10,000 units per year. If money is worth 10% annually, which machine should be purchased?

2.(a) What do you understand by Inflation? List its causes.

For the cash flow diagram shown in Fig. 1, compute the rate of return. The amounts are in rupees.

Fig. 1. Cash flow diagram

Contd....2.
2.(b) Define 'economic life' of an equipment.
An existing machine has a market price of $10,000 with a remaining useful life of 3 years. The operational and maintenance costs are $8,000 and a salvage value of $2,500. Proposal is made to change this existing machine with a new machine having a cost of $15,000, with the same useful life as the existing machine. The new machine has an operational and maintenance costs of $6,000 and a salvage value of $5,500. Decide whether the machine should be replaced now or not.

OR

2'.(a) What is meant by cost-benefit analysis? What are the various criteria for performing a cost-benefit analysis?
A state government is planning a hydroelectric project for a river basin. In addition to the production of electric power, this project will provide flood control, irrigation and recreation benefits. The estimated benefits and costs that are expected to be derived from this project are as follows:

<table>
<thead>
<tr>
<th>Initial cost</th>
<th>Rs. 8,00,00,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual power sales</td>
<td>Rs. 6,00,00,000</td>
</tr>
<tr>
<td>Annual flood control savings</td>
<td>Rs. 30,00,000</td>
</tr>
<tr>
<td>Annual irrigation benefits</td>
<td>Rs. 50,00,000</td>
</tr>
<tr>
<td>Annual recreation benefits</td>
<td>Rs. 20,00,000</td>
</tr>
<tr>
<td>Annual operating and maintenance costs</td>
<td>Rs. 30,00,000</td>
</tr>
<tr>
<td>Life of the project</td>
<td>50 years</td>
</tr>
</tbody>
</table>

Check whether the state government should implement the project (Take $i = 12\%$)

2'.(b) What is meant by depreciation? Give the reasons for declining value of an asset.
An asset has a first cost of $30000 and an expected salvage value of $4000 after 12 years. Calculate using declining and double declining methods, the depreciation for the seventh year and the book value at the end of sixth year. Compare the results.

3.(a) Describe the kinds of managers found at different levels and in different areas of the organization.

3.(b) Differentiate between Delphi and Nominal group decision making techniques. What are the advantages of Group and team Decision making?

OR

3'.(a) Discuss the classical model of decision making including the steps in rational decision making.

3'.(b) Explain the basic managerial roles that managers may play and the skills they need in order to be successful. How might the various managerial skills relate to different...
managerial roles?

4.(a) Discuss the five alternatives to job specialization. What is the advantage of each as compared to specialization? (06)

4.(b) Discuss how control helps the organization. What are the steps involved in the control process? (06)

OR

4'.(a) Each historical perspective on motivation built on the earlier perspectives and differed from them in some ways. Describe the similarities and differences between the traditional approach and the human relations approach. Then describe the similarities and differences between the human relations approach and the human resource approach. (06)

4'.(b) What do you understand by organizational planning? Differentiate among strategic, tactical and operational plans. (06)

5.(a) Describe the four basic levels of international business activity. Do you think any organization will achieve the fourth level? Why or why not? (04)

5.(b) Describe the processes of human resource planning, recruiting, and selection. As a potential employee, what things might a firm do in its recruiting efforts to impress you? (04)

5.(c) What do you understand by marketing mix or 4P’s of marketing (04)